NATURAL VARIATION IN HUMAN MATING STRATEGY AND THE EVOLUTIONARY SIGNIFICANCE OF MATE CHOICE CRITERIA.

by

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NATURAL VARIATION IN HUMAN MATING STRATEGY AND THE EVOLUTIONARY SIGNIFICANCE OF MATE CHOICE CRITERIA.

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The present studies focus on the two components of female attractiveness, fluctuating asymmetry (FA) and waist-to-hip ratio (WHR), which are alleged to represent genetic quality and fertility, respectively. Male mating strategies may be characterized by individual differences in sociosexuality, a personality dimension that is predicted to correlate with differential valuation of these two components of female mate value. Three predictions were made: **Prediction 1.** *Measures of waist-to-hip ratio and symmetry in women are dissociable physical traits*. **Prediction 2**. *Men's individual differences in sociosexuality will differentially affect their valuations of two aspects of women's physical attractiveness, WHR and FA*. **Prediction 3.** *Sociosexuality and parental investment as two opposing components of mating strategy are inversely related to each other.* The relationships among sociosexuality and parental investment, as measured by three indices, (Sociosexuality, Parental Investment, "Caditude") and male preferences for two components of female physical attractiveness, symmetry and waist-to-hip ratio, were examined in several studies.

A sociosexuality questionnaire pilot study, a correlational study of FA and WHR, and three empirical studies were done. The questionnaire pilot study analyzed by factor analysis was done to develop indices of the three predictor variables: sociosexuality, parental investment and "caditude". A correlational study examined the relationship between WHR and FA in a sample of women's images (Prediction 1). Using the sociosexuality questionnaire and visual stimuli of women who varied in WHR and FA, empirical studies of three groups of participants (total n = 273) tested the relationships between sociosexuality and female phenotype (Prediction 2). Finally, another correlational study utilized questionnaire data to examine the relationship between indices of sociosexuality and parental investment (Prediction 3). Support was found for Predictions 1 and 3, but not for Prediction 2. Results and critique of the methodology are discussed along with future implications.

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PREFACE

I would like to thank Rachel Chandler, Hélène Krothè, and Bill Adams for research assistance, Elizabeth Blum and David Putz for collegial support, Robert Ferry for technical support, and my committee for their criticism. Thanks also to Gregory Webster for statistical assistance.

Dedicated to my father, Calvin Lucien Perilloux, Sr.

INTRODUCTION

This dissertation will examine natural variation in human mating strategy in terms of a recently defined dimension of personality--sociosexuality--and examine its relationship to male assessments of evolutionarily relevant aspects of female attractiveness. Two aspects of female physical attractiveness, symmetry and waist-to-hip ratio, are alleged to indicate genetic quality and fertility, respectively. This research tests specific predictions concerning the relationship between individual variation in sociosexuality and the relative valuation of symmetry and waist-to-hip ratio in judgments of female attractiveness.

After an extended focus on sex differences in human mating strategies (Buss 1988, 1994; Kenrick et al. 1996), evolutionarily based theories of human mating have more recently focused on conditional strategies and the plurality of strategies found within each sex (Bailey et al. 1994, Cashdan 1994, Clark 2004, Gangestad & Simpson 2000, Gangestad & Thornhill 1998, Mikach & Bailey 1999). There is considerable within-sex variation and between-sex overlap in the mating strategies of men and women, and this variation is thought to be context-dependent. This paper will first review the broader parameters of the sex differences in mating strategy in order to show the general goals and problems faced by each sex, before going on to examine the various strategies that have evolved within sexes to meet these goals. Male mating strategies will be examined in light of a dimension of personality, sociosexuality, and an argument will be made that individual variation in male sociosexuality may be reflected in mate choice criteria. Three evolutionarily derived predictions about the relationships between male mating strategy and the evolutionary significance of human female attractiveness will be presented, tested, and discussed.

1. Sexual selection theory and the evolution of sex differences in mating strategies

1.1. Sexual selection

Some traits are selected because they confer mating advantages independent of advantages in differential survival. A trait that enhances the bearer's mating opportunities, even at a survival cost, is sexually selected (Darwin 1874). Sexual selection has affected two kinds of adaptations: traits that aid in direct intrasexual competition and traits that appeal to the preference of the opposite sex (Andersson 1994).

1.2. Reproductive rate

The prerequisite for sexual selection is that males and females differ in maximum reproductive rate. Female mammals reproduce more slowly because they spend more time in a state of gestation or lactation, whereas male reproductive rate is limited only by mating access (Clutton-Brock & Vincent 1991). Thus, the way to maximize reproductive success differs for males and females in that, as a general rule, male reproductive output is limited by access to fertile females, whereas for females, who are physiologically limited in the number of offspring they can produce, access to resources for provisioning offspring is the limiting requirement. The outcome of this sex difference in maximum reproductive rate is that for males, but not for females, reproductive output is directly related to the number of mates an individual can obtain, and female reproductive capacity is a limited resource for which males must compete.

1.3. Mate choice

Competition among males is either directly against other males, or competition to attract females. Females, on the other hand, bear the entirety of gestation and lactation as the minimum investment required in an offspring, and have evolved traits favoring selectivity or choosiness in mate choice. Choosing a poor quality mate as the father of her offspring is a relatively much more costly mistake for a female than for a male, who can usually just walk, swim, slither, or stumble away from offspring-rearing.

Against this background, humans present an interesting case, in that human males frequently do provide substantial parental care (Geary 2000). The evolution of paternal care has provided another resource human females may obtain from males beyond genetic material. Theory thus predicts that females should respond to two types of cues in males: cues that indicate genetic quality, and cues that indicate good parenting (Cashdan 1996, Gangestad & Simpson 2000). Human males who provide parenting should likewise be concerned with the quality of the targets of their investment, females and their offspring, and their ability to maximize the investment devoted to them; thus men should be sensitive to cues which signal female quality. However, because of the potential disparity between the sexes in parental investment, each sex has different traits it advertises and seeks, and sex differences in preferred mate characteristics and in mating strategy have evolved as a result (Buss 1989; Symons 1979).

2. Sex differences in mate choice criteria in humans.

In general, sex differences in preferred partner traits are expected to reflect the different reproductive resources each sex represents to the other, which can be described as mate value. For men, women need to be fertile and plentiful. For women, men need to provide paternal investment: resources (food, money, shelter, or protection) that can be converted into offspring, or used to protect and provide for offspring. But since it is the case that for men the minimal investment may consist of only his genetic material, females should also be concerned with the quality of this genetic material when paternal investment is unlikely. And for some for men who invest in offspring, genetic quality of female partners should be of concern in addition to fertility. Thus, both sexes may be interested in the fertility, genetic quality, and parental investment potential of mates, but the traits that represent the ability to invest differ in each sex. The fertility of a woman represents one aspect of her ability to maternally invest- her physical ability to conceive and gestate, thus converting other resources into nutrition for her offspring. This parallels men's paternal investment; men can donate resources to women for her to contribute to offspring, or they can invest directly to offspring in various ways. A key difference between men and women in regard to parental investment is that parental investment potential as represented by fertility may be more readily apparent in a woman's physical appearance.

But what are traits that signal mate value? Mate value is represented in the preferred partner traits of each sex. The forthcoming sections will review preferred partner traits and the aspects of mate value they represent.

2.1. Preferred partner traits

Compared to women, men prefer to have a greater number of partners, who are youthful and physically attractive; on the other hand, women prefer partners who are older and have resources, wealth, or high social status. Consistent findings across all cultures thus far studied demonstrate that there are reliable sex differences in preferred age of partner (Buss et al. 2000, Kenrick et al. 1996, Kenrick & Keefe 1992), socioeconomic status of partner (Townsend 1989, Townsend 1993, Townsend & Levy 1990), and physical attractiveness of partner (Buss et al.

1989). Each preference reflects some aspect of mate value the opposite sex is seeking, and studies of mate preferences have targeted specific preferences to assess the traits contributing to mate value.

2.1.1. Partner age

Partner age preferences of men change in a systematic fashion as they themselves age; very young men are interested in women of a similar age or older than they are, and older men become interested in women of increasing relative youth (Kenrick & Keefe 1992; Kenrick et al. 1996). Younger women are viewed as more attractive than older women (Cunningham 1996; Townsend & Levy 1990; Henss 1991), and controlling for men's age, the number of children a man desires from a long-term mateship shows a positive correlation with preferred spousal age difference (Buss et al. 2000). Consciously or not, women respond to men's age preferences. One study found that younger women manipulate their appearance through makeup and adornments such that they are judged by raters to be within the fertile range; women younger than 20 years bias their apparent age upward, while women over 30 years bias their apparent age downward (Perilloux & Gaulin 1997). This preference of men and presentation bias of women tracks the fertility curve of women, with peak fertility occurring between 20 to 24 years in well-nourished women, followed by a steep decline in fertility after 35 years, tapering to the end of fertility at menopause (52 years, mean menopausal age in the US) (Frisch 2002). The evolutionary assumption of these findings is that men are interested in a woman's fertility, which is correlated with age (Menken & Larsen 1986).

On the other hand, women prefer men who are older than themselves, a preference revealed by studies of personal advertisements and marriage age statistics of both western (Holland, Germany, United States) and non-western cultures (India, Philippines) (Kenrick &

Keefe 1992). This may be due to the fact that the attributes women seek in men, such as social status and economic resources, tend to accumulate with age, as well as the fact very young men may lack the social dominance and physical development to provide protection for same-age females. Women are not seeking men for their fertility; men generally do not experience the rapid drop in fertility that women do at menopause, and may remain fertile well into old age (Frisch 2002).

2.1.2. Partner socioeconomic status

Compared to men, women place significantly more emphasis on male socioeconomic status (SES) and social dominance (Buss et al. 1989, Townsend 1989). Status traits such as socioeconomic standing and social dominance seem to affect women's judgments of men's attractiveness more than they affect men's judgments of women's attractiveness. Women's ratings of men's attractiveness are affected more than men's ratings of women by manipulations of verbal and visual status cues, and a man's social status is related to his acceptability as a partner (Townsend & Levy 1990). In contrast, as SES increases for women, the socioeconomic standards they hold for potential partners increases, but for men, the importance of SES of their future wives diminishes in importance as their own anticipated income increases (Townsend 1993).

2.1.3. Physical attractiveness

Compared to women, men place more importance on physical attractiveness of a partner (Buss 1989, 1994; Kenrick & Keefe 1992; Symons 1979, 1995). Several components of physical attractiveness have been studied: body shape, body mass index (BMI), averageness of facial feature size, and symmetry of bodily and facial traits. One aspect of women's physical attractiveness that has received particular attention is waist-to-hip ratio (WHR).

2.1.3.1. Waist-to-hip ratio

Men perceive certain female bodily features that signal female reproductive capacity as attractive. Body fat distribution measured as the waist-to-hip ratio is one such feature. It is calculated by dividing the circumference of the waist (at the narrowest point between the lower costals and the iliac crest) by the circumference of the hips at the greatest protrusion of the buttocks. Values for WHR range from 0.68 to 0.80 for normal western women, and studies suggest that a value of 0.7 is optimally attractive. Research in a variety of cultural contexts has shown low waist-to-hip ratios (small waist relative to hips) to be reliably correlated with attractiveness judgments (Furnham, McClelland, & Omer 2003; Singh & Luis 1994; but see Puhl & Boland 2001 for opposite result). Men rate women's figures with low waist-to-hip ratios as the most feminine, healthy, attractive, and desirable for both casual and long-term relationships (Furnham, Tan, & McManus 1997; Henss 1995; Singh & Young 1995; Singh 1993; Streeter & McBurney 2003). Singh (1993) has proposed that waist-to-hip ratio is the best indicator of a woman's current reproductive capability, and as such, men have an evolved mechanism for detecting this indicator and using it in judgments of women's attractiveness.

2.1.3.2. Averageness

Two components of physical attractiveness that hold importance for both men and women are averageness and symmetry. Perhaps the first researcher to investigate facial attractiveness was Francis Galton (1878). In an attempt to identify the "principal criminal types," he combined photographs of criminals by a method of superimposition. He was perplexed to note that the composite photographs became much more attractive-looking than the individual criminals, noting that "the special villainous irregularities in the latter have disappeared, and the common humanity that underlies them has prevailed". Much later but with not too different a technique, the attractiveness of and preference for average facial features was shown in work done with facial images that were composites of several faces (Langlois & Roggman 1990). Composite faces were rated as more attractive than most of the individual faces that went into them, and facial attractiveness increased as more individual faces entered the composite.

Grammar and Thornhill (1994) attributed the effects of composites to be due to averageness. The positive effects of averageness held for women's faces but not for men's faces; individual male faces were rated as more attractive than male composite faces, and averageness of male features correlated with unattractiveness. Whereas averageness with respect to some features, such as the nose, is associated with attractiveness, largeness in secondary sexual features is considered attractive (Cunningham et al. 1990). For example, in men testosterone facilitates the development of the chin, jaw, cheekbones and brow ridges. Largeness in these traits may be favored as the result of sexual selection on these features (Trivers 1972), possibly contributing to the effect of decreased attractiveness when these features are closer to the mean. Another study found that in women non-averageness of three features, cheekbones, lips, and the chin are considered attractive (Cunningham 1986). Large cheekbones, full lips, and a small chin may display the effects of high estrogen and low testosterone, and non-averageness in the given direction is considered more attractive in these traits (Cunningham 1986, Johnston & Franklin 1993). Testosterone generally handicaps the immune system in males, while estrogen suppresses the cell-mediated immune system in women (Alexander & Stimson 1988, Grossman 1985); thus, traits that are dependent on high levels of these circulating hormones display the immunocompetence of the bearer (Folstad & Karter 1992).

2.1.3.3. Symmetry and fluctuating asymmetry

While averaging faces has the effect of making them more attractive in some cases, it also has the effect of making facial features more symmetrical (Alley & Cunningham 1991). Attractiveness is correlated with measures of symmetry in the human body and face (Gangestad, Thornhill, & Yeo 1994, Grammer & Thornhill 1994, Perrett et al. 1999, Scheib et al.1999, Singh 1995). One type of deviation from perfect symmetry is fluctuating asymmetry. Fluctuating asymmetry is measured as deviation from perfect bilateral symmetry in bilateral traits for which the signed left versus right differences have a population mean close to zero and are normally distributed (Ludwig 1932).

Many studies indicate that inter-individual variation in symmetry explains considerable variance in attractiveness. Measures of symmetry in the human body and face are correlated with attractiveness in both sexes (Gangestad et al. 1994, Grammer & Thornhill, 1994, Perrett et al. 1999, Thornhill & Gangestad 1993, Scheib et al. 1999, Singh 1995). Gangestad et al. (1994) found a significant negative correlation between the fluctuating asymmetry of seven bilateral characters of humans and physical attractiveness. Another study showed that even with the effects of averageness statistically removed, fluctuating asymmetry was significantly negatively correlated with facial attractiveness in both sexes (Grammer & Thornhill 1994). Scheib et al. (1999) showed that women rated symmetrical men's faces as more attractive, even when direct visual cues of symmetry were removed by presenting only half faces of men. And Singh (1995) found that female figures with large symmetric breasts were rated as more attractive than figures with large asymmetric breasts.

Some studies utilize techniques to artificially "symmetricize" faces or bodies. Perrett et al. (1999) created pairs of faces consisting of a (asymmetrical) normal face and a symmetrical version that was created by averaging left/right differences of the normal face at 224 points, then re-mapping the original face to the symmetric shape created by the averaged 224-point layout. The more symmetrical faces were chosen as more attractive significantly more often, and given higher attractiveness rankings than their asymmetrical partner. Likewise, Tovee et al. (2000) found that artificially “symmetricized” women’s figures were chosen as more attractive than unaltered, asymmetrical, images of the same women.

If symmetry is judged to be attractive, then it follows that symmetrical mates would be more preferred as potential mates, and several studies provide this evidence. Women’s olfactory sensitivities and preferences vary across the menstrual cycle, and Gangestad and Thornhill (1998) tested the hypothesis that women would prefer the scent of more symmetrical men during ovulation. Men who had been measured for FA wore a T-shirt for two nights, then women, kept blind to all other characteristics of the men, rated the attractiveness of the smell of each shirt. As predicted, only the women in the most fertile phase of their cycles rated the shirts of the more symmetrical men as better smelling. In another study by Gangestad and Thornhill (1997), it was found that women are more likely to choose symmetrical men for partners outside their primary relationship. Likewise, symmetrical men have more lifetime sex partners (Thornhill & Gangestad 1994) and more extra-pair copulations (Gangestad & Thornhill 1997).

3. The evolutionary significance of physical attractiveness

While many traits are considered important in judgments of attractiveness, the attributes of such traits with regard to reproductive success are not arbitrary. It is likely that many of the traits discussed above offer cues to the fitness of their bearers. What particular qualities do these traits signal with regard to fitness of the bearer, and thus with regard to the eventual fitness of the individual who chooses on their basis?

3.1. Waist-to-hip ratio and fertility

In terms of female mate value, WHR may be a good signal of fertility. The public health literature suggests that the female waist-to-hip ratio is a good predictor of numerous fertility-relevant medical conditions. Low waist-to-hip ratios reflect a distribution of body fat associated with an estrogenic rather than androgenic hormonal profile (Tonkelaar et al. 1990), which is predictive of high fertility (Bjorntorp 1988, Singh 1993). Low WHR correlates with lower testosterone (Rebuffe-Scrive et al. 1989), higher fertility (Kaye et al. 1990), and lower long-term health risks (Bjorntorp 1988). Factors such as pregnancy, menopause, polycystic ovary syndrome, diabetes, and parasitic infections are all associated with increases in WHR, and decreases in fertility (Pirwany et al. 2001; Wass et al. 1997; Zaastra et al. 1993).

3.1.1. Waist-to-hip ratio and body weight

Waist-to-hip ratio seems to be a cue to fertility, and there is evidence that WHR preference is sensitive to ecological context. Some studies have shown that men in non-Western subsistence-based populations do not prefer female figures with low WHRs, but rather a preference for higher weight figures takes precedence over low WHR (Marlowe & Wetsman 2001). Wetsman and Marlowe (1999; Marlowe & Wetsman 2001) found no preference between low and high WHR figures among Hadza men; men instead preferred higher weight figures no matter the WHR. And among the Matsiguenka, men gave more importance to weight than WHR when ranking female attractiveness (Yu & Shepard 1998, 1999). In these cases WHR is confounded with body weight; as WHR increases, body mass increases with all else held constant. When high body weight/high WHR figures are preferred, it is impossible to tell if the preference is for high body weight, high WHR, or both.

These conflicting findings have lead to the proposition that context-sensitive shifts in WHR preference occur; the local context of WHR is different in that the average WHR in these populations is higher than in western populations (Sugiyama 2004). Matsiguenka and Shiwiar women have higher average WHRs than western women (0.92 and 0.87 respectively; 0.68 – 0.80 range for normal western women). Another aspect of the local context may be food scarcity. It is proposed that to men of subsistence cultures where food may be scarce at times, female body weight may be a first criterion of mate value. Higher WHRs are confounded with higher body weights, so men select on apparent body weight. With these concerns in mind Sugiyama showed figures from one weight class at a time, thus minimizing differences in body weight of figures. Under these experimental conditions Shiwiar men did prefer figures with lower WHRs than higher WHRs.

While BMI and WHR both have importance for judgments of attractiveness (Tovee & Cornelissen 2001), some argue that the effects of WHR are negligible as compared to the effects of BMI on attractiveness (Tovee et al. 1999), but the above studies and others that control for the effects of BMI on attractiveness diminish this claim (Streeter & McBurney 2003), and allow for the possibility that the relative importance of BMI and WHR may change in different environmental contexts. Nevertheless, WHR and BMI are certainly salient features of the female phenotype, and both offer information about the fertility and health status of women (Tovee et al. 1999).

3.2. Averageness and genetic heterozygosity

Averageness may be favored for two reasons. Firstly, evolutionary biology suggests that normalizing or stabilizing selection operates against extremes in the population, leaving average values (Dobzhansky 1970). It is posited that a preference for average features may be beneficial because averageness reflects the effects of stabilizing selection against extremes of the population, and deviations from average values may be due to genetic or developmental abnormalities (Thornhill & Gangestad 1993).

Secondly, the parasite theory of sexual selection holds that the antagonistic, coevolutionary battle between hosts and their rapidly adapting parasites and pathogens resulted in preference for traits indicating high protein heterozygosity. A large body of theory and data suggests that sexual reproduction and its attendant processes of meiosis and recombination have been shaped by natural selection over the course of an evolutionary arms race between hosts and their parasites and pathogens (Jaenike 1978; Hamilton 1980; Bremermann 1980; Tooby 1982; Bell 1982). Parasites and pathogens have been a strong selective force on long-lived organisms; they have short generation times relative to their hosts, which allows them to become rapidly adapted to the host's genotype. The parasite theory of sexual selection proposes that sex short-circuits the rapidly evolving tactics of these somatic invaders, by producing offspring with novel genotypes, or high heterozygosity. High heterozygosity refers to the possession of uncommon alleles and the subsequent ability to produce uncommon proteins to which pathogens are less likely to be adapted. How is this related to averageness of a feature? Heterozygosity "is highest in individuals who exhibit the average expression of continuously distributed, heritable traits" (Thornhill & Gangestad 1993, p. 251; Mitton & Grant 1984).

Few studies have tested for a relationship between averageness and actual measures of health or heterozygosity. At least one study shows a link between averageness of facial features and health measures; Rhodes et al. (2001) found a correlation between poor childhood health in males and poor current health in females.

3.3. Symmetry and developmental stability

What does symmetry indicate? Since most organisms are genetically coded to develop identically on the right and the left (aside from directional asymmetry (e.g. the human heart and brain) or antisymmetry (e.g. fiddler crab claws)), *deviation* from perfect bilateral symmetry at different points of the body and face is believed to reflect the degree to which an individual's genotype is *unsuccessful* at precisely expressing developmental design when assaulted during development by foes such as parasites, pathogens, and other environmental perturbations or insults (Van Valen 1962). Fluctuating asymmetry has been used extensively as a marker of developmental stability, which is correlated with fitness (Kowner 2001) via its relation to several domains of physical and mental health (discussed below), mating behaviors, and attractiveness perceptions (discussed previously).

3.3.1. Studies of symmetry and health

Symmetry in the features of both humans and non-humans correlates with genetic heterozygosity and with several measures of fitness, including health, longevity, mental health and cognitive performance (Moller & Thornhill 1997). Schizophrenics have greater dermatoglyphic FA than non-schizophrenics (Markow & Wandler 1986), and in heterosexual and homosexual men, higher FA scores correlated with poorer scores on cognitive tasks of line orientation judgments, verbal fluency, and perceptual speed (Qazi, Wilson, & Abrahams 2004) (however the same relation between FA and cognitive task performance was not found in women). Also in men, but not in women, increased FA was associated with higher measures of depression (Martin, Manning, & Dowrick 1999). Symmetric bilateral morphological features such as the digits, ears, and feet in humans, and fins and tail feathers in other species are indicators of heterozygosity. Low fluctuating asymmetry in such features is associated with several measures of fitness: increased fecundity, growth, and survival; reduced parasite load (Moller 1997, 1999; Manning et al. 1997); and decreased health risks (Scutt et al. 1997).

In humans, asymmetry is associated with negative health measures. Chromosomal abnormalities and genetic diseases were found to be associated with increased FA (reviewed n Thornhill & Moller 1997). A positive association between FA and BMI (in women) and between FA and number of medical conditions was found in a sample of 965 twenty-six year old men and women (Milne et al. 2003). Similarly, Waynforth (1998) showed that FA predicted number of adult illnesses in a sample of men in rural Belize. Al-Eisa, Egan, and Wassersug (2004) found that low back pain was associated with increased FA in measures of the pelvis, ulna, and bistyloid. However, one study found no relationship between facial symmetry, in particular, and measures of past or present health in 316 men and women (Rhodes et al. 2001).

The study by Scheib et al. (1999) (Section 3.1.5) is interesting because despite not being able to see both sides of the men's faces, women chose the most symmetrical faces as more attractive. This suggested that there is another independent correlate to symmetry that is detectable. Jones et al. (2004) found that the cue may be skin condition; symmetrical faces tend to have skin that is perceived as healthier in color and texture, and healthy skin is a further indication of one's genetic quality.

3.3.2. Symmetry and good-genes sexual selection

Because morphological symmetry correlates with other measures of fitness, it is a candidate phenotypic marker of genotypic quality, or "good genes" (Moller 1992, Moller & Swaddle 1997, see Moller & Thornhill 1997 for a review), and may reflect the underlying genetic heterozygosity that allows for maintainable heritable resistance to parasites (Thornhill &

Gangestad 1993). Good-genes sexual selection theory asserts that individuals should seek out partners who display traits indicative of viability, genetic fitness, parasite resistance, and heterozygosity (Hamilton 1980; Hamilton & Zuk 1982), traits that may be signaled by symmetry. On this view parasite and pathogen resistance should be a key criterion of mate choice, and a good cue to it may be symmetry.

But what is the relationship between the perception of cues of mate value in potential mates and what we call "attractiveness"? And how does "attractiveness" serve to guide mate choice?

3.3.3. Attractiveness and mate value

"Attractiveness" is a key independent variable in the social and evolutionary psychological literature, and it allegedly explains considerable variance in how individuals are perceived and in how they behave. Several aspects of attractiveness have been identified, and many of the studies reviewed above demonstrate attempts to parse attractiveness itself by explaining the variance in attractiveness. Thus, over the past decade psychologists have begun to realize that "beauty is in the adaptations of the beholder" (Symons 1995). This viewpoint suggests that we should have evolved to perceive any reliable phenotypic correlates of fitness as attractive. But different phenotypic traits may signal different components of fitness. As described above, several different phenotypic traits are part of attractiveness, and each represents some aspect of the quality of the individual bearing it. Men may give greater weight to physical attractiveness because two aspects of mate value of women, fertility/maternal investment and genetic quality, are represented by physical traits in women. On the other hand, of men's mate value features, good genes and paternal investment, genetic quality stands out as a physical trait (i.e. symmetry). Since it is impossible to maximize all preferred traits in a mate, a plan for optimizing investment of energy into the various activities surrounding mate selection and acquisition must be implemented; these plans are mating strategies.

4. Mating strategies

Mating strategies are "integrated sets of adaptations that organize and guide an individual's reproductive effort" (Gangestad & Simpson 2000). Reproductive effort can be spent in multiple ways: seeking mates, parenting, competing against conspecifics for mates. Various factors influence where effort should optimally be spent, and each individual's own mate value partly determines what kind of bargain he or she can drive. While men and women should have been selected to prefer mates who are high on all preferred traits, few can actually obtain such high-quality partners because most fall short themselves on what they have to offer a partner. Furthermore, partners who *are* of high mate value can and do invest less in a single partnership due to their high demand by many of the opposite sex (Simpson et al. 1999; Burley 1986 (zebra finches)). This results in a negative correlation between high investment and high genetic quality or viability (Gangestad & Simpson 2000). Since it is impossible to maximize all qualities in a mate, most mate-seekers are forced to trade off one quality for another, and to pursue certain actions over others. The set of specific behaviors and actions that individuals utilize, in combination with/as a response to environmental or genetic cues, form the basis of a conditional mating strategy. In general, there are broad sex differences in mating strategy, but the end result is a strategy to obtain a mate of highest quality possible given one's own value.

4.1. Women's strategies

Males and females of most species have divergent but overlapping mating strategies, due to the differing limitations on reproductive success imposed on each by their reproductive physiologies (Trivers 1972). Women's mating strategies revolve around attempting to maximize two aspects of male mate value: paternal investment for her offspring or good genes to pass on to her offspring. The preferences of women have evolved to favor cues to these and related qualities of men (Cashdan 1996).

Physical attractiveness is one cue of mate quality. In general, women give lower priority to mate physical attractiveness as compared to men. However, the preference for physical attractiveness can take priority in some circumstances, leading to within-sex variation in how important physical attractiveness is. In a pair of studies examining traits desired in partners and the level of involvement in a relationship, Kenrick et al. (1993) found that women exhibited a reversal in the preference for physical attractiveness of partner. In one-night stand situations men's requirement for female physical attractiveness was lowered, whereas for women in one-night stand situations the requirement for male physical attractiveness increased, as compared to their requirements for more involved relationships. In other words, when told to expect no paternal investment at all, women preferred males high in physical attractiveness. Thus in a situation in which women are least likely to get any investment, the most important trait in such a mate becomes his physical attractiveness. But why is there a shift in the importance of physical attractiveness for women? Selecting a partner who is a good provider is important for women, but in situations where she is receiving only genes from her partner, selection on the basis of good genes is of overriding importance.

Mating strategies include behavioral components as well. Complementary to the findings of Kenrick et al. (1993), Cashdan (1993) predicted that women who expect non-investing men are more likely to display their sexuality and be more sexually promiscuous, while women expecting to find investing males attract them by displaying fidelity and chastity. Women's expectations about paternal investment were measured on a paternal investment scale which contained questions about participants' attitudes about male paternal roles and questions about the importance of the financial and emotional investment participants had received from their own parents. A Mate Attraction Questionnaire adapted from Buss (1988) was used to determine the acts and behaviors utilized by women to attract mates. There were strong correlations between PI score and mate attraction scores in the predicted directions; women who expected investing men were less likely to report using tactics like "act sexy" but were more likely to demonstrate fidelity and chastity. These results have been interpreted as evidence for a tradeoff between acquiring resources from a partner versus acquiring "good genes" from a partner when resources are not available, and displaying mating behaviors consistent with that choice of tradeoff.

One limitation of the Kenrick et al. (1993) study is that it asked participants to place themselves in hypothetical situations making choices about potential mate characteristics. While everyone was asked to make the same evaluations, potential effects of participants' own, real mating strategies may have biased them. On the other hand, Cashdan did evaluate the participants' own states of paternal investment, and mate attraction tactics related to PI expectations were assessed. However, preferences for (as opposed to expectations about) particular partner characteristics were not investigated.

Variation in women's preferences for partner traits has been demonstrated. Preferences for the physical attractiveness traits of facial symmetry and facial masculinity have been demonstrated in several studies (Penton-Voak & Perrett 2000, Gangestad & Thornhill 1999, Penton-Voak et al. 1999, Perrett et al. 1998). Women are capable of differentiating between more and less symmetrical men, even without seeing them; olfactory cues are sufficient as are half faces. Women shift their preferences for men of varying degrees of facial masculinity over the course of the menstrual cycle, preferring more masculine men around ovulation, and more feminine men at other points in the cycle (Gangestad & Thornhill 1998, Rikowski & Grammer 1999, Thornhill & Gangestad 1999). This variation in preference represents facultative shifting of mating strategy over the course of the cycle; when chances of conception are increased, more masculine, symmetrical men are preferred (good genes preference). When chances of conception are low, less masculine men are preferred (good provider). These two facial types may represent the two qualities women seek in mates: good genes and paternal investment.

But are masculine, symmetrical men really less paternally inclined as compared to more facially feminine men? Research suggests that these facial traits may be related to behavior, specifically behaviors that may be related to sociosexuality, a dimension of personality that reflects interest in casual sex versus commitment. Symmetrical men appear to be more socially dominant (Gangestad & Thornhill 1998), aggressive (Manning & Wood 1998), and violent (Furlow, Gangestad, & Armijo-Prewitt 1998) than less symmetrical men, and direct competition tactics in dating situations (e.g., verbal derogation of a competitor) are more likely to be utilized by men with lower FA. One study found that men lower in sociosexuality (i.e., more interested in a long-term relationship) were less likely to be willing to approach attractive women than men scoring higher in sociosexuality (Brase & Walker 2004). If these behaviors are related to sociosexuality, and if sociosexuality is inversely related to paternal investment, then it follows that low FA men may be less likely to invest. Just as sociosexuality may mediate overall mating strategy in women, it likely does so in men as well.

4.2. Men's strategies

Ideally, a man should choose women who are highly fertile and have good genes. His choices may be limited by what he has to offer women and the degree to which he can provide what they seek: paternal investment or good genes. Since men vary in what they can offer, and women, facing a higher minimum parental investment (Trivers 1972), are more discriminating in their partner choices, few men can obtain partners high in all the preferred dimensions of mate choice. Likewise, women vary in the benefits they can offer to men. Women can offer men a reproductive benefit through availability for fertilization and gestation, or can provide high genetic quality of offspring, and women likely vary in their ability to provide these resources. The level of paternal investment a man is willing to commit in part mitigates the outcome of this tradeoff. Paternal investment interacts with several aspects of mating behavior.

4.3. Paternal investment

Paternal investment can range from contributing only gene-containing sperm to rearing of young to maturity with no maternal investment beyond producing the egg. Across the animal kingdom, most paternal investment falls toward the former end of the spectrum. But among humans a large percentage of males put forth substantial paternal investment that falls toward the latter end of the spectrum. In addition, humans may be unique in that there is such a large degree of variation in paternal investment within this species. Human male mating strategies may be characterized along a continuum ranging from low paternal investment to high paternal investment, and the degree of paternal investment affects the mate attraction tactics men employ (Geary 2000).

Cashdan's (1993) study showed that investing men, as measured by a paternal investment questionnaire, were more likely to display their willingness to invest and their ability to acquire resources, whereas non-investing males were more likely to advertise their sexual attractiveness and engage in more sexual behavior. It follows that variation in paternal investment and variation in subsequent mate attraction behaviors should coincide with variation in the characteristics of the targets of this effort, women. Paternal investment should be directed to women in such a way as to maximize its benefit and minimize its cost for men. Moreover, women vary in the degree to which they are willing to forgo paternal investment, and in the degree to which they provide returns on paternal investment. Different levels of maternal investment provide differing returns on paternal investment (see Cashdan 1993).

4.4. Female physical attractiveness: a non-unitary trait

For women it has been shown that different aspects of male attractiveness represent different qualities of male mate value. Is there a parallel for men? That is, is women's physical attractiveness a unitary trait, representing one aspect of mate value, or do different aspects of physical attractiveness represent different qualities to men? The crux of this research is to test the idea that different features indicate different qualities to men, and that they will choose these qualities on the basis of their own mating strategies.

It is proposed that some phenotypic traits of women may reflect fertility, the ability to garner resources and convert those resources into offspring. And others may reflect genetic quality, the ability to contribute genes that build adaptive phenotypes. While there may be a positive correlation between fertility and genetic quality, the two are obviously distinct and dissociable: For example, a woman's genetic quality is constant over her lifetime while her fertility varies widely as a function of her age.

Perceptions of attractiveness have probably been sculpted by natural selection so as to optimize mate choice, and the fitness dimensions, fertility and genetic quality, should be part of the optimal mix. This fact complicates the study of attractiveness: Which attractiveness dimensions reflect fertility and which reflect genetic quality? Is there any tool one might use to sort these two types of attractiveness criteria? The approach proposed here relies on naturally occurring variation in human mating strategy measured by the personality dimension sociosexuality.

4.5. Sociosexuality

The term “sociosexuality” refers to a dimension of personality that indexes interest in casual or uncommitted sex as opposed to interest in investing as a committed parent (Simpson & Gangestad 1991). It is measured, as are other personality dimensions, by the participant's level of agreement or disagreement with a series of items to place him or her along a continuum of restricted/unrestricted sexuality. Relatively restricted individuals prefer exclusive sexual relationships and are more willing to invest in any resulting offspring. Unrestricted individuals require relatively little emotional commitment to form a sexual relationship but cannot be counted on to invest in any resulting progeny. Previous studies have shown there is considerable variance in sociosexuality within each sex, there is a substantial and replicable mean sex difference, and there is external validity based on partner report (Simpson & Gangestad 1991, Oliver & Hyde 1993).

Sociosexuality is correlated with higher numbers of sex partners in both men and women and (Mikach & Bailey 1999, Simpson & Gangestad 1991)), and variation in male sociosexuality is associated with variation in mating tactics, such that more highly sociosexual men are more likely to use direct competition tactic (e.g. verbal derogation of competitors) rather than indirect tactics (e.g. present self as nice guy) (Simpson et al. 1999). The sociosexuality construct and measure were designed to measure the degree to which individuals require commitment and closeness before entering a sexual relationship with a romantic partner (Gangestad & Simpson 1990, Simpson & Gangestad 1991). As such, it serves as a proxy measure for behaviors and attitudes related to mating strategy, and its variation should be related to trade-offs made in other aspects of mating strategy, such as preferences about mates who vary in qualities related to fitness and fertility.

5. Hypothesis

Theory suggests that sociosexually restricted and unrestricted individuals will have different mating priorities, the former emphasizing quality via a long-term mating strategy while the latter will emphasize quantity by following a short-term mating strategy. Since restricted individuals will tend to pursue a long-term strategy, with investment in a single mate and her offspring, it is important for them to recruit high quality genes for these offspring. In contrast, unrestricted individuals will invest little in any individual mating, and will succeed best simply by avoiding less fertile partners. Thus men who vary in sociosexuality may also vary in their mating preferences, especially when forced to make tradeoffs between various desirable female traits. A plausible case has been made above that symmetry and waist-to-hip ratio reflect genetic quality and fertility, respectively. In this series of studies the relationship between sociosexuality, as measured by the Sociosexuality Inventory, and two components of female physical attractiveness, symmetry and waist-to-hip ratio will be examined.

5.1. Predictions.

The present studies focus on the two components of female attractiveness, fluctuating asymmetry (FA) and waist-to-hip ratio (WHR), which are alleged to represent genetic quality and fertility, respectively. Individual differences on the sociosexuality dimension of men are predicted to correlate with differing priorities on these two components of female mate value.

Prediction 1. *Measures of waist-to-hip ratio and symmetry in women are not correlated.* One assumption of this research is that symmetry and waist-to-hip ratio of women are independent and thus dissociable elements of mate value representing genetic quality and fertility, respectively. It is predicted that these two measures of genetic quality and fertility are not correlated.

Prediction 2. *Men's individual differences in sociosexuality will affect the valuation of two aspects of women's physical attractiveness, WHR and FA*. Specifically, highly sociosexual men pursuing a short-term mating strategy will prefer women with lower WHR to women with lower FA. Men lower in sociosexuality (long-term investing strategy) will show preferences for women with lower FA rather than lower WHR. Thus "cad's" will prefer fertility (low WHR) to good genes (low FA), whereas "dad's" will prefer good genes (low asymmetry) to fertility (low WHR), when forced to trade these values off in a mate choice paradigm.

Prediction 3. *Sociosexuality and parental investment scores are inversely related to each other*. If they are complementary aspects of mating strategy, energy expended on one would preclude or limit expenditure on the other domain, therefore attitudes about each should be inversely related.

6. Overview of studies

A sociosexuality questionnaire pilot study, a correlational study of FA and WHR, and three empirical studies were done. The questionnaire pilot study was done to develop a questionnaire that integrated questions about both sociosexuality and parental investment into one instrument. A correlational study examined the relationship between WHR and FA in a sample of women's images (Prediction 1). Empirical studies of three groups of participants, using the sociosexuality questionnaire and visual stimuli of women who varied in WHR and FA, tested the relationships between sociosexuality and female phenotype (Prediction 2). Finally, another correlational study utilized questionnaire data to examine the relationship between indices of sociosexuality and parental investment (Prediction 3).

METHODS

7. Measures

7.1. Sociosexuality questionnaire

7.1.1. Pilot study

There have been many studies examining the role of parental investment (Cashdan 1993) and sociosexuality (Gangestad & Simpson 1991, Gangestad & Thornhill 1997, Bailey et al. 2000, Michalski & Shackelford 2002) in the mating context. Researchers have investigated sociosexuality and parental investment using several different instruments. The most commonly used scale is Simpson and Gangestad's (1991) seven-item Sociosexuality Orientation Inventory. Another frequently used scale is Eysenck's Personality Inventory (1976) from his study of the genetics of sexual behavior. And Cashdan's Parental Investment Scale (1993) looks at the complement to sociosexuality, parental investment. Because the current research is concerned with both parental investment and sociosexuality, a questionnaire measuring both constructs was necessary. Since combining questions from the above instruments resulted in an unduly long questionnaire, principal components analysis was used to explore dimensional loading of questions, and correlational analysis was utilized to remove redundant questions.

7.1.1.1. Principal components analysis

Thirty-five questions from the above inventories were combined in one questionnaire that was administered to 24 male and 43 female participants. Principal components analysis with varimax rotation and Kaiser normalization was utilized to determine the factor structure of items. By retaining components with Eigenvalues greater than one, seven components emerged. Three components had nineteen, seven, and five questions loading on each, and these are referenced as the sociosexual component, the parenting component, and the "cad"-itude component (as in "cads" versus "dads") respectively. The remaining four components each had a single question loading on them.

7.1.1.2. Correlational analysis

A correlational analysis was performed to identify highly correlated questions so that redundant questions could be identified and removed from the questionnaire to reduce its length. From pairs of questions within the same component that were highly correlated ($r > .90$), one question of the pair was eliminated. This resulted in the elimination of seven questions. One additional question was eliminated due to archaic terminology and three were eliminated on the basis of face validity (e.g., double-barreled question dealing with two concepts).

The final questionnaire contained 24 questions remaining from the above, and of those 24 questions, 17 questions were converted into separate component indices based on their loading on the components of interest (sociosexuality, parental investment, or caditude), whereas seven other questions remained on the questionnaire but were not used for the present analysis. The 17 questions formed the Sociosexuality Index (seven questions, Appendix B), the Parental Investment Index (five items, Appendix C), and the Cad Index (four questions, Appendix C). These items were counterbalanced by polarity such that for some items agreement indicates high sociosexuality, parental investment, or caditude, whereas for others disagreement does so.

For each index, items were scored by inverting the choices of the reverse-polarity items, assigning values 1 through 6 for "strongly disagree" through "strongly agree", multiplying each value by that question's factor score (Appendix B) taken from the pilot study's principal components analysis, and then summing the resulting values over all items in the index. Sixteen other questions on the questionnaire were related to demographics of the subjects or were openended questions that did not lend themselves to the above analyses. This 40-item (total) questionnaire (Appendix A) was used with all experimental groups described herein.

7.2. Stimulus images

Images used in the study were selected from images on Akira Gomi's CD-ROM *Americans 1.0*. The images were of one hundred Los Angeles women recruited by Japanese art photographer, Akira Gomi, to pose clothed and unclothed for $25. Each woman was photographed both clothed and unclothed from all four aspects (front, back, left, right) while standing upright with a neutral body posture and facial expression. Sixty-three unclothed rear images were selected for these studies on the basis of possession of three factors: non-extreme BMI, clearly visible lines of measurement (unobscured by hair or decoration), and apparent Caucasian type. This resulted in the selection of 63 images. Each image was frame-grabbed to extract it from the disk, and then the background was cropped out to magnify the proportion of the image occupied by the woman's image. This technique of extraction produced an approximately 5" x 8" image in which the middle vertical third was occupied by the woman's image; the remainder was background (see Figure 1 for example of one image).

For the correlational study of FA and WHR, this 63-image sample was used, referred to as Sample I. But for Study 1 and Study 2, two subsamples of 15 images (Set I) and 10 images (Set II) were selected from Sample I. (Note that one image was used in both subsamples.) The criterion for selection from these 63 images was those with highest discordance in WHR and FA; that is, none chosen possessed desirable values for both WHR and FA, i.e., images with good (low) WHRs had to have poor FA (high) measures, whereas images with good (low) FA measures had to have poor (high) WHRs. The 24 highest-discordance images were selected, and they were divided into three sets of images, Set I, Set II, and Set III, described below.

7.2.1. Image set descriptions

In order to rule out the possible effects of breast size or facial attractiveness, all sets consisted of images of the posterior view of the model. Sets varied in number of images, head cropping, and amount of skin smoothing applied to images (Table 1). Set I contained 15 full body images that were relatively unaltered. Heads were cropped in Sets II and III to rule out effects of hair color and style. Uneven skin tone, spots, tan lines, and bruises were airbrushed with Photoshop on Sets II and III. Set II contained 10 images with heads cropped at the shoulder and any long hair airbrushed out with Photoshop; one image in Set II was also included in Set I. Set III consisted of the same 15 women as in Set I, but with heads cropped off at the shoulders and skin airbrushed. Images from all sets were presented to participants as 8 ½” x 11” photographic-quality color prints.

7.2.2. Measurement

The stimulus images were measured in pixels for WHR and FA using Adobe Photoshop 6.0. Measurements of WHR and FA of each image were obtained as described below, and Figure 1 shows the measurement lines.

7.2.2.1. WHR measurement

The WHR measure was the length of the horizontal line across the narrowest point at the waist divided by the length of the horizontal line across the widest point at the hips. Distributions of WHRs for Sample I and for combined Sets I and II are shown in Figures 2 and 3 respectively.

7.2.2.2. FA measurement

Fluctuating asymmetry is a population measure that measures deviation from perfect bilateral symmetry in bilateral traits for which the signed left versus right differences have a population mean close to zero and are normally distributed (Ludwig 1932). More recently, FA has been used as an individual difference measure (Grammer & Thornhill 1994, Jones et al. 2001, Perrett et al. 1999, Putz et al. 2004, Rhodes et al. 2001, Scheib et al. 1999, Tovee et al. 2000). As such, FA may be expressed as the absolute value of the difference between the left and right sides, divided by the mean of the left side plus the right side (Moller & Swaddle 1997; Livshits & Kobylianski 1989; Gangestad et al. 1994). A composite index is achieved by summing the FA of several traits, and differences in this index from different samples is thought to reflect developmental stability.

The measure of fluctuating asymmetry used herein followed from the above. This composite index of FA was measured as the additive deviation of the left and right sides of eight horizontal lines measured from the vertical centerline of the image, plus the additive deviation in height of two pairs of left and right vertical lines measured from a horizontal reference line to two bodily features (see Figure 1). Thus the formula below, where L and R represent the left and right measurements of traits *i* (1 through 10):

$$FA = \sum_{i=1}^{10} \frac{|L_i - R_i|}{\left(\frac{L_i + R_i}{2}\right)}$$

Two different sets of FA measurements were made based on placement of the vertical centerline on an image. Because the vertical crease of the buttocks seems to be a salient feature of the rear view, *Measure I* was anchored by the vertical centerline's placement such that it evenly divided the natural vertical line between the buttocks. In an attempt to use a more objective placement of the centerline, *Measure II* used the midpoint of the horizontal waist measure as the anchor for the vertical line bisecting the body. Because ideal FA should display a mean of zero and a normal distribution for the L-R distribution (Palmer & Strobeck 1992), each set of measurements was then tested for fluctuating asymmetry. Descriptive statistics for WHR and Measures I and II are shown In Table 2.

7.2.2.3. Test of fluctuating asymmetry

By each method of measurement (Measure I and Measure II), the asymmetry measures from images in Stimulus Sets I and II (total 24 images) were tested for fluctuating asymmetry.

Trait pairs from Measure I and Measure II were tested for normality of distribution by subjecting L-R differences to the Shapiro-Wilk Normality test. From Measure I, two trait pairs of the ten measured showed significant non-normality, Line 7 and Line 9 ($p = 0.034, 0.000051$ respectively). From Measure II, of the 10 trait pairs, two showed significant non-normality. These were Line 1 and the Waist Line ($p = 0.016, 0.00002$, respectively). All other trait pairs were non-significant at $p \leq 0.05$, and thus showed approximately normal distributions.

Paired sample *t*-tests were run for the mean L-R differences on each measured trait pair. For Measure I, three trait pairs showed significant mean L-R differences (test value = 0, $p \leq 0.05$). The measures that showed these differences were Line 1 (the line above the waist), Waist Line, and Line 3 (next below the waist) (see Figure 1). For Measure II, no trait pair showed significant mean L-R differences (test value = 0, $p \leq 0.05$).

Because all traits did not display mean L-R differences of zero when measured by Measure I, it was abandoned in favor of Measure II. Thus, all subsequent tests were run using Measure II. Distributions of FA Measure II for Sample I and for the combined Stimulus Sets I and II are shown in Figures 4 and 5, respectively.

8. Correlational analysis of FA and WHR

To test Prediction 1, the assumption that FA and WHR are not correlated, WHR and the composite FA measurements of two samples of women's images were tested for correlation. One sample was the 63 images described above (Sample I), and another sample was a convenience sample of 32 images from the 63 (Sample II). Pearson's r was computed between WHR and FA for both sets.

9. Study 1

9.1. Participants

Participants (n = 132; mean age = 20.6 years) were undergraduate heterosexual male (n = 41; mean age = 21.) and female students (n = 91; mean age = 20.5) participating in the study as an alternative extra credit assignment at the University of Pittsburgh. Participants had the option of either participating in the one-hour study or writing a short paper for extra credit. Informed consent was obtained from all participants prior to the study. To maintain anonymity, only identification numbers identified participants' materials; there was no link between participant name and ID, and all consent forms and test materials were placed in a secure location.

Since no predictions were made about female sociosexuality and judgments of female attractiveness, the female participants served as controls. Presumably homosexual or bisexual participants of either sex were identified by their answer to item 39, "which do you most enjoy and/or fantasize about? Having sex with members of the opposite/your own/ both sex(es)," and excluded from analysis (n = 9).

9.2. Procedure

After informed consent was given, participants completed the sociosexuality questionnaire and ranked stimulus Set I (described in section 8.2.1.). Participants were tested in a testing room either individually or in pairs, with each having a set of all testing materials. Upon completion of testing, participants were thanked, debriefed, and invited to ask any further questions.

9.2.1. Ranking task

Male participants were instructed to rank photographs from "*most attractive as a partner*" (rank 1) to "*least attractive as a partner*" (rank 15). No further instruction as to the meaning of "partner" was given. If the experimenter was questioned about the meaning of "partner" the participant was told, "whatever partner means to you". Female participants were instructed to imagine that the women in the photographs were "*interested in their boyfriend or in the same guy*" they were interested in, and ranked the photographs from "*most threatening*" (rank 1) to "*least threatening*" (rank 15) in terms of mating competition.

Participants were instructed to put all of the images in order from "least attractive/threatening" to "most attractive/threatening" based on the above. To avoid confusion for the experimenter and potential embarrassment to the participant, participants were instructed to apply sticky notes indicating "least" and "most" on the images at the top and bottom of the piles. In addition, a suggestion was made that they could first group the images into a "least" pile, a "most" pile, and an "in-between" pile to assist with the sorting. No experimenters were present in the room during either the completion of the questionnaire or the ranking task.

In addition, a subset of subjects (N = 70) also rated Set II images for attractiveness (after ranking them) on a scale of one (least attractive) to ten (most attractive). The use of rating scores in subsequent analyses provided results similar to those given by ranking scores, thus ranking scores were used for all analyses described below.

9.2.2. Data analysis

Data were analyzed using the SPSS 11.0 statistical package. Separate analyses were performed for stimulus Sets I and II.

Preference slopes For each participant two preference slopes were computed: s*lope of WHR on rank of stimuli* and *slope of FA on rank of stimuli*, where $\mathbf{rank_{given}}$ is the rank ascribed by participant to a particular stimulus**,** $\mathbf{rank_{total}}$ is the total number of ranks possible (either 15 or 10 for Sets I or II, respectively), $\mathbf{rank_{actual}}$ is the particular stimulus' rank according to actual measure of trait, $\mathbf{X_{measure}}$ is mean FA or WHR for a given stimulus set, $\mathbf{SD_{measure}}$ is standard deviation of the measure of FA or WHR for a given stimulus set, and $\mathbf{SD_{ranks}}$ is the standard deviation of total ranks.

$$slope = \left[\frac{\sum_{i=1}^{n_{rank}} ((rank_{given} - rank_{total}) * (rank_{actual} - \overline{X}_{measure}))}{(rank_{total} * SD_{measure} * SD_{ranks})} \right] * (SD_{measure} / SD_{ranks})$$

Each slope thus indicates the individual rater's degree of preference for the trait in question. Preference for male raters is in terms of "most attractive as a partner" and preference for female raters is in terms of "most threatening" in mating competition.

Regressions. Regressions between individual preference slopes and SI score were computed, separately for WHR and FA. These regressions indicated the extent to which trait preferences changed across the spectrum of sociosexuality scores represented by participants.

10. Study 2

Study 2 was a replication of Study 1 using a stimulus set of 10 novel female images (Set II) in addition to the original 15 images with some alterations (Set III). These sets differed from Set I with regard to head cropping and skin airbrushing, as described in Section 8.2.1. A new sample of 141 male participants was recruited from the psychology subject pool at the University of Pittsburgh; no female participants were recruited. After informed consent was obtained, participants completed the sociosexuality questionnaire and evaluated the two stimulus sets separately on attractiveness as in Study 1.

10.1. Participants and procedure

Participants were undergraduate heterosexual males (n = 141, mean age = 19.0 years) from the University of Pittsburgh psychology subject pool. After informed consent was given, participants completed the sociosexuality questionnaire and ranked Set II and Set III separately. All participants ranked Set II, and will be referred to as Group 1. A subset of Group 1, Group 2 (n = 40, mean age = 19.8 years), also ranked Set III. Participants were tested in a testing room either individually or in pairs, with each having a set of all testing materials.

10.2. Data analysis

As in Study 1, for each participant two preference slopes were computed: s*lope of WHR on rank of stimuli* and *slope of FA on rank of stimuli.* Each slope indicates the individual rater's degree of preference for the trait in question. Preference is in terms of "most attractive as a partner". The slope formula in section 10.2.2 was used. Regressions between individual preference slopes and SI, PI, and CAD scores were computed, separately for WHR and FA, and separately for stimulus Set II and Set III. These regressions indicated the extent to which trait preferences changed across the spectrum of sociosexuality, parental investment, or caditude scores represented by the participants. Regressions between WHR or FA preference and the quadratic term of SI were performed as well.

11. Correlational analyses of SI, PI, and CAD indices

Questionnaire data from participants in the above studies were used to examine the relationship between the Sociosexuality Index, the Parental Investment Index, and the Caditude Index. Correlational analyses were run between SI, PI and CAD Indices. Sociosexuality should be positively related to negative attitudes about investment in a mate and offspring ("caditude"), and negatively related to positive attitudes about parental investment. High CAD scores indicate less willingness to invest, and high PI scores indicate more willingness to invest.

11.1. Participants and data analysis

Participants were from two groups based on the above studies. Study 1 participants consisted of male (n = 41, mean age = 21.0) and female (n = 91, mean age 20.5) undergraduate heterosexuals (total n = 132, and Study 2 participants (all male, n = 141, mean age = 19.0 years) described above. Correlational analyses were run between SI, PI and CAD Indices for each group separately.

RESULTS

12. Correlational analysis of FA and WHR

Measures of WHR and FA of Sample I (63 images), Sample II (32 images), and combined Stimulus Sets I and II (24 images) were analyzed for Pearson's correlation. There was no significant positive correlation between WHR and FA in Sample I ($r = 0.0827$, $p = 0.5196$), Sample II ($r = 0.1139$, $p = 0.5346$), or combined Sets I and II ($r = -0.021$, $p = 0.921$).

12.1. Relationships between attractiveness and FA/WHR

Participants from Study 1 and 2 (described below) ranked all images in the Studies described below. Each image's mean rank was computed and then inverted so that increasing inverted ranks indicated increasing attractiveness scores. For Stimulus Set II ranked by 137 male participants, there was a marginally significant relationship between attractiveness and WHR ($r = -0.608$, $p = 0.062$), and no significant relationship between attractiveness and FA ($r = -0.103$, $p = 0.776$). For Stimulus Set III ranked by 40 men, there were no significant relationships between attractiveness and WHR ($r = -0.061$, $p = 0.830$) or FA ($r = 0.386$, $p = 0.156$).

While the correlations did not show significant relationships between attractiveness rankings and WHR or FA, Figures 23, 24, and 25 show that the variables are non-significantly related to each other in the predicted directions (a negative relationship: as attractiveness increases, WHR or FA decrease). Figure 26, however, shows the relationships between mean attractiveness rankings and FA score to be contrary to the predicted direction.

13. Study 1

Scores on the three component indices SI (sociosexuality), PI (parental investment), and CAD (caditude) were obtained for 43 men and 93 women. Mean SI for men ($M = 21.1$, $SD = 6.6$) significantly exceeded mean SI for women ($M = 15.7$, $SD = 5.5$), $p < .001$, whereas mean PI and CAD were not significantly different for men and women ($p = 0.255$ for PI, $p = 0.809$ for CAD).

Regressions -- Male participants

Sociosexuality Index. For regression between WHR preference slope and SI score, there was no significant correlation ($r = -0.140$, $p = 0.370$, Figure 6). **For regression between FA preference slope and SI score there was a significant correlation ($r = 0.310$, $p = 0.043$, Figure 7).**

Parental Investment Index. **For regression between WHR preference slope and PI score, there was a significant negative correlation ($r = -0.300$, $p = 0.045$)**. For regression between FA preference slope and PI score, there was no significant correlation ($r = 0.097$, $p = 0.525$).

Caditude Index. For regression between WHR preference slope and CAD score, there was no significant correlation ($r = 0.152$, $p = 0.318$). For regression between FA preference slope and CAD score, there was no significant correlation ($r = 0.196$, $p = 0.196$).

Regressions -- Female participants

Sociosexuality Index. For regression between WHR preference slope and SI score, there was no significant correlation ($r = -0.026$, $p = 0.808$, Figure 8). For regression between FA preference slope and PI score, there was no significant correlation ($r = 0.112$, $p =0.284$, Figure

9).

Parental Investment Index. For regression between WHR preference slope and PI score, there was no significant correlation ($r = -0.051$, $p = 0.612$). For regression between FA preference slope and PI score, there was no significant correlation ($r = 0.136$, $p = 0.176$).

Caditude Index. For regression between WHR preference slope and CAD score, there was no significant correlation ($r = 0.083$, $p = 0.410$). For regression between FA preference slope and CAD score, there was no significant correlation ($r = 0.035$, $p = 0.729$).

To summarize, regression analysis revealed a significant positive correlation between SI index and FA preference slope and between PI index and WHR preference slope for men, but no other relationships for PI, SI, or CAD indices were found for either men or women.

14. Study 2

Scores on the three component indices SI (sociosexuality), PI (parental investment), and CAD (caditude) were obtained for 137 men who ranked the 10 images from stimulus Set II and a subgroup of 40 men who ranked the 15 images from stimulus Set III, separately. Relationships among SI score ($M = 21.4$, $SD = 5.5$), PI score ($M = 13.8$, $SD = 1.9$), CAD score ($M = 5.3$, $SD = 1.3$), and preference slopes were examined by correlational analysis as described below.

Set II -- Regressions

Sociosexuality Index. For regression between SI score and WHR preference slope , there was no significant correlation ($r = 0.068$, $p = 0.425$, Figure 10). For regression between SI score and FA preference slope, there were no significant correlations ($r = 0.019$, $p = 0.827$, Figure 11).

Parental Investment Index. For regression between PI score and WHR preference slope, there was no significant correlation ($r = 0.015$, $p = 0.855$). For regression between PI score and FA preference slope, there was no significant correlation ($r = 0.031$, $p = 0.716$).

Caditude Index. For regression between CAD score and WHR preference slope, there was no significant correlation ($r = 0.072$, $p = 0.395$). For regression between CAD score and FA preference slope, there was no significant correlation ($r = 0.082$, $p = 0.337$).

To summarize, no significant correlations were found between any measures of the independent variables (the component indices SI, PI, and CAD) and the dependent variables (FA preference slopes or WHR preference slopes) in Study 2 using stimulus Set II among a sample of 137 men.

Set III -- Regressions

Sociosexuality Index. For regression between SI score and WHR preference slope, there was no significant correlation ($r = 0.074$, $p = 0.636$, Figure 12), and for regression between SI score and FA preference slope, there was no significant correlation ($r = 0.003$, $p = 0.984$, Figure 13).

Parental Investment Index. For regression between PI score and WHR preference slope, there was no significant correlation ($r = 0.061$, $p = 0.696$). For regression between PI score and FA preference slope, there was no significant correlation ($r = 0.217$, $p = 0.162$).

Caditude Index. For regression between CAD score and WHR preference slope, there was no significant positive correlation ($r = 0.195$, $p = 0.215$). For regression between CAD score and FA preference slope, there was no significant correlation ($r = 0.172$, $p = 0.271$).

To summarize, no significant correlations were found between measures of the independent variables (the component indices SI, PI, and CAD) and the dependent variables (FA preference slopes or WHR preference slopes) in Study 2 using stimulus Set III among 40 men.

15. Analysis of the quadratic term of SI

An analysis of the quadratic terms of the sociosexuality index was performed in addition to the above simple linear regressions. The pattern of results paralleled those of the previous analyses. In each study group, the WHR and FA preferences were regressed separately with the quadratic term of SI (SI^2). Results including values of r, standardized coefficient of Beta, and p-values are given in Table 4.

As in the linear regressions, significant correlations were found in the regressions for men in Study 1, between WHR preference and the quadratic term of SI, and between FA preference and the quadratic term of SI. No other significant results were found for women or men from Study 1, or for men from Study 2.

16. Correlational analyses of SI, PI, and CAD indices

Correlational analyses were performed on questionnaire data from the above two studies to examine the relationships between the three component indices, Sociosexuality Index, Parental Investment Index and Caditude Index. Two groups of participants were used, from Study 1 (total n = 136, male = 43, female = 93) and from Study 2 (n = 137, all male). Predictions were that SI should correlate negatively with PI and correlate positively with CAD, and that PI and CAD should be negatively correlated.

<u>Study 1</u>. **Across both sexes, SI and PI were significantly negatively correlated (r = --0.165, p = 0.043), SI and CAD were significantly positively correlated (r = 0.210, p = 0.010),**

and PI and CAD were significantly negatively correlated ($r = -0.293$, $p < 0.001$). Within males only, there were no significant correlations (Figure 14, 15, 16), and within females SI and PI were not significantly correlated ($r = -0.154$, $p = 0.142$, Figure 17), but **SI and CAD were significantly positively correlated ($r = 0.290$, $p = 0.005$, Figure 18), and PI and CAD were significantly negatively correlated ($r = -0.237$, $p = 0.018$, Figure 19)**. The significant effects for both sexes combined appear to be mainly due to the effects of females.

Study 2. In the larger sample of males ($n = 137$) from Study 2, the predicted relationships between component indices were demonstrated. **SI and PI were significantly negatively correlated ($r = -0.259$, $p = 0.002$, Figure 20), SI and CAD were significantly positively correlated ($r = 0.194$, $p = 0.022$, Figure 21), and PI and CAD were significantly negatively correlated ($r = -0.292$, $p < 0.001$, Figure 22).**

DISCUSSION

Results will first be discussed study by study with regard to significant results and each prediction tested, then results will be evaluated in terms of support for Predictions 1, 2, and 3. Finally, studies will be critiqued for strengths and weaknesses, evaluated in terms of the literature, and directions for future research will be given.

17. Discussion of study results

17.1. Correlational analysis of FA and WHR: Tests of Prediction 1

It may be argued that if fluctuating asymmetry were a measure of genetic quality and developmental stability, another correlate of the two latter factors would necessarily be high fertility; after all, how can one be fit without being fertile? But one assumption of the present research is that female phenotypes may possess separate cues for genetic quality versus fertility; it is argued herein that FA and WHR represent genetic quality and fertility, respectively.

A correlational analysis of the relationship between measures of fluctuating asymmetry and waist-to-hip ratio was performed to test the assumption that FA and WHR are measurably dissociable traits in women (Prediction 1). Two samples of images from Akira Gomi's *Americans 1.0* were tested for correlation in these traits, and in neither sample were measures significantly positively correlated. Correlations were in fact rather low, but in the positive direction, indicating FA and WHR are dissociable, but not negatively correlated. *The prediction that FA and WHR in women are dissociable traits is therefore supported.*

17.2. Study 1: Tests of Prediction 2

Prediction 2 was that men lower in sociosexuality pursuing a long-term mating strategy would differ from men higher in sociosexuality in that they would prefer traits indicative of genetic quality in long-term mates, as opposed to traits indicating fertility, which would be preferred by unrestricted, more highly sociosexual men pursing a short-term strategy. Thus higher SI scores in men should be correlated with a preference for women who are superior in a cue of fertility, low waist-to-hip ratio. Men with lower SI scores should prefer mates signaling genetic quality, represented by low fluctuating asymmetry in this sample.

Study 1 utilized two methods of measuring fluctuating asymmetry in a stimulus sample of 15 women's images, thus two sets of analyses were performed.

<u>Relations with SI index</u>. Regression analysis revealed a significant effect with sociosexuality (as measured by SI index) and mating preferences, but in the direction opposite to the above prediction: SI score was significantly positively correlated with FA preference, such that unrestricted males preferred low FA to low WHR, whereas more restricted males showed a lower preference for low FA women. Female participants showed no significant association between sociosexuality and their ratings of the stimulus females as competitors.

<u>Relations with PI and CAD indices</u>. Regression analyses between preferences for FA or WHR and other variables potentially related to sociosexuality were performed. Measures of parental investment and "caditude" (cavalier attitude toward investment in a mate or offspring) were obtained as PI and CAD indices. The sole significant regression was between WHR preference and PI; men who have stronger PI scores show greater preference for low WHR women.

These results fail to support Prediction 2: the only significant relationships show men's sociosexuality positively related to preference for low asymmetry, contradicting Prediction 2. Implications of these disparate findings will be discussed after first reviewing results of Study 2.

17.3. Study 2: Replication attempt and further tests of Prediction 2

Relations with SI, PI, and CAD indices. Study 2 showed no significant relationships between male SI, PI, or CAD indices and preference for female phenotype when evaluating either stimulus Set II (10 novel female images) or Set III (Set I images cropped).

Contrary to Study 1, men's variation in sociosexuality was not related to any bias in preference for either low FA or low WHR female images; no significant correlations were found between SI scores and a preference for either female phenotype. The findings of Study 1 with regard to the link between men's sociosexuality or parental investment scores and preferences for either assay of female mate value were not replicated in Study 2. *Prediction 2 is not supported.*

17.4. Correlational analyses of SI, PI, and CAD indices: Tests of Prediction 3

In terms of mating strategies, it is impossible to expend energy on all behaviors that may increase reproductive success, so it was proposed that individuals make a trade off in their tendency to invest in mate seeking (sociosexuality) versus investment in committed relationships and resultant offspring (parental investment). Specifically, it was predicted that sociosexuality would be negatively related to willingness to parentally invest (Prediction 3).

Two measures of willingness to parentally invest, PI Index (indicating willingness to invest) and CAD Index (indicating lack of willingness to invest), were significantly related to a measure of sociosexuality, SI Index, in the predicted directions, in two samples of participants including men and women. In general, higher sociosexuality scores were related to lower willingness to invest parentally (as measured by PI score), and more cavalier attitudes about investment (higher CAD scores). *Prediction 3 was therefore supported.*

18. Summary of support for Predictions

Prediction 1. Overall, Prediction 1 was strongly supported; female waist-to-hip ratio and fluctuating asymmetry are not correlated in measures of female images. This fundamental assumption of the current research implies that WHR and FA are measurably dissociable aspects of female physical attractiveness. However, the question remains, are men using variation in these two traits as cues for specific aspects of female mate value? Does WHR specifically indicate to men the state of a woman's fertility, or is it used as a more general indicator of female fitness? Likewise, for symmetry, do men, is FA used as a specific indicator of developmental stability and genetic quality, or is it part of a gestalt of female attractiveness and a general fitness indicator? Studies 2 and 3 may be viewed as bioassays for the "meaning" of attractive traits.

Prediction 2. Studies 2 and 3 were designed to harness individual variation in men's sociosexuality as a tool for answering the above questions. Assumptions about tradeoffs in mating effort versus parenting effort (essentially what sociosexuality measures) lead to the prediction that men would expend effort in keeping with their mating strategy: high investors and low investors would differentially prefer women who varied in their ability to maximize men's investment (or lack thereof) in them, and this ability of women was alleged to be manifest in variation in WHR and FA. Correlations between men's sociosexuality and preferences for women who varied in waist-to-hip ratio and symmetry were largely non-significant, and showed no interpretable pattern. Prediction 2 found no support.

Prediction 3. Trivers (1972) noted the basic trade-off necessary for pursuing any particular mating strategy; investment in one means of success (e.g. parental investment) precluded energy or resources available for expenditure in other means of success (e.g. courting additional mates). Correlational analyses of component indices of sociosexuality, parental investment, and "caditude" of two samples of men and women demonstrated this trade-off. Participants who scored high on parental investment tendencies (PI index) scored low on sociosexual tendencies (SI and CAD indices), and vice versa. The trade-offs in components of mating strategy delineated in Prediction 3 were clearly demonstrated; Prediction 3 was therefore strongly supported.

19. Critique and discussion of studies

One significant correlation of Study 1 was contradictory to Prediction 2 (that high-SI men would prefer low-WHR women). It was found that, in contrast, high SI men preferred low FA women., and complementarily, high PI men preferred low WHR women. Why would high SI men prefer more symmetrical women? Some studies indicate that symmetrical men tend to be more highly sociosexual; they have more sexual partners, earlier first sex, and a greater number of times involved in extra-pair copulations (Gangestad & Thornhill 1997; Thornhill & Gangestad 1999). Since symmetry is also correlated with attractiveness (Clark 2004; Gangestad et al. 1994; Grammer & Thornhill 1994; Perrett et al. 1999; Rikowski & Grammer 1999; Thornhill & Gangestad 1993), these highly sociosexual, potentially attractive and symmetrical men may simply be selecting women they perceive to be more like themselves—highly symmetrical women, who may also be higher in sociosexuality and attractiveness. This result is in keeping with a “likes-attract” decision rule (Buston & Emlen 2003) employed in mate choice. When this rule was taken to the extreme of shaping potential mates, Little et al. (2001) found that women with high self-perceptions of their physical attractiveness modified male faces (via a computer program) to be more symmetrical and masculine than did women who gave themselves lower scores on self-rated attractiveness.

Of course, while WHR and FA may be correlated with fertility and genetic quality, this does not necessitate that they are <u>the</u> cues used to identify these components of mate value. It may be that men are simply forming a composite index of attractiveness that sums across features that indicate fertility, genetic quality, heterozygosity, developmental stability, and other fitness factors. Disagreement exists over what WHR actually indicates: fertility, fecundity, nulliparity, youthfulness, non-pregnancy. Andrews, Gangestad, and Matthews (2002) noted “that if WHR is a cue just of reproductive value then a low WHR should be specifically preferred for long-term mating partners, but if WHR is only as a cue for non-pregnancy then a low WHR should be preferred for both short-term and long-term mating partners” (cited in Brase & Walker 2004). In any case, justification of the one significant SI-related result of Study 1 does not mitigate the fact that there was no replication of it in Study 2.

Indeed, no relationships found in Study 1 between men’s sociosexuality and female phenotype were replicated in Study 2, which used a much larger sample of male participants. Why not? Aside from the obvious, that the effect simply does not exist, methodological choices may have played a role. A basic difference between Studies 1 and 2 was in the treatment of the stimulus images. Concerns about the hair color, condition, or style of models unduly influencing the results led to images for Study 2 to be cropped headless and skin abnormalities to be reduced. Together, these treatments may have had the effect of removing other cues of female fitness that correlated with the variables of interest, WHR and FA. Recent studies (Jones et al. 2004) have shown that women use male facial skin condition as a correlate of symmetry in judgments of male attractiveness, perhaps accounting for Scheib et al.'s (1999) finding of women's preference for symmetrical male faces, even when only half the face is shown. Hair may provide similar cues to symmetry or overall condition of an individual. Therefore, rather than a weakness, one strength of Study 1 may have been the inclusion of the heads of the stimuli, and the lack of "corrective" skin treatment of the images.

A strength of all studies presented herein was the use of images of real women rather than the ubiquitous line drawings of the female form used in most other WHR research (Forestell, Humphrey, & Stewart 2004; Furnham, Tan, & McManus 1997; Marlowe & Wetsman 2001; Singh 1993, 1995; Singh & Luis 1995; Singh & Young 1995; Sugiyama 2004; Tassinary & Hansen 1998; Wetsman & Marlowe 1999, to name a few).

The current research may have benefited from examining attractiveness judgments of the levels FA and WHR while controlling for the effects of levels of one on levels of the other (i.e., without forcing a trade-off between them). With regard to the stimulus sets employed in these studies, stimuli were deliberately chosen to be discordant for attractive measures of FA and WHR; low waist-hip-ratio women were chosen only if they were relatively asymmetrical, while highly symmetrical women were selected only if they had unattractive (high) WHRs. This discordance may have cancelled out the effects of attractiveness of each trait: a high WHR/ low FA woman may have been judged equally attractive as a low WHR/ high FA woman. However, this should not happen if low-SI and high-SI men value these traits differently.

20. Conclusions: Do men's mating strategies affect mate choice?

This research does not support the notion that men's mating strategies affect a measurable *trade-off* in men's preference for two aspects of female mate value, bodily symmetry and waist-to-hip ratio. However, in a very recent study by Brase & Walker (2004), men's mating strategies as measured by sociosexuality were demonstrated to affect willingness to approach attractive women. Factors that influence or are correlated with sociosexuality are being examined as well. The work of Brase and Walker (2004) and others (Clark 2004) has begun to look at the relations between self-assessments (of attractiveness and other traits) and judgments of attractiveness potential mates. Brase and Walker (2004) found that men low in physical self-assessment gave higher attractiveness ratings to women than men higher in physical self-assessment, while Clark (2004) found a self-rated attractiveness predicted sociosexuality score in women. Future research on mating strategies that takes into account the relative mate value of the participant, whether self- or other-assessed, and the role of self-assessment in mating strategy will be key in deciphering physical attractiveness cues.

TABLES

Table 1: Stimulus Set treatment descriptions

Set	Number of images	Heads cropped (yes or no)	Skin smoothed (yes or no)
I	15	No	No
II	10	Yes	Yes
III	15 (same women as Set I)	Yes	Yes

Table 2: Stimulus Set descriptive statistics

Sets I and III	**Asymmetry**		
N = 15	**Measure I**	**Measure II**	**WHR**
Mean	0.725	0.450	0.708
SD	0.298	0.287	0.049
Range	1.005	0.859	0.145
Min	0.297	0.110	0.634
Max	1.302	0.969	0.779
Set II			
N = 10			
Mean	0.736	0.369	0.708
SD	0.409	0.174	0.050
Range	1.231	0.547	0.137
Min	0.159	0.170	0.642
Max	1.390	0.717	0.779

Table 3: Regressions of quadratic terms of SI

	WHR preference	Symmetry preference
Study 1		
Set I		
Men	r = 0.422	r = 0.428
(n = 43)	Beta = 2.352	Beta = -1.660
	p = 0.050*	**p = 0.045***
Women	r = 0.189	r = 0.164
(n = 93)	Beta = 0.966	Beta = -0.619
	p = 0.740	p = 0.251
Study 2		
Set II	r = 0.072	r = 0.095
(n = 137 men)	Beta = 0.134	Beta = -0.603
	p = 0.808	p = 0.275
Set III	r = 0.226	r = 0.082
(n = 40 men)	Beta = 1.408	Beta = 0.540
	p = 0.174	p = 0.607

Beta is the standardized coefficient

* Significant at $p \leq 0.05$

Table 4: Tests of correlations between FA and WHR

Sample I (n=63)	Mean	SD	Min	Max	Range
FA	0.401	0.223	0.110	0.969	0.859
WHR	0.693	0.038	0.592	0.779	0.187
Pearson's r	**0.083**				
Sig. (2-tailed)	**0.520**				
Sample 2 (n=32)					
FA	0.636	0.319	0.217	1.313	1.096
WHR	0.704	0.044	0.632	0.789	0.157
Pearson's r	**0.114**				
Sig. (2-tailed)	**0.535**				
Set I and II (n=24)					
FA	0.423	0.251	0.109	0.969	0.860
WHR	0.705	0.047	0.634	0.779	0.145
Pearson's r	**-0.021**				
Sig. (2-tailed)	**0.921**				

FIGURES

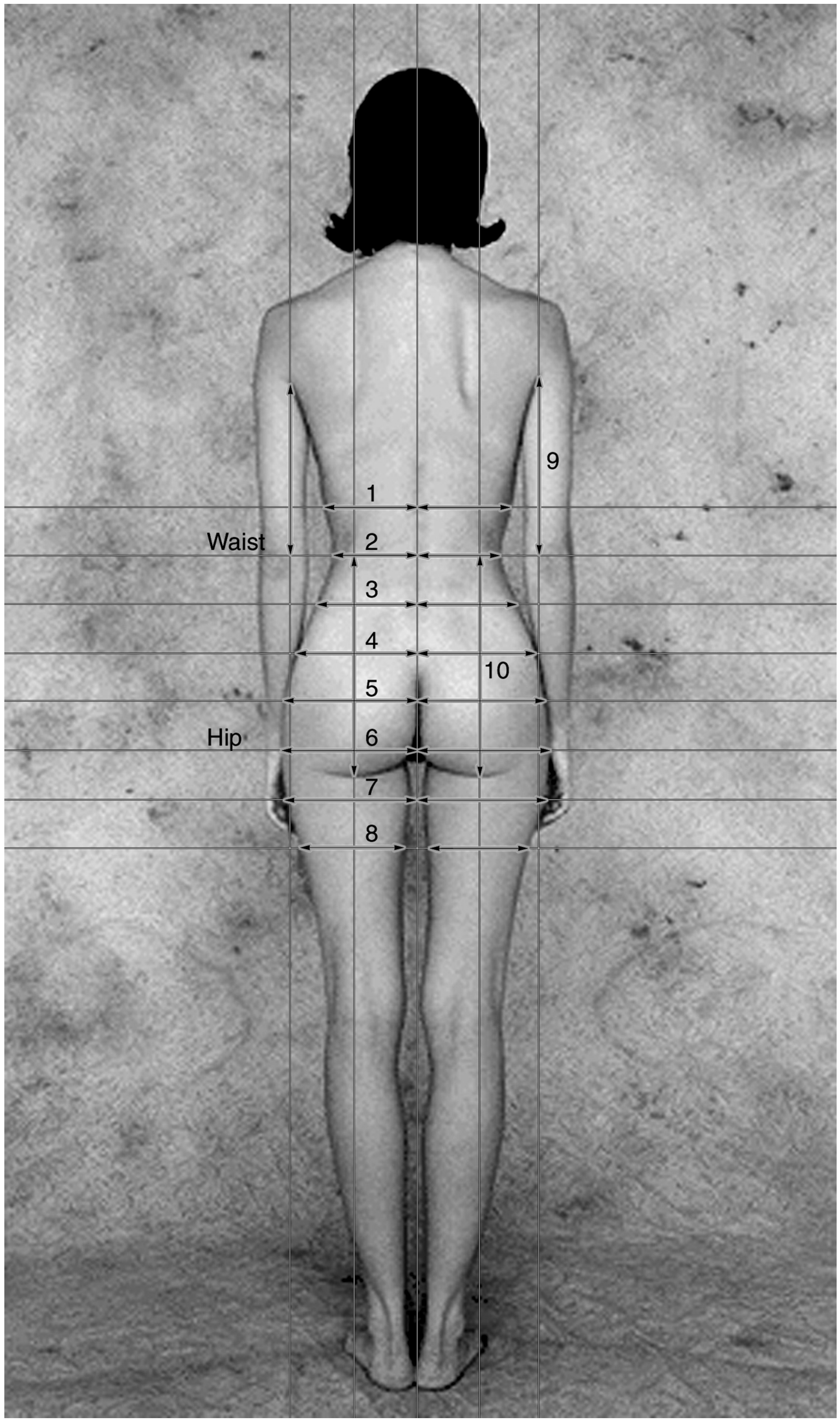

Figure 1. WHR and FA measures of an image

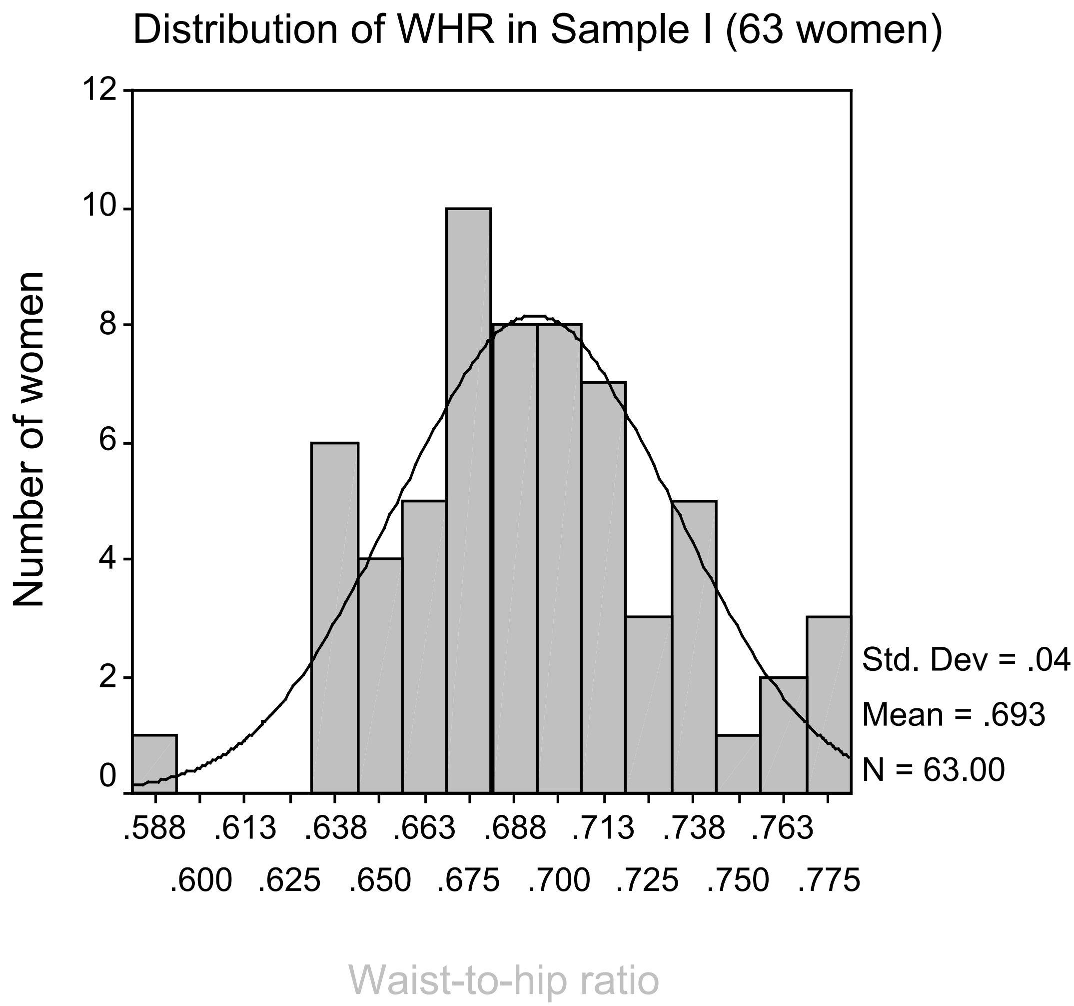

Figure 2. Distribution of WHR in Sample I

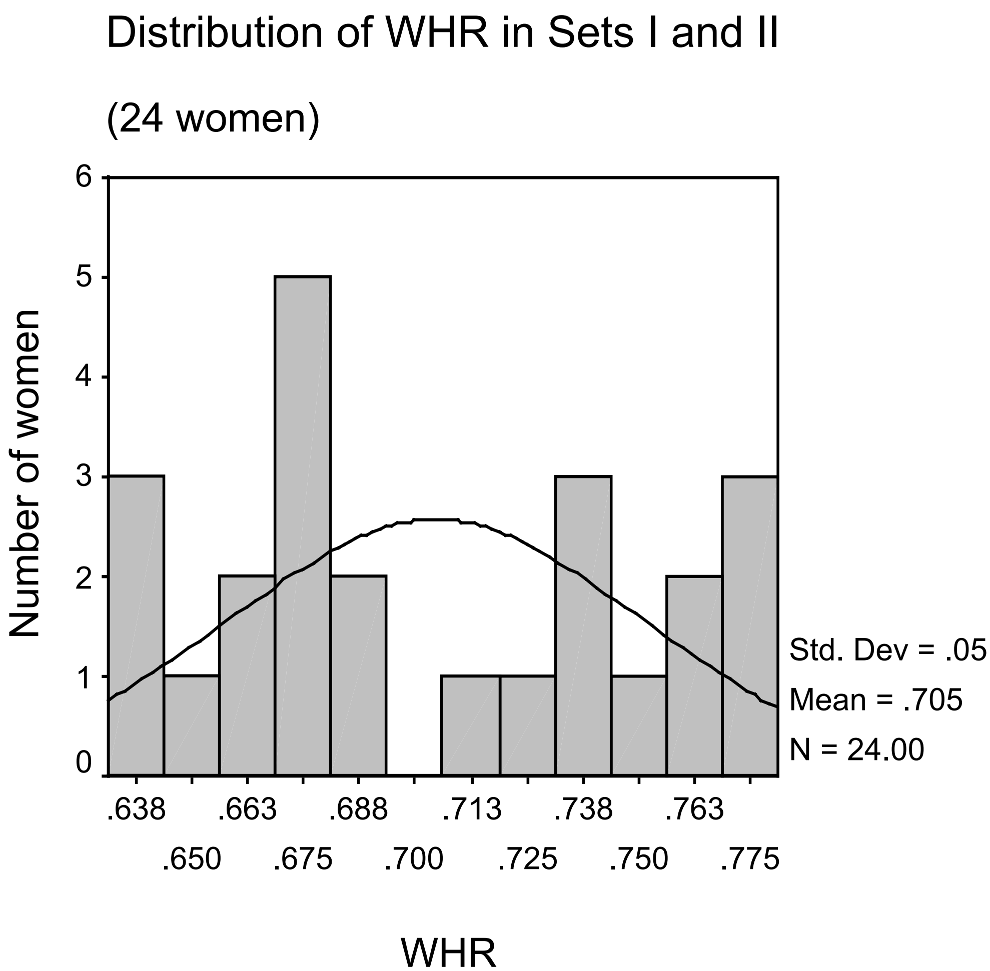

Figure 3. Distribution of WHR in Sets I and II

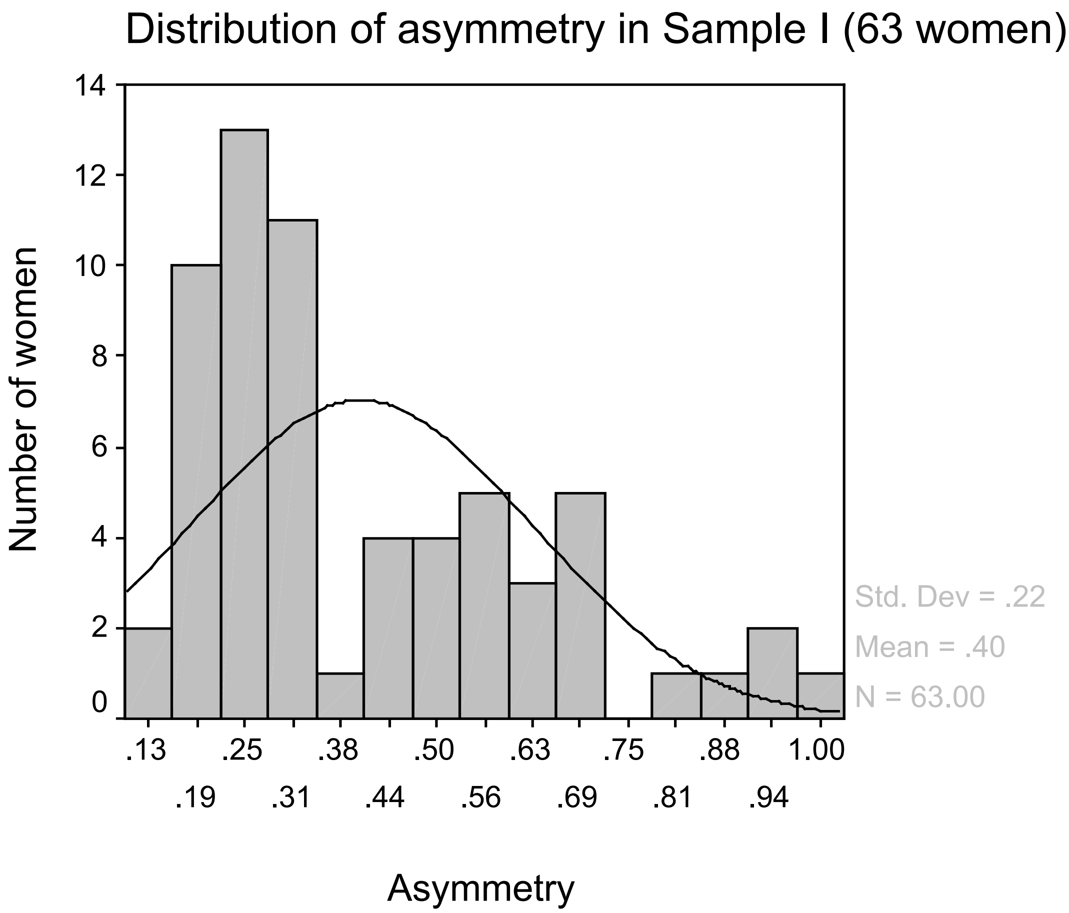

Figure 4. Distribution of asymmetry in Sample I

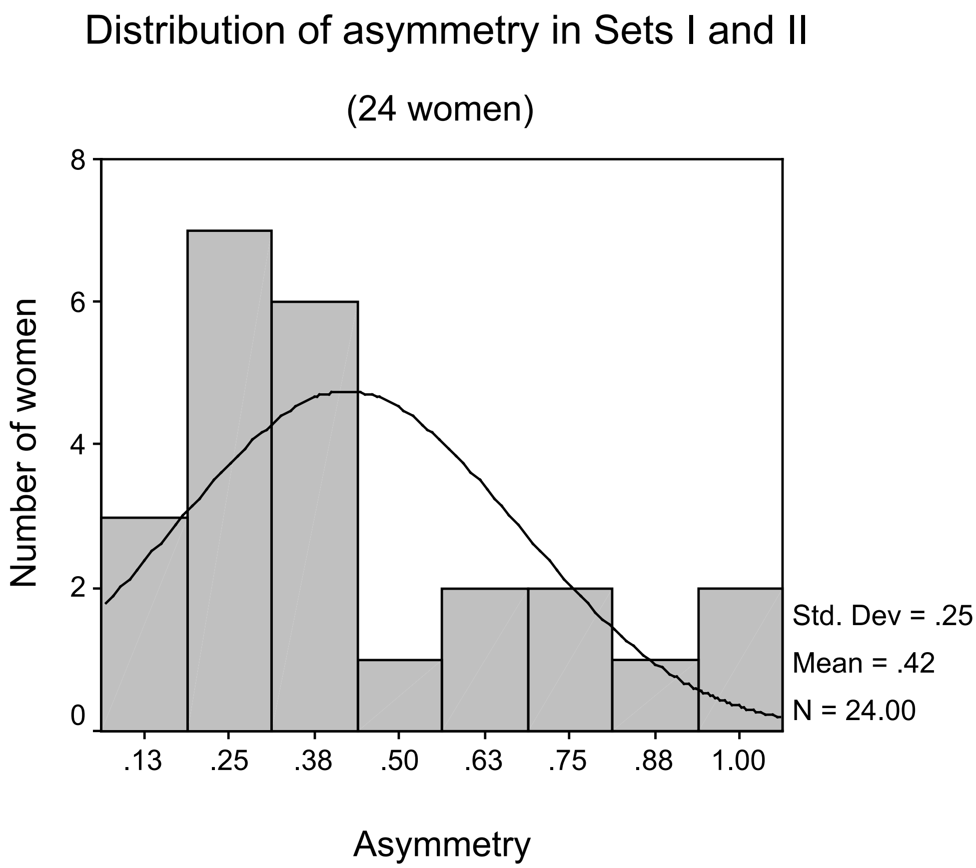

Figure 5. Distribution of asymmetry in Sets I and II

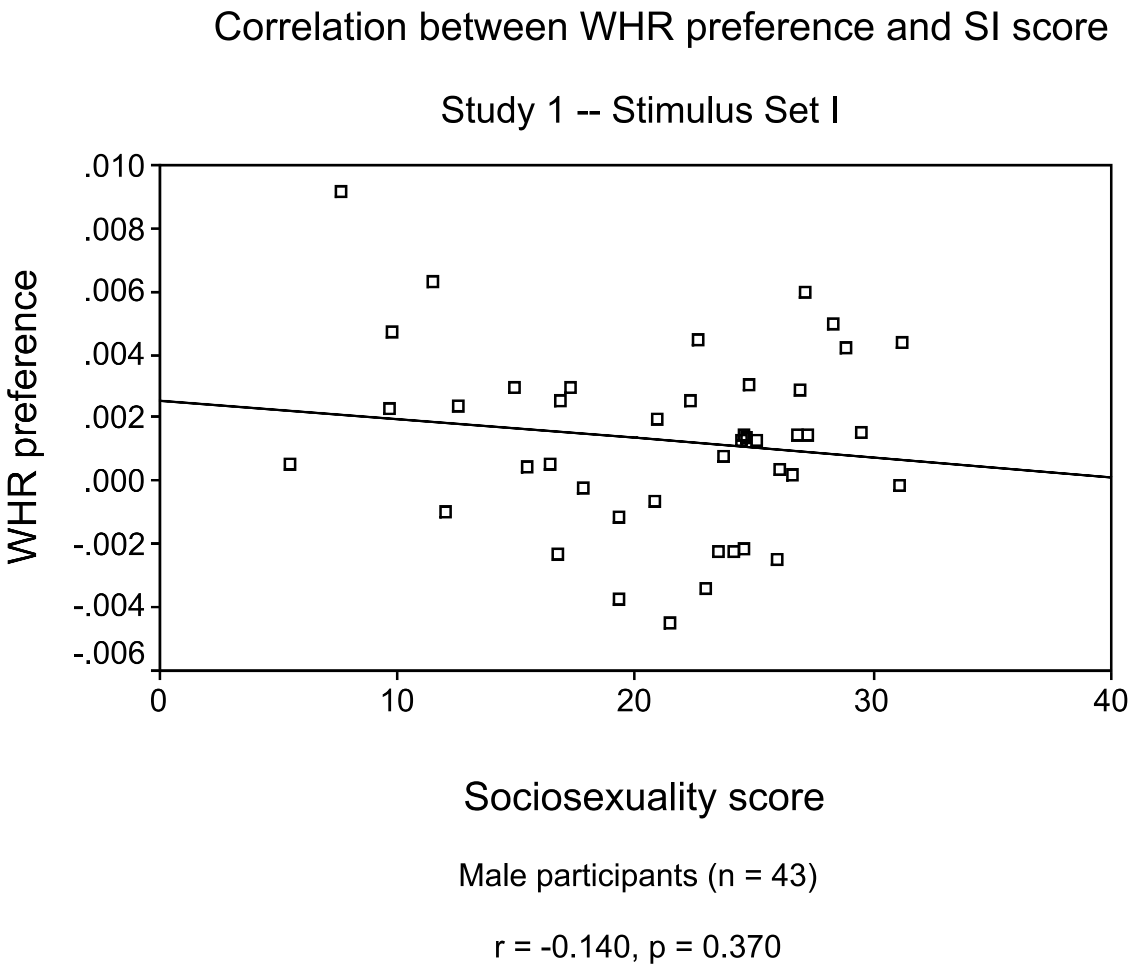

Figure 6. Study 1: Correlation between WHR preference and SI score (male participants)

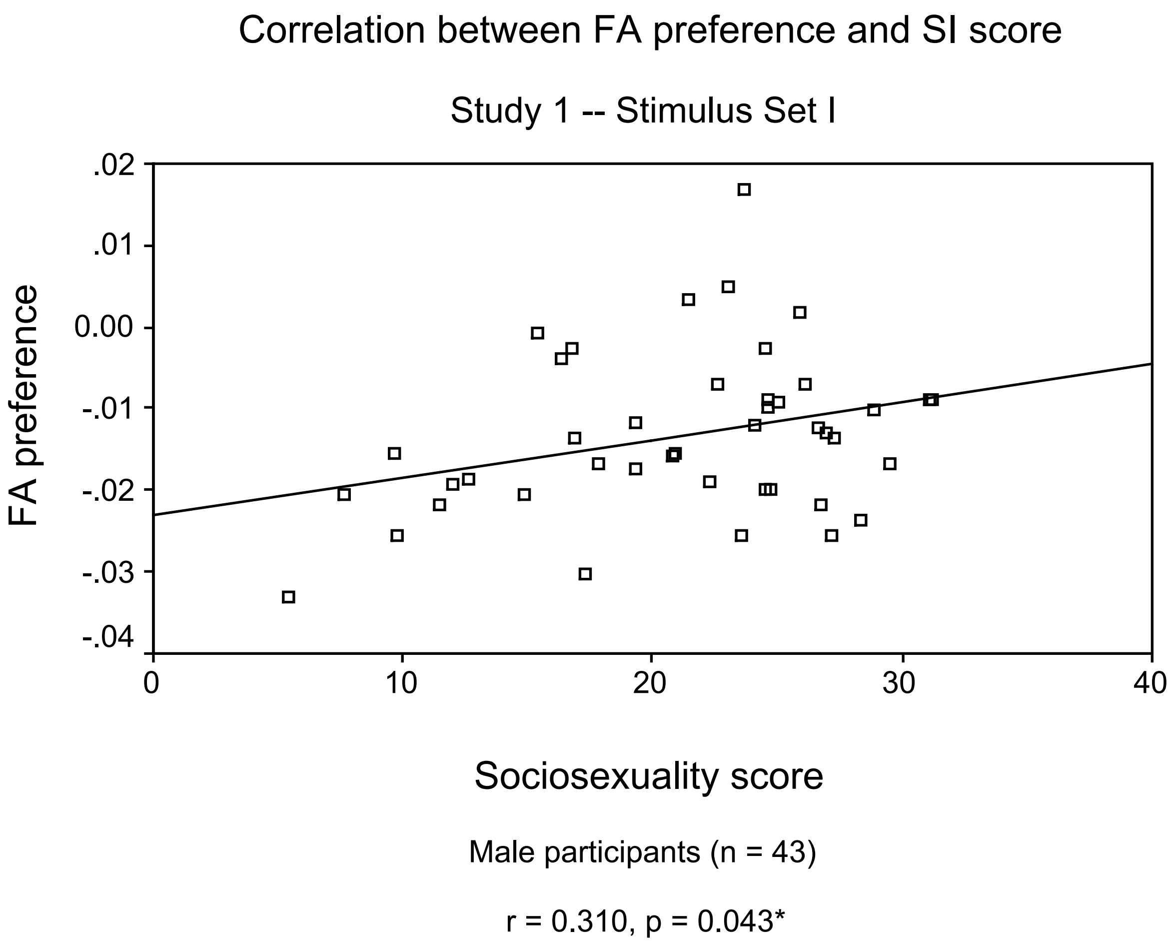

Figure 7. Study 1: Correlation between FA preference and SI score (male participants)

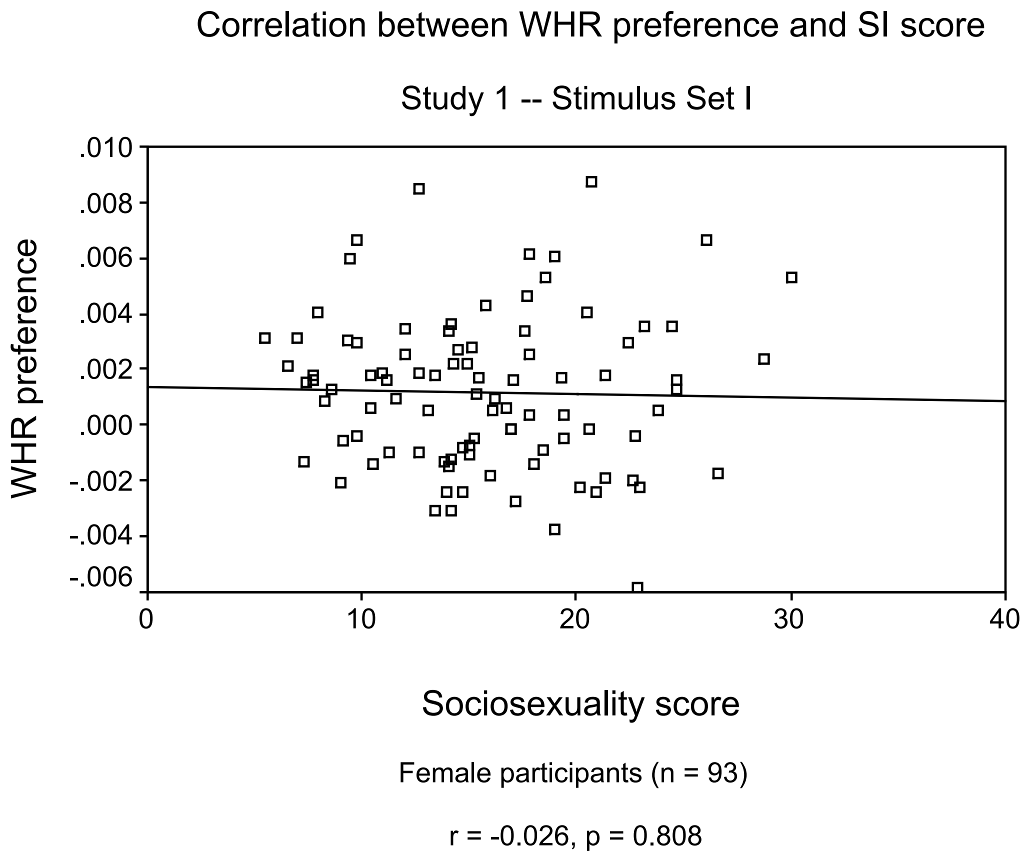

Figure 8: Study 1: Correlation between WHR preference and SI score (female participants)

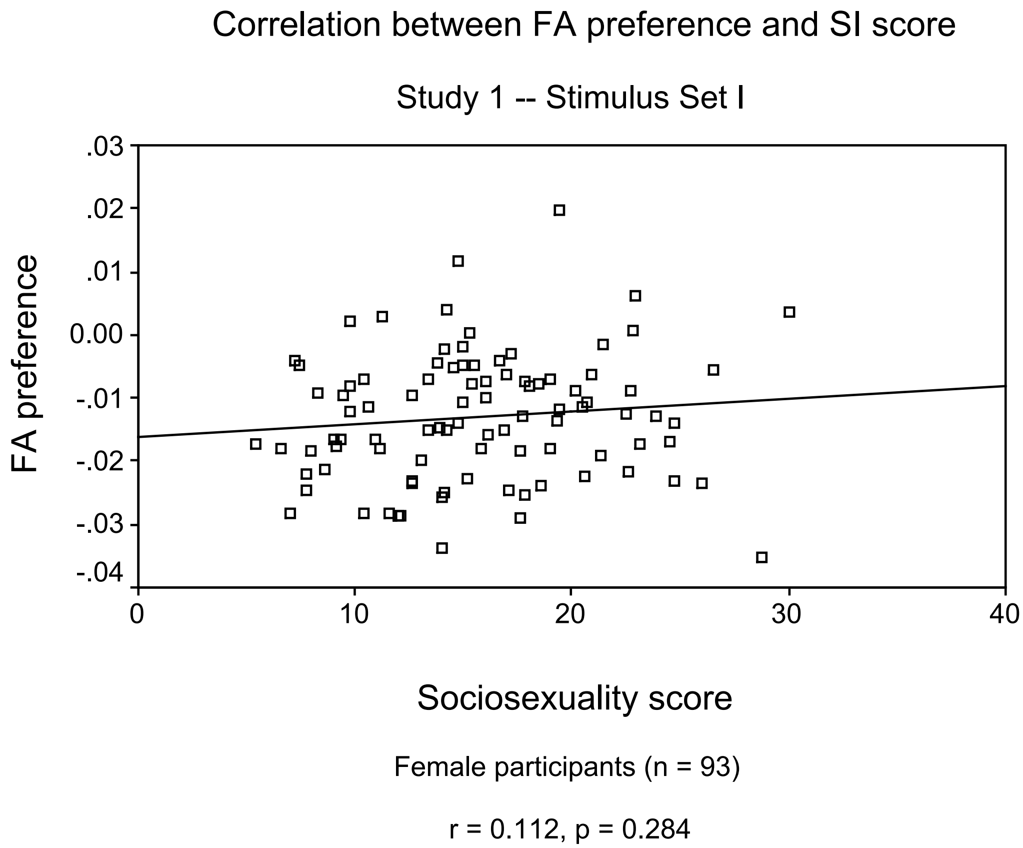

Figure 9. Study 2: Correlation between FA preference and SI score (female participants)

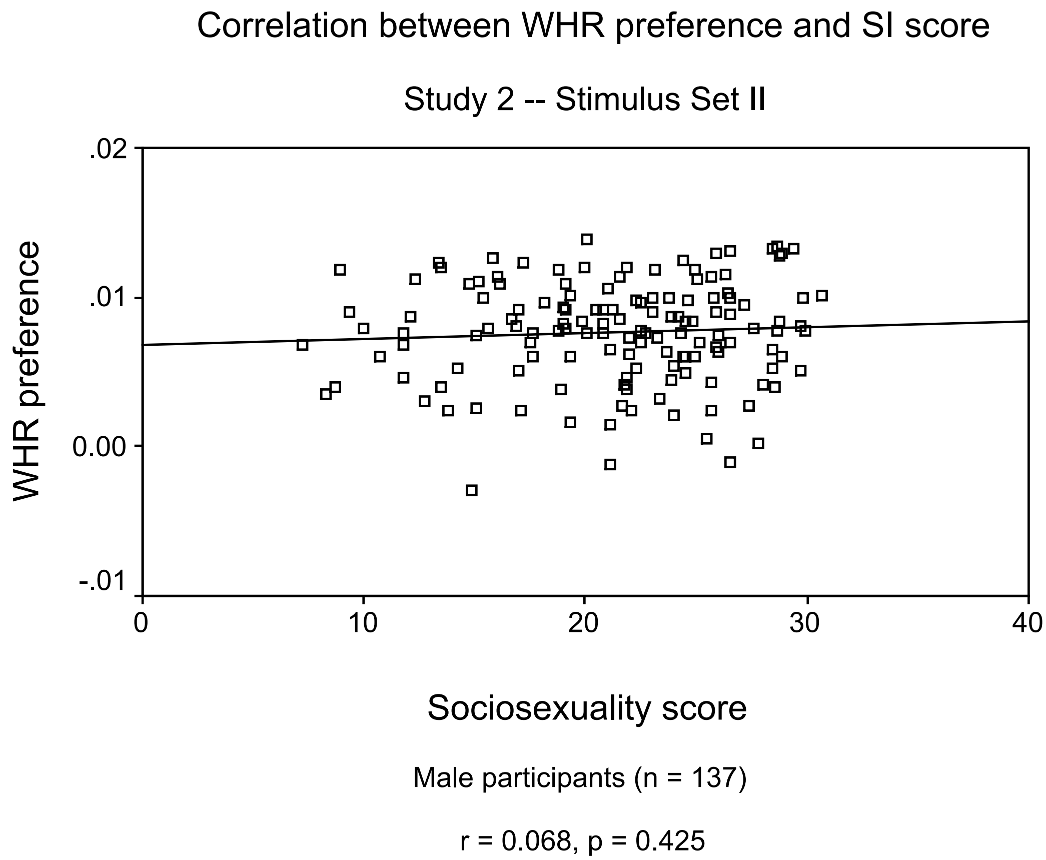

Figure 10. Study 2: Correlation between WHR preference and SI score (Stimulus Set II)

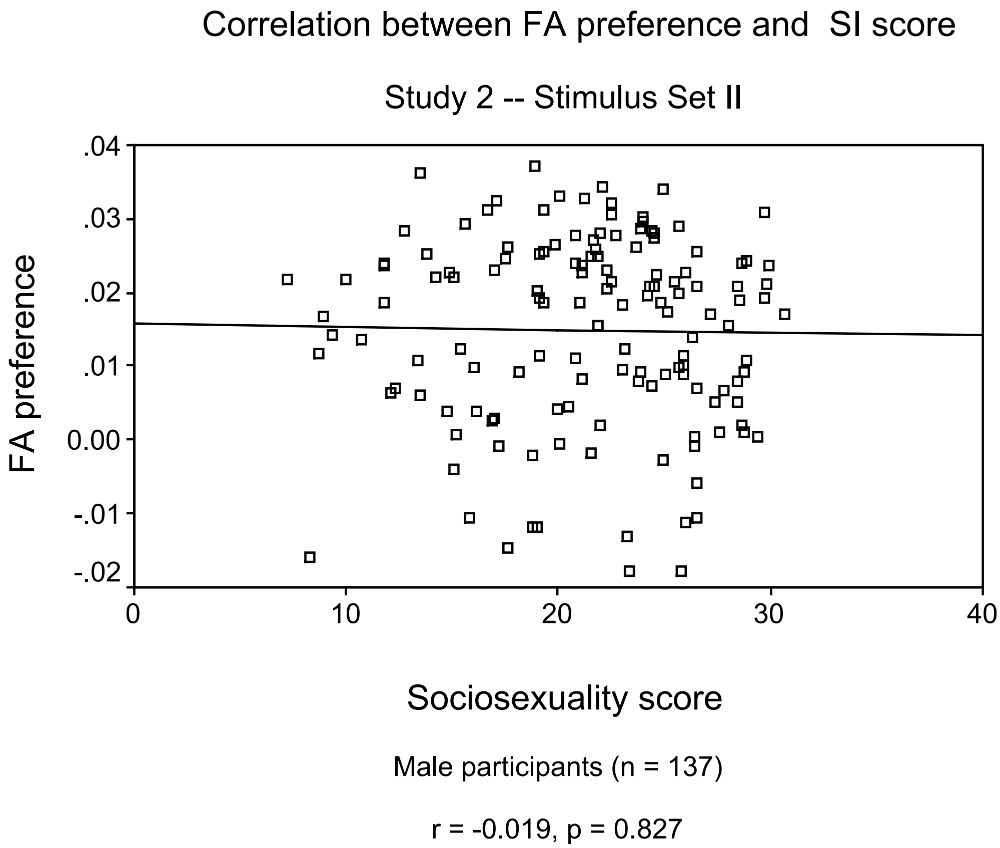

Figure 11. Study 2: Correlation between FA preference and SI score (Stimulus Set II)

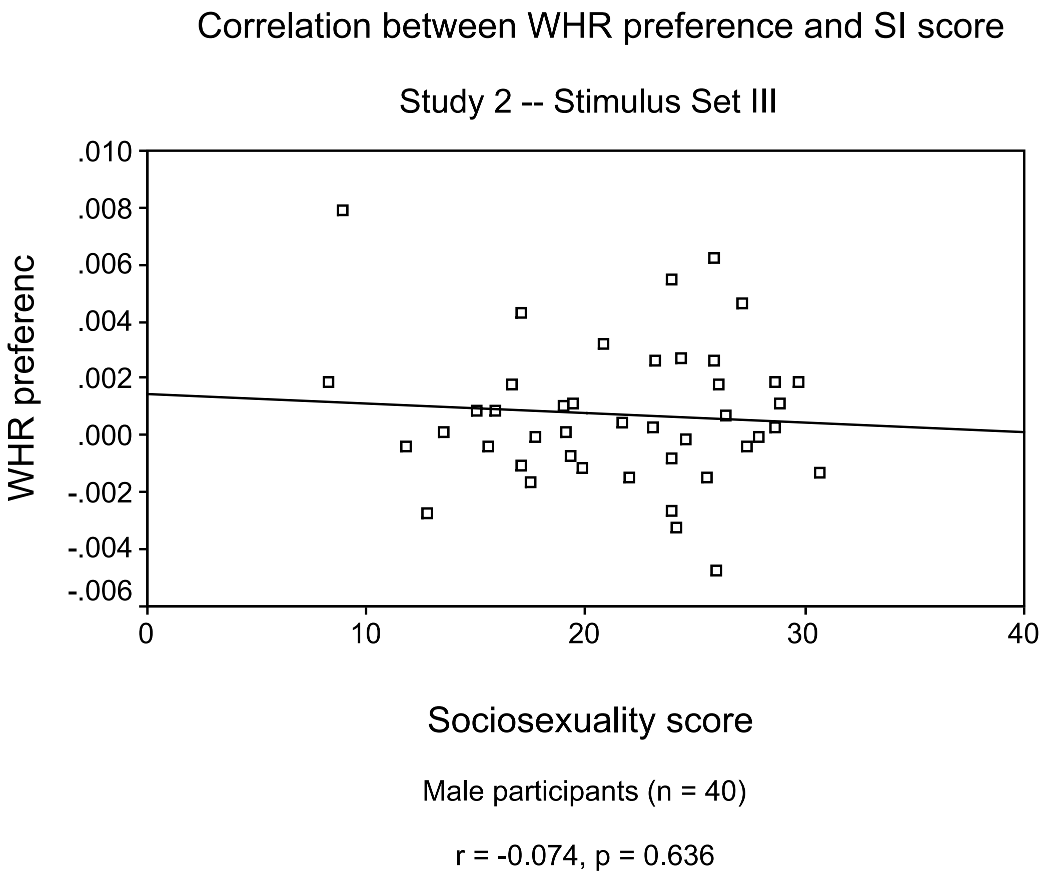

Figure 12. Study 2: Correlation between WHR preference and SI score (Stimulus Set III)

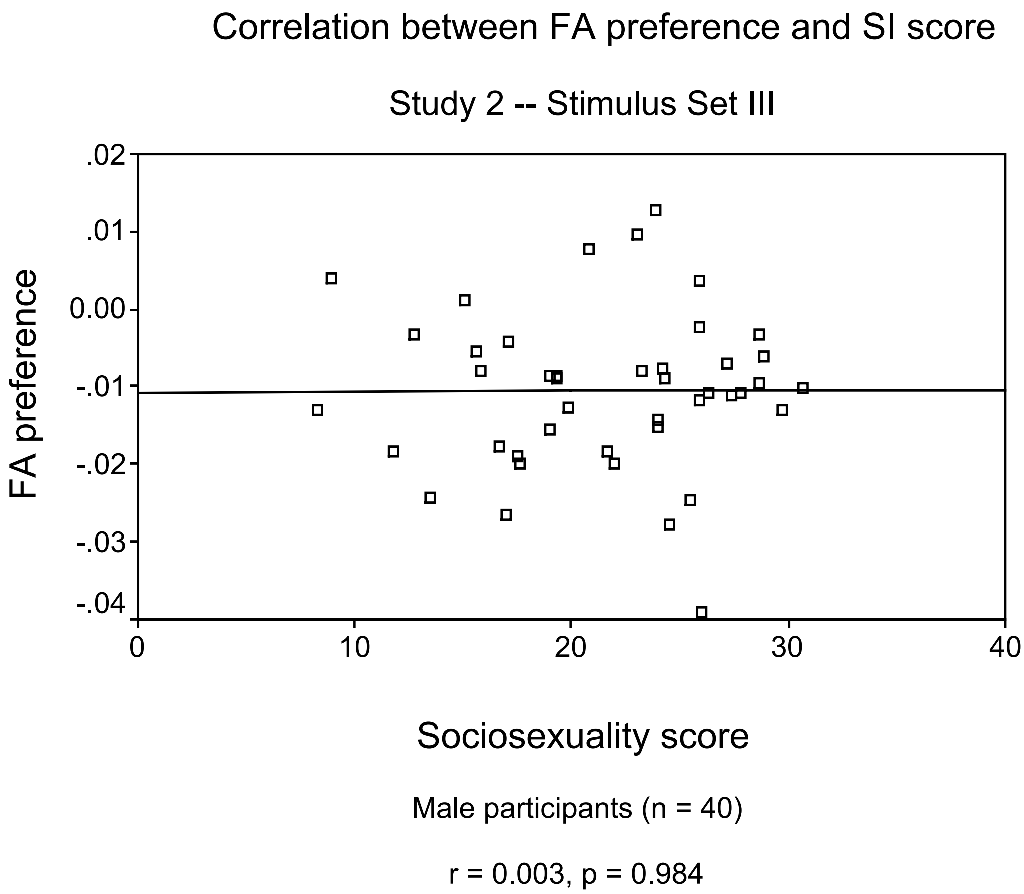

Figure 13. Study 2: Correlation between FA preference and SI score (Stimulus Set III)

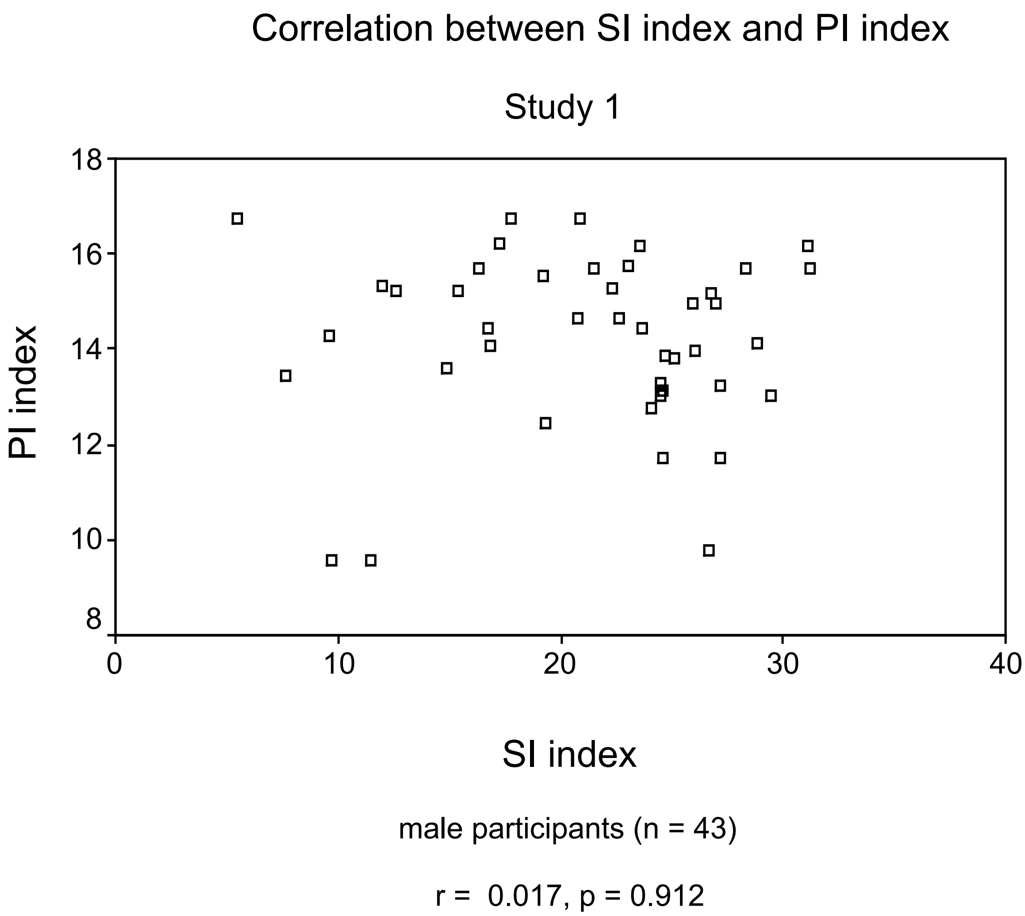

Figure 14. Correlation between SI index and PI index (Study 1)

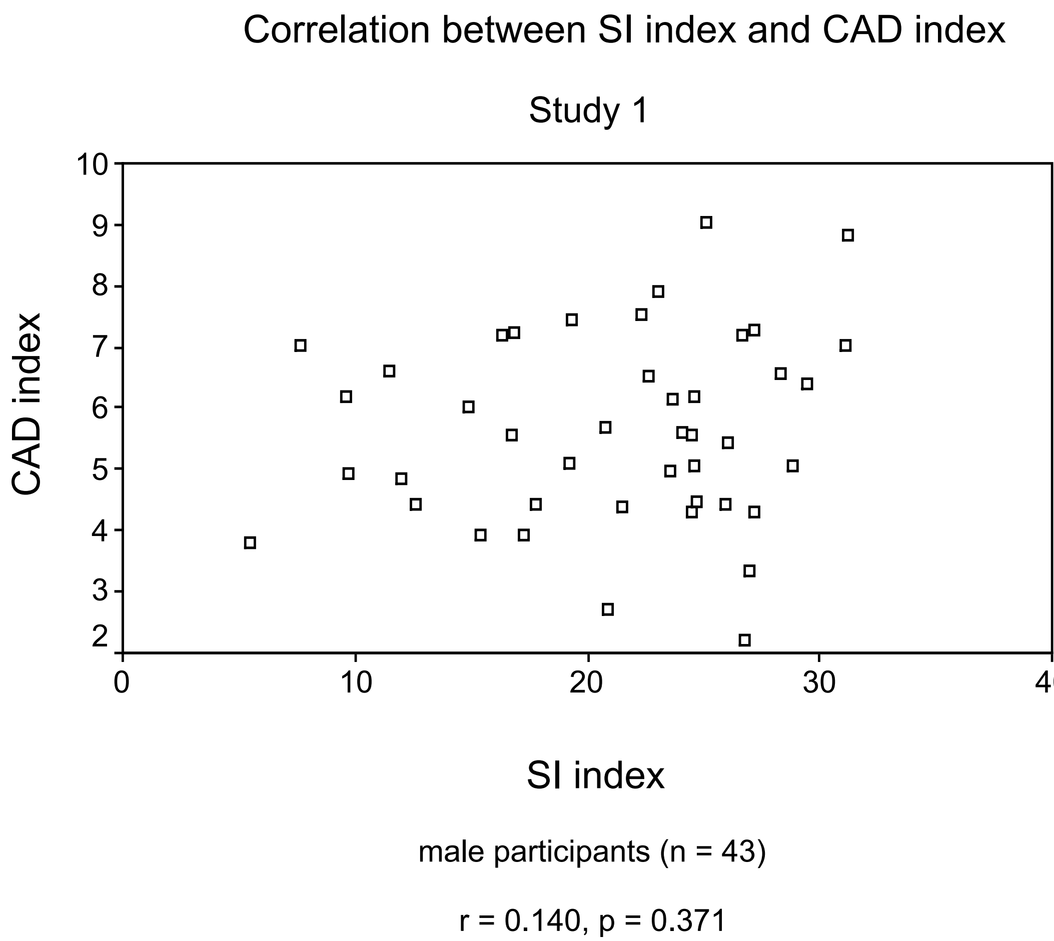

Figure 15. Correlation between SI index and CAD index (Study 1)

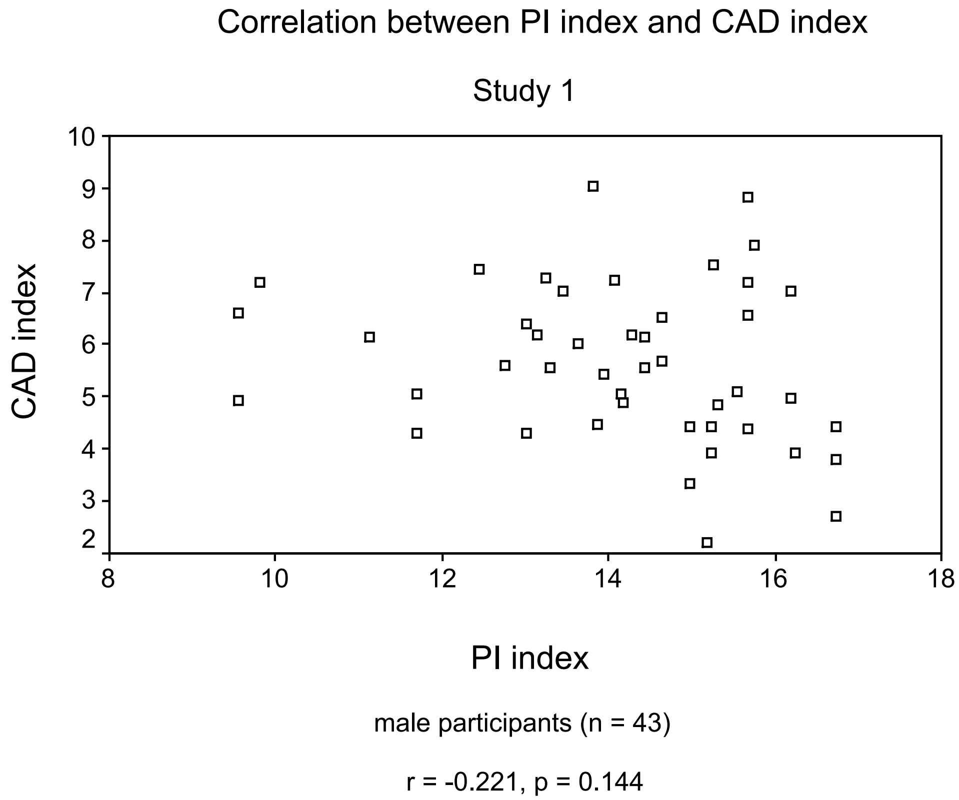

Figure 16. Correlation between PI index and CAD index (Study 1)

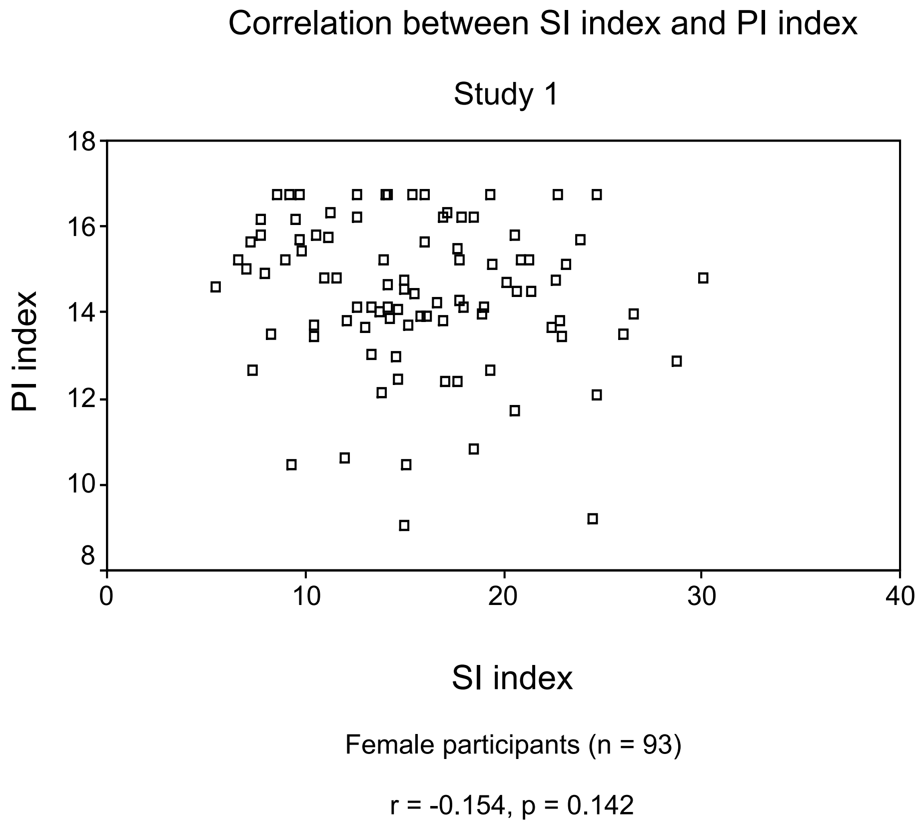

Figure 17. Correlation between SI index and PI index (Study 1)

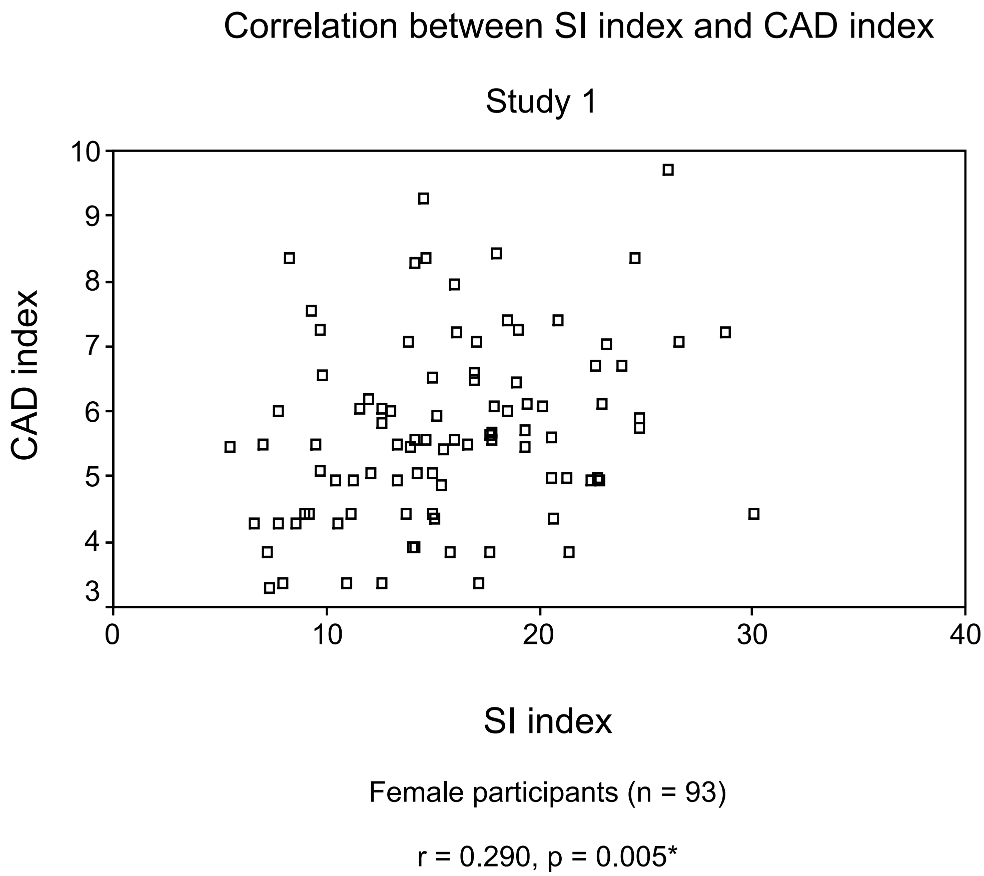

Figure 18. Correlation between SI index and CAD index (Study 1)

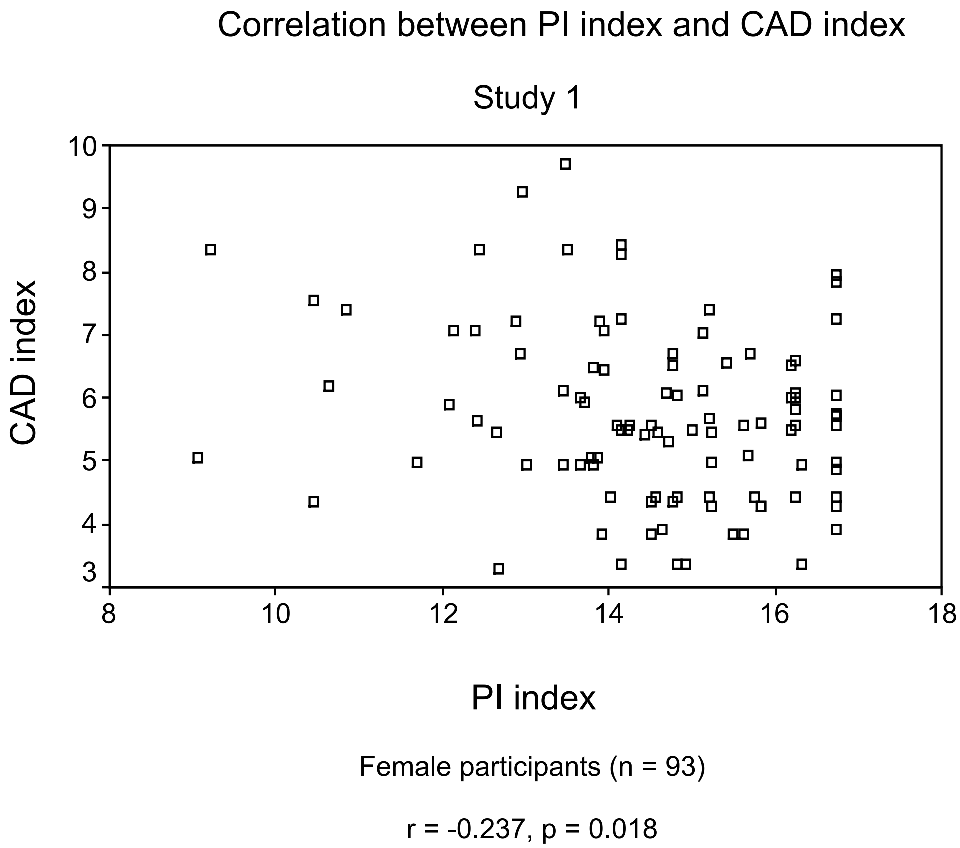

Figure 19. Correlation between PI index and CAD index (Study 1)

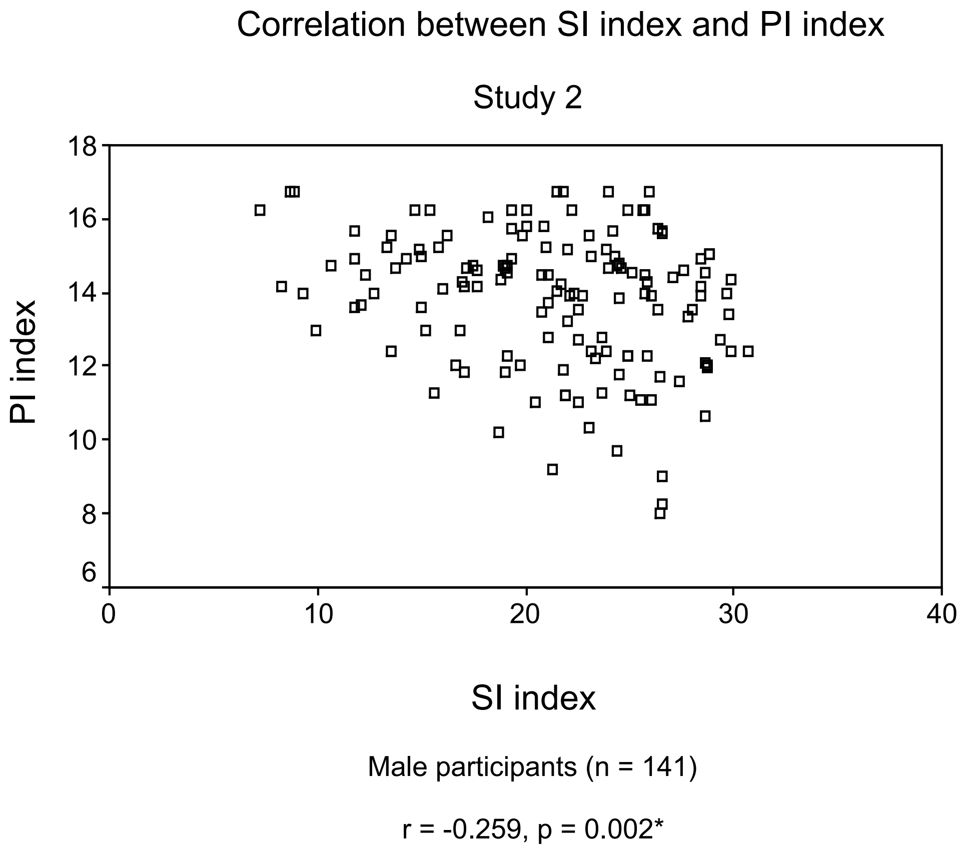

Figure 20. Correlation between SI index and PI index (Study 2)

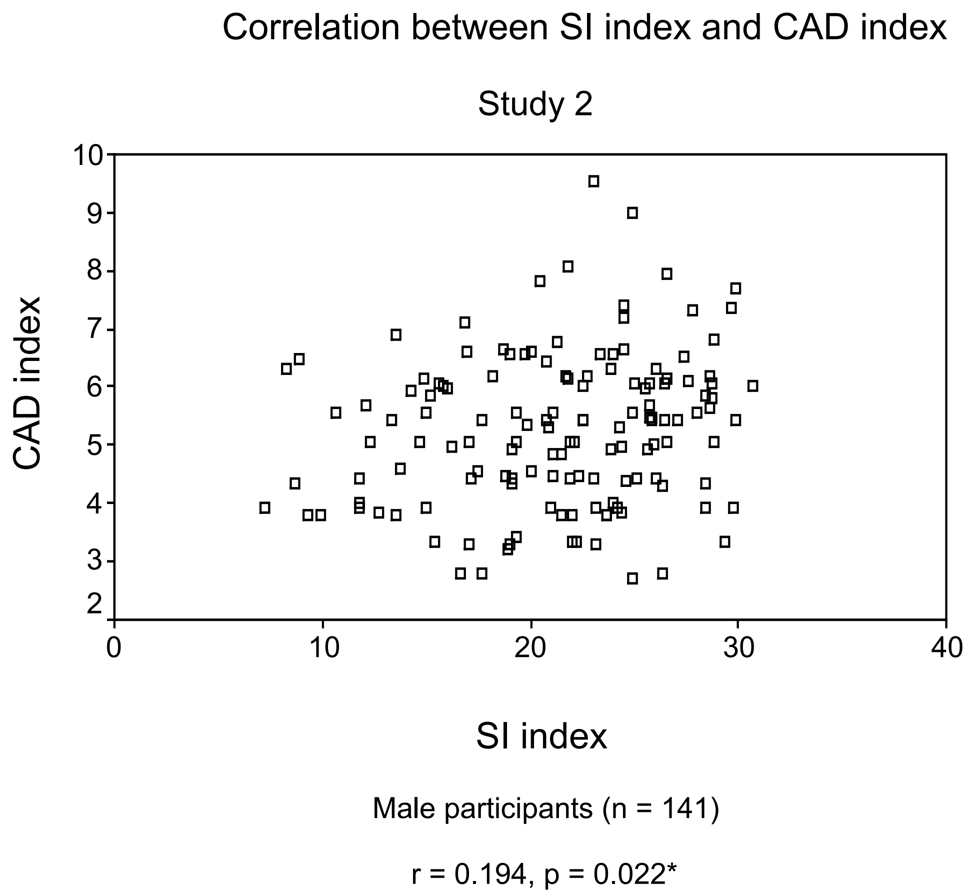

Figure 21. Correlation between SI index and CAD index (Study 2)

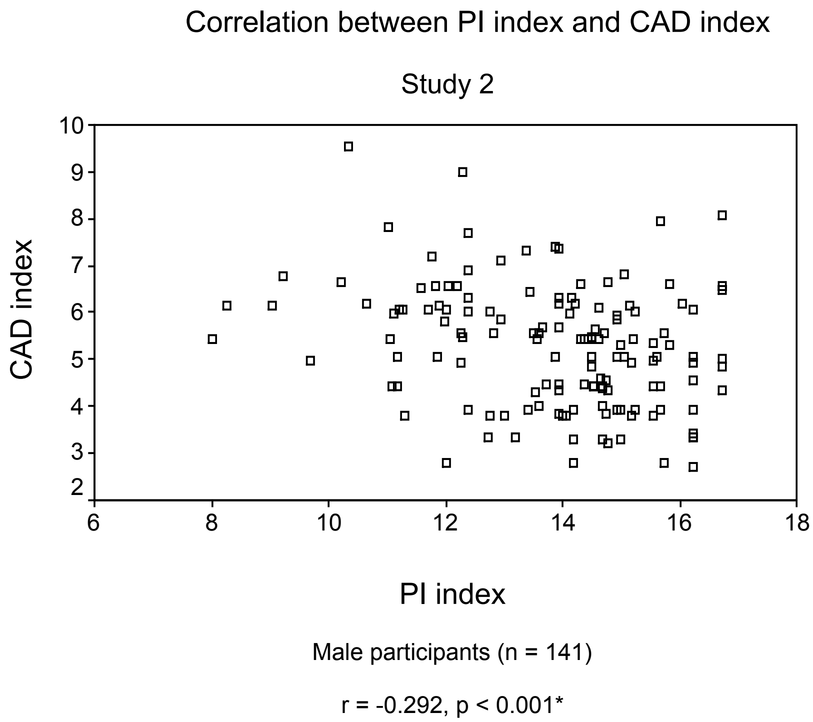

Figure 22. Correlation between PI index and CAD index (Study 2)

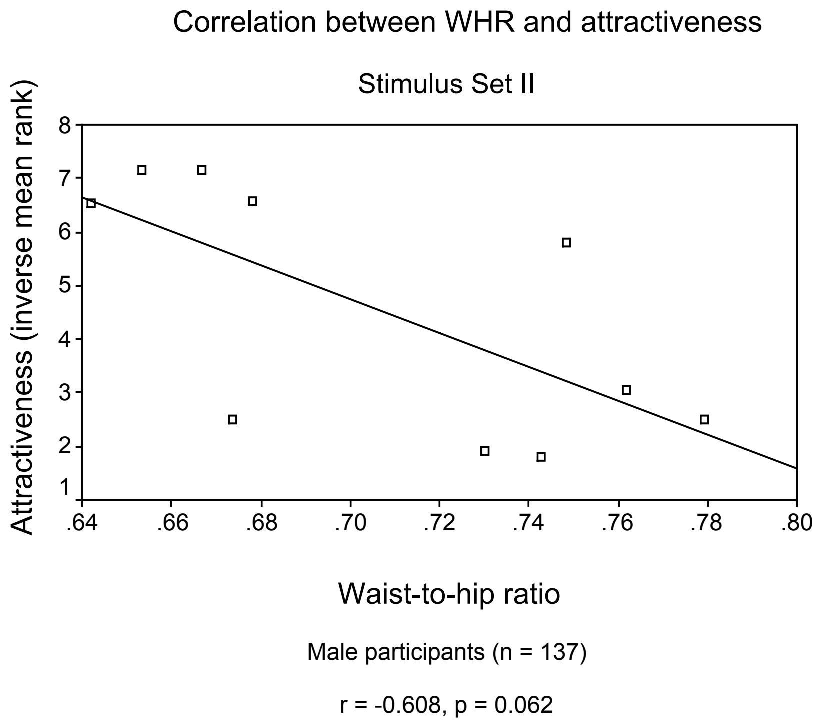

Figure 23. Correlation between WHR and attractiveness (Stimulus Set II)

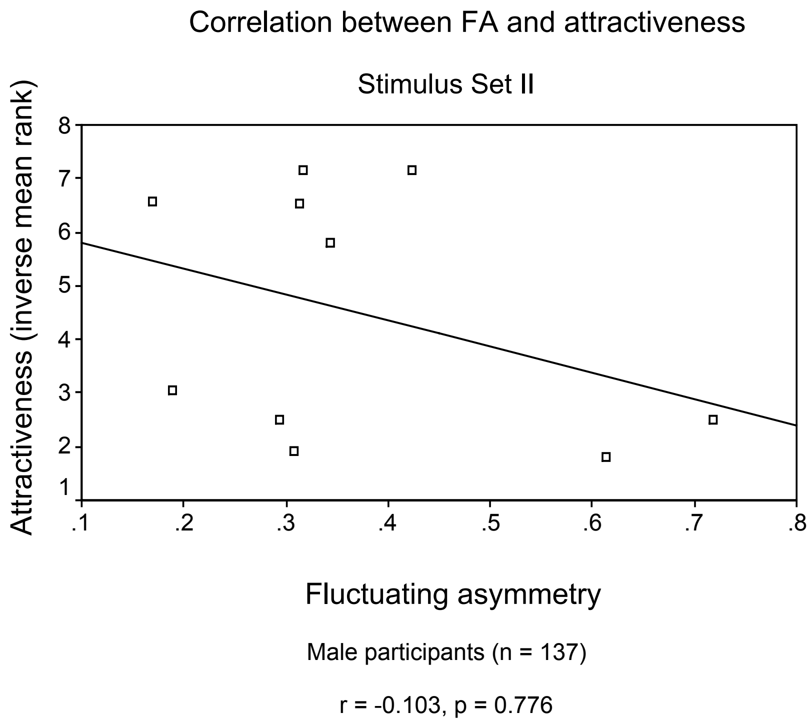

Figure 24. Correlation between FA and attractiveness (Stimulus Set II)

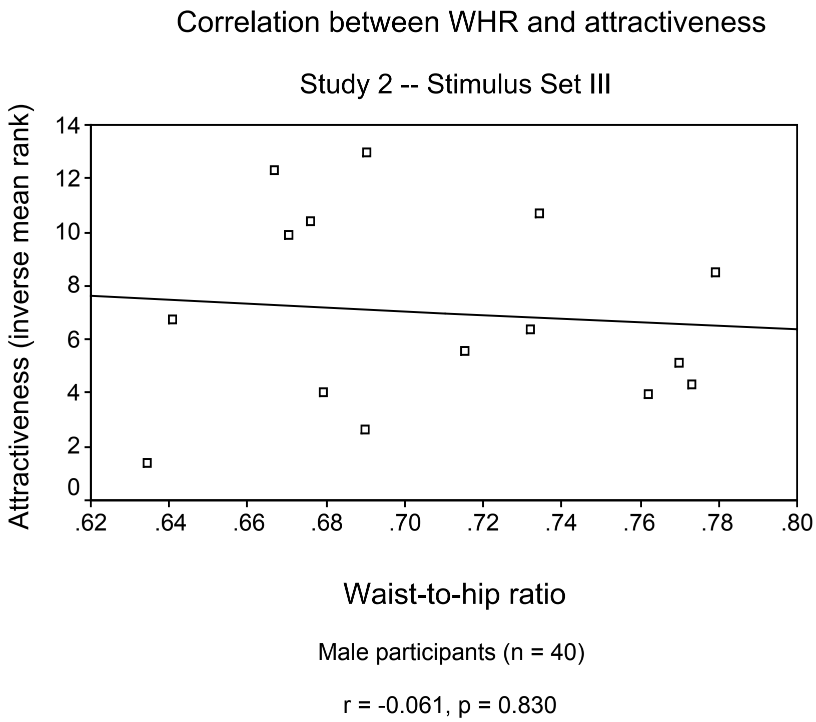

Figure 25. Correlation between WHR and attractiveness (Stimulus Set III)

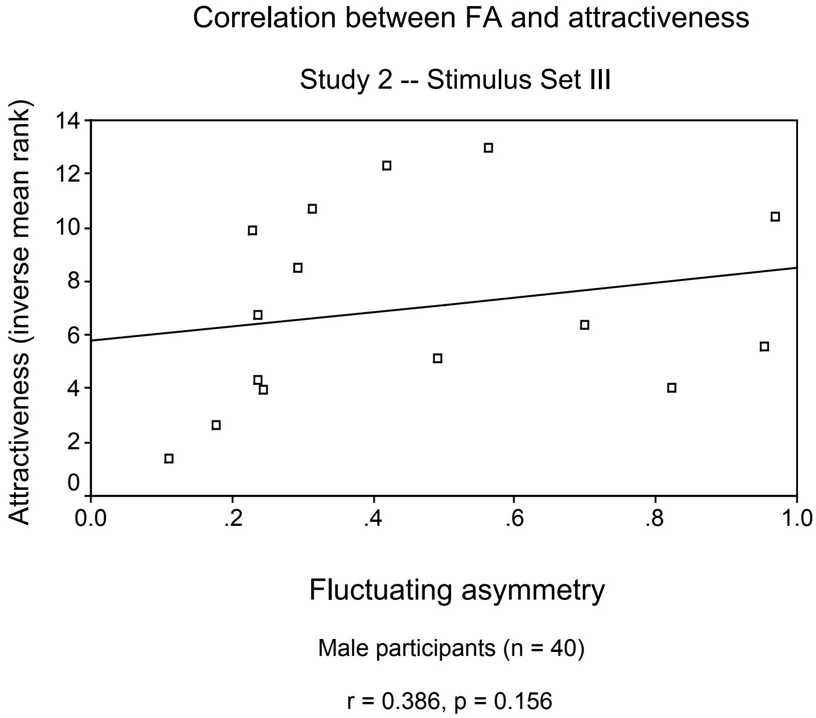

Figure 26. Correlation between FA and attractiveness (Stimulus Set III)

APPENDIX A

SOCIOSEXUALITY QUESTIONNAIRE

ID______

Please do not write your name anywhere on these forms!

PART I. *Read the following statements and circle the number that comes* <u>*closest*</u> *to your own opinion on a scale of* ***1 (strongly disagree) to 6 (strongly agree)****:*

1. A woman can raise children successfully on her own**.**

1	**2**	**3**	**4**	**5**	**6**
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

2. I could enjoy having sex with someone I was attracted to, even if I did not feel anything emotionally for him or her.

1	**2**	**3**	**4**	**5**	**6**
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

3. Children need to have their father present when they are growing up.

1	**2**	**3**	**4**	**5**	**6**
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

4. I have a healthy attitude about sex, and do not feel the need for a long-term commitment in order to have sex with someone.

1	**2**	**3**	**4**	**5**	**6**
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

5. I feel confident that I will be able to support my children.

1	**2**	**3**	**4**	**5**	**6**
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

6. I really look forward to being married.

1	**2**	**3**	**4**	**5**	**6**
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

7. I think that most men would try to get out of supporting their children if they could get away with it.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

8. The thought of an illicit sexual affair excites me.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

9. I would have to be closely attached to someone (both emotionally and psychologically) before I could feel comfortable and fully enjoy having sex with her.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

10. I can't imagine dealing with the responsibilities of being a parent.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

11. Infidelity is wrong, and cannot be condoned.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

12. A woman with a healthy attitude about sex does not feel the need for a long-term commitment in order to have sex with a man.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

13. It is really important to have a good relationship with my partner.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

14. Being a parent would be a really rewarding experience.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

15. A woman should not want to have sex with a man unless she is convinced that he is serious about a long-term commitment.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

16. It is better not to have sexual relations until you are married.

1	2	3	4	5	6
strongly disagree	**disagree**	**slightly disagree**	**slightly agree**	**agree**	**strongly agree**

17. I think that most men are as strongly committed to supporting their children as women are.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

18. Sex without love (impersonal sex) is highly unsatisfactory.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

19. I would not want to have sex with someone unless I am convinced that she is serious about a long-term commitment.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

20. Sometimes sexual feelings overpower me.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

21. I would be a great parent to my children.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

22. The thought of sex with more than one partner at once is appealing to me.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

23. I can imagine myself being comfortable and enjoying "casual" sex with different partners.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

24. I would not hesitate to get divorced if my marriage had trouble.

1	2	3	4	5	6
strongly disagree	disagree	slightly disagree	slightly agree	agree	strongly agree

---

PART II. *The following questions ask about how you perceive yourself relative to people you know, and about how you think other people perceive you. Please rate yourself on a scale from* ***1 (least____/far below average)*** *to* ***6 (most____/far above average)****.*

25. Compared to people you know, how healthy are you?

1	2	3	4	5	6
least healthy (far below average)					most healthy (far above average)

26. How would you rate your overall physical attractiveness?

1	2	3	4	5	6
least physically attractive (far below average)					**most physically attractive (far above average)**

27. How attractive to members of the opposite sex do you think you are?

1	2	3	4	5	6
least attractive to opposite sex (far below average)					**most attractive to opposite sex (far above average)**

28. How desirable as a one-night stand partner do you think you are?

1	2	3	4	5	6
least desirable (far below average)					**most desirable (far above average)**

29. How attractive as a marriage partner do you consider yourself to be?

1	2	3	4	5	6
least attractive as marriage partner (far below average)					**most attractive as marriage partner (far above average)**

30. How good a parent do you think you would be?

1	2	3	4	5	6
worst parent (far below average)					**best parent (far above average)**

PART III. *The following are questions about your experiences growing up with your own family. Please circle the number that* best describes your own experience *from* ***1 (not important) to 6 (very important)****:*

31. How important was your father to you in terms of financial support?

1	2	3	4	5	6
not important					**very important**

32. How important was your father to you in other ways (emotional support, practical help, etc.)?

1	2	3	4	5	6
not important					**very important**

33. How important was your mother to you in terms of financial support?

1	2	3	4	5	6
not important					**very important**

34. How important was your mother to you in other ways (emotional support, practical help, etc.)?

1	2	3	4	5	6
not important					**very important**

PART IV. The following are questions related to your own sexual interests. Please answer in the space provided for #35, and by circling the number that best reflects your opinion for #36.

35. With how many partners of the opposite sex do you foresee having sexual intercourse during the **next five years**? _______ partners

36. How often do you fantasize about having sex with someone other than your current dating partner/spouse?

N/A	1	2	3	4	5	6
not currently in a relationship	never	rarely	somewhat less than half the time	somewhat more than half the time	often	always

---

PART V. The following questions are to obtain basic demographic information about you. Please answer in the spaces provided.

37. How old are you? _______ years old

38. What sex are you? [ ] Male [ ] Female

39. Which do you most enjoy and/or fantasize about?
[ ] Having sex with members of the opposite sex
[ ] Having sex with members of your own sex
[ ] Having sex with members of both sexes

40. How many children would you like to have? ___________ children (zero is a possible answer).

Please take a moment to check your questionnaire for completeness. Thank you!

APPENDIX B

COMPONENT INDICES AND FACTOR SCORES

Sociosexuality Inventory (SI Index)

2. I could enjoy having sex with someone I was attracted to, even if I did not feel anything emotionally for him or her. (0.778)
8. The thought of an illicit sexual affair excites me. (0.631)
9. I would have to be closely attached to someone (both emotionally and psychologically) before I could feel comfortable and fully enjoy having sex with her. (0.759)
16. It is better not to have sexual relations until you are married. (0.524)
18. Sex without love (impersonal sex) is highly unsatisfactory. (0.697)
19. I would not want to have sex with someone unless I am convinced that she is serious about a long-term commitment. (0.796)
22. The thought of sex with more than one partner at once is appealing to me. (0.616)
23. I can imagine myself being comfortable and enjoying "casual" sex with different partners. (0.635)

Parental Investment Inventory (PI Index)

5. I feel confident that I will be able to support my children. (0.419)
6. I really look forward to being married. (0.559)
10. I can't imagine dealing with the responsibilities of being a parent. (0.500)
14. Being a parent would be a really rewarding experience. (0.699)
21. I would be a great parent to my children. (0.613)

"Caditude" Inventory (CAD Index)

3. Children need to have their father present when they are growing up. (0.510)
7. I think that most men would try to get out of supporting their children if they could get away with it. (0.505)
17. I think that most men are as strongly committed to supporting their children as women are. (0.563)
24. I would not hesitate to get divorced if my marriage had trouble. (0.634)

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