Perceiving Sociosexuality: How is it done?

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Abstract

People make judgements about personal characteristics (including age, sex, attractiveness, health and personality) from strangers' face and body appearance, and from small snippets of behaviour. These perceptions are thought to be somewhat accurate. Previous research has suggested that people are able to accurately perceive sociosexuality (SOI) at zero acquaintance, however it is not clear what cues people are using to make these accurate judgements. Further research has established a link between body morphology (2D:4D ratio) and SOI score, but it is not known whether facial morphology, which is also influenced by in utero hormones, is associated with SOI. Thus, the focus of this study was to examine whether: a) SOI is reflected in facial morphology, and b) whether observers can accurately perceive SOI from these facial cues. In Study One, 123 participants (63 female) completed a version of the SOI and had facial photographs taken under standardized conditions. Geometric morphometric methodology was used to statistically quantify the variation in face shape of each participant. This produced a significant model producing self-reported SOI scores from facial shape in male, but not female, faces, suggesting that SOI is reflected in men's, but not women's facial morphology. In Study Two, 65 participants (45 female) rated the SOI of participants photographed in Study One and a series of composites. Geometric morphometric modelling provided a statistical model that significantly predicted perceived SOI from the facial morphology of males but not females. Significant correlations between perceived SOI and self-reported SOI, and between self-reported SOI scores and perceived SOI scores predicted by the statistical model, were found in male faces but not female faces. Female participants appear to be able to accurately perceive the SOI of men using facial shape. Future studies should investigate other potential cues to SOI, such as colour or texture.

Declaration of Originality

I hereby confirm that all material contained in this project are my original authorship and ideas, except where the work of others has been acknowledged or referenced. I also confirm that the work has not been submitted for a higher degree to any other university or institution. The research project was approved by the Macquarie University Human Research Ethics Committee (Approval No. 5201700796). Signed:

Joseph Antar

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Perceiving Sociosexuality: How is it done?

People make rapid judgements about other people based on the information they retrieve from faces. The validity of these judgements has drawn interest from researchers and has resulted in numerous psychological studies since the early 20th century (e.g Andersen 1921). Research has provided evidence that people are able to accurately judge traits such as cooperativeness (Verplaeste, Vanneste & Braeckman, 2007), deceptiveness (Bond, Berry & Omar, 1994) and sociosexuality (Simpson & Gangestad, 1991; Boothroyd, Jones, Burt, DeBruine & Perret, 2008; Boothroyd, Cross, Gray, Coombes & Gregson-Curtis, 2011; Stillman & Maner, 2009) from photographs and short videotapes. These studies have indicated that people are perceiving certain characteristics from strangers' physical appearance such as their face or from small snippets of behaviour; perceiving these characteristics somewhat accurately; and that people are using the morphology of people's faces to make these perceptions (Boothroyd, et al., 2008; Boothroyd et al., 2011; Stillman & Maner, 2009). For some judgements such as attractiveness, we know that people are using cues such as facial symmetry, shape, averageness and skin colour/texture to make their evaluations (Little, Jones & DeBruine, 2011). For other judgements, such as sociosexuality (a measure of one's willingness to take part in uncommitted sexual relations), research has determined that people are able to accurately perceive it at zero acquaintance, however it is not clear what cues people are using and there are few studies examining *how* people are making this judgement.

Perceiving Sociosexuality

As noted, one's sociosexual orientation or sociosexuality, refers to their willingness to take part in uncommitted sexual relations. The higher or more unrestricted one's score on the SOI or SOI-R (Penke & Asendorpf, 2008), the less commitment one needs to take part in sexual relations, and the more commitment one needs, the lower or more restricted their score. In the initial five-part study conducted by Simpson and Gangestad (1991), they demonstrated the validity of the tool by showing that people who score higher on the SOI tend to have sex sooner in a relationship, have sex with more than one partner at a time and tend to require less investment, commitment and dependence when in a relationship.

Shortly after the initial development of the SOI, Gangestad, Simpson, DiGeronimo and Biek (1992) examined the perception of SOI at zero acquaintance. Participants were recruited and interviewed by an attractive confederate through a video monitor whilst on a supposed lunch date. Following this, they completed a number of personality and behavioural tests which examined social potency, social closeness, stress reaction and SOI. These interviews were recorded and then shown to a second group of participants who were asked to rate the participants on the same tests the first group had completed themselves. A significant correlation was found between males' perception of SOI and self-reported SOI; and overall, participants' ratings of SOI corresponded with target self-reports more closely than the other personality variables. Other studies have replicated this effect. Stillman and Maner (2009) also used video footage, however, they did not use video footage of a target participating in a dating scenario; instead female targets were filmed whilst trying to solve a Rubik's Cube with a male research assistant. Following this, raters were asked to estimate the female's SOI on a scale of one to ten. Participants were able to accurately assess female SOI with researchers finding a strong positive association between estimated SOI and self-reported SOI.

Boothroyd, Jones, Burt, DeBruine and Perrer (2008) also found evidence to suggest people could perceive SOI at zero acquaintance. Firstly, researchers built composites of facial photographs, an example of which can be seen in *Figure 1*. Building these average composites involves marking the same landmarks, such as the bridge of the nose and outline of the eyebrows, on a series of facial photographs of different people. These marks are each given coordinates which can then be averaged across the entire sample of faces along with skin colour (Tiddeman, Burt & Perrett, 2001). Although this may decrease the generalizability of findings because real human faces are no longer being used; averaging faces across groups allows traits that are significantly different between groups to be clearer and results in less variance, with irrelevant facial structures playing less of a role in participants' decision making (Boothroyd et al., 2008).

Figure 1: An example of the side-by-side composites used by Boothroyd et al. (2008). A *restricted* SOI composite is shown on the left whilst an *unrestricted* SOI composite is shown on the right.

In the aforementioned study, participants were asked to rate "Which of these faces looks more open to short-term relationships and sex without love?". They found that observers were able to correctly identify unrestricted female composites and found these unrestricted composites more attractive. In study 2 of the same paper, they also showed real photographs to people unacquainted with the targets. Raters were asked to rate what they thought the person in the photograph would score on four different SOI indices based on different aspects of SOI. Statistically significant correlations were found between self-reported SOI and observers' ratings of SOI (Boothroyd et al., 2008). However, unlike the original study, these researchers found evidence suggesting that women were better at identifying sociosexuality, especially in other women. A follow up study using a similar methodology replicated these findings by creating composites of the 17 highest and lowest scoring females (from a sample of 82) and the 14 highest and lowest scoring males (from a sample of 31) (Boothroyd, Cross, Gray, Coombes, & Gregson-Curtis, 2011; Coombes & Gregson-Curtis, 2011). The high and low SOI composites were then shown to 44 observers who were asked to decide which composite they thought "would be more open to sex without love and one-night stands?" along with a series of other comparisons relating to masculinity vs femininity, impulsivity and attractiveness. Correlations between observers' assessments of high SOI females and the composites' SOI were again found to be statistically significant, along with a positive relationship between the female composites' SOI and how attractive they were rated.

Explaining Sociosexuality Perception

A number of explanations have been offered to explain why people are able to accurately perceive sociosexuality at zero acquaintance. These explanations generally help explain the adaptive function, evolutionary history, development and causation of the accurate detection of SOI in strangers. Explaining behaviour in this manner was first proposed by Dutch ethologist Niko Tinbergen (1963). This framework has guided the scientific study of human and animal behaviour across a variety of fields including ecology, zoology and evolutionary psychology (Fawcett, Marshall & Higginson, 2015; Mcnamara & Houston, 2009; Stephen, Mahmut, Case, Fitness, & Stevenson, 2014) and is an effective way of understanding how and why behaviour occurs.

Functional Explanations. There are a number of ways in which both men and women's ability to detect the SOI of strangers could assist their reproductive fitness and therefore have a functional use. In men, having the ability to recognise women with an unrestricted SOI may increase their chances of reproduction as they would know that these women would be more likely to reciprocate their advances for short-term sexual encounters. For men, maximising their reproductive opportunities is the overall goal of their mating strategy because males who miss reproductive opportunities will be out produced by males who do not. Having the ability to detect SOI would increase these aforementioned opportunities. An analogous argument could be made for women too. Women who are more attuned to the sociosexual orientation of strangers would be better at choosing male partners that are more open to long-term relationships, thus decreasing the chances of abandonment following conception (Boothroyd et al., 2011).

Presumably, it would also be beneficial for men and women to have the ability to detect the SOI of those within their sex too. SOI score is positively associated with sexual infidelity and individuals with a previous history of sexual infidelity report a more unrestricted SOI and less commitment (Rodrigues, Lopes, & Pereira, 2017). Knowing the sociosexual orientation of people within their sex and therefore having a better understanding of who would be more or less likely to pursue short-term encounters with their own partners, would assist people when mate guarding in both men and women. Stillman and Maner (2009) offered this explanation themselves and the adaptiveness of being able to develop an accurate impression of a strangers' personality characteristics has been proposed by other researchers (Haselton & Funder, 2006). Thus, from a functional perspective, it makes evolutionary sense for humans to have the ability to detect the SOI of strangers in both sexes.

Phylogenetic Explanations. Explanations that focus on the phylogenetic causes of behaviour largely focus on how the behaviour has changed over the course of evolutionary history (Vasey, 2007). Phylogenetic trees are often formulated, and they aim to determine the relationships between species, and the point in evolutionary history at which particular traits evolved or were lost. The traits that are analysed can include behavioural traits such as mating strategies and systems (e.g Temrin & Sillén-Tullberg, 1994). Research has provided insight into the relationship between different morphological features and the different mating systems of primate taxonomic groups. Morphological characteristics such as the relative size of the testes for example, provide a valid cue to the type of breeding system that exists in each species. Chimpanzees have testes that are proportionally far greater in size compared to gorillas or orangutans because females in their species will usually mate with multiple males in a short time frame, leading to intense sperm competition (Harcourt, Harvey, Larson & Short, 1981). Sperm competition is where sperm from multiple males are present in the reproductive tract of a female simultaneously, and thus compete to fertilise the ova. Males with more sperm, produced by larger testes, have a selective advantage, driving the evolution of larger testes in this species. Female orangutans and gorillas on the other hand usually only mate with one male at a time, and thus since sperm competition is largely absent, male orang-utans and gorillas have relatively much smaller testes than chimpanzees (Harcourt et al., 1981).

The sexual dimorphism that is present within a species is also a good indicator of the mating strategy that is being implemented. In species where there is a high level of male-male competition for sexual access to females, males are usually far greater in size than the females, whereas when there is little competition and females are largely monogamous, the difference is far less (Short & Balban, 1994). Morphology is therefore a good predictor of the mating systems that exist between primate species and may also be a good predictor of mating strategies between humans.

Furthermore, whilst we do not know whether primates can detect the sociosexuality of one another, we do know that most species of mammals and primates such as baboons, can tell when females are more interested in copulation. Males are made aware of females that are in an oestrus phase (which is when they are fertile) by sexual swellings of areas on their body

(Domb & Pagel, 2001)**.** Oestrus is a phase of female sexuality that differs from other phases of the ovarian cycle because it is a period where females experience heightened sexual motivations and attractiveness to prospective partners. While women appear to have largely lost oestrus, some researchers suggest that human women still go through this phase and that males are sensitive to this too (Gangestad & Thornhill, 2008). Female lap dancers earn significantly more during the follicular (fertile) phase of their menstrual cycle compared to their luteal phase, suggesting that men can detect menstrual cycle phase (Miller, Tybur, & Jordan, 2007), though others argue that these findings are greatly exaggerated (Dixon, 2013). There is clear evidence that suggests our genetic relatives are able to detect mates who are more open to their sexual advances and this suggests that humans having this ability is evolutionarily plausible.

Ontogenic Explanations. Ontogenetic explanations are focused on how a particular behaviour develops within the organism's lifetime. It can develop through the influence of genes, nutrition, learning and often an interaction of them all together. In the context of SOI perception, people may be particularly sensitive to particular facial features that are influenced by hormones and are indicative of high sociosexuality. Concurrently, people may learn to associate these facial features with behaviours that are indicative of high sociosexuality. The more exposure one has to a particular behaviour, the more opportunity one has to associate facial features and other features in general with this behaviour. This has been demonstrated in studies researching sexual behaviour. For example, Ambady, Conner and Hallahan (1999) found that homosexual people were better at detecting the sexual orientation of strangers, possibly because they had more opportunity to interact with people they know who are homosexual. Thus, human's may learn to associate certain facial features with SOI. Causal or mechanistic explanations discussed below will help elucidate exactly how this may be occurring.

Causal Explanations. A number of mechanistic explanations, which look to understand how the detection of SOI arises from underlying psychological, physiological and molecular processes have been proposed. The most obvious causal explanation relates to hormones. Early androgen exposure has been linked to SOI through the measurement of the ratio of one's second and fourth finger, known as "2D:4D". This method is used to test whether hormones are having an organisational effect on the brain in humans (Lutchmaya, Baron-Cohen, Raggatt, Knickmeyer, & Manning, 2004). Males generally have a lower 2D:4D than females and the emergence of this difference occurs within the first trimester of gestation, suggesting a strong influence of prenatal sex hormones, with higher concentrations of testosterone in utero correlating negatively with 2D:4D (Galis, Ten Broek, Van Dongen, & Wijnaendts, 2009; Manning, Scutt, Wilson, & Lewis-Jones, 1998; Puts, McDaniel, Jordan, & Breedlove, 2007). Interestingly, just as males generally score higher than females in SOI, individuals with more masculine 2D:4D ratios generally provide more unrestricted SOI scores, suggesting that a division of brain areas involved with sociosexuality occurs very early in development due to in utero testosterone (Charles & Alexander, 2011; Clark, 2004).

Like 2D:4D, aspects of facial morphology are also influenced by in utero hormones. Studies have shown a statistically significant association between more masculine 2D:4D and more masculine facial structure in men (Weinberg, Parsons, Raffensperger, & Marazita, 2015). Similarly, higher levels of circulating testosterone in the umbilical cords of newborn babies is positively correlated with the development of masculine facial features in both males and females when they are 20 years old (Whitehouse et al., 2015). An activational effect of sex hormones can be implied through the measurement of current levels of these hormones, with higher testosterone in both men and women also associated with sociosexuality. Research has shown that people who have a more restricted sociosexual orientation when in a relationship have lower testosterone than those who are single, however those who are less restricted demonstrate no observable difference in testosterone whether they are in a relationship or not (Edelstein, Chopik, & Kean, 2011). Furthermore, through the use of composites, research has indicated that participants identify facial images with relatively higher circulating levels of testosterone as being more masculine (Penton-Voak & Chen, 2004). This adds further weight to the argument that hormones are somehow linked to sociosexual orientation, although the direction of the causal effect, if there is one, is unclear.

Similar studies have demonstrated links between activating hormones and facial structure too. Testosterone is much higher in adolescent males than females and has been proposed as a possible explanation for why male and female faces begin to differ so much during adolescence (Whitehouse et al., 2015). Additionally, the administration of testosterone to teenagers with delayed puberty results in the growth of craniofacial structures that were positively correlated with circulating testosterone in another study (Verdonck, Gaethofs, Carels, & de Zegher, 1999). In linking these findings to the behaviour in question, when people judge sociosexual orientation in strangers, they may be using facial features that are particularly sensitive (or insensitive) to the effects of testosterone. Indeed, sexually unrestricted women are rated as having more masculine faces by male raters (Campbell et al., 2009), however so far research has not provided answers as to what facial features people are sensitive to when they are attempting to rate a stranger's SOI.

Geometric Morphometric Modelling

GMM extracts underlying patterns from facial landmarks and uses them to predict other factors such as intelligence. Thus, specific characteristics of people's faces can be examined to first see whether certain characteristics are predictive of behavioural or personality variables and secondly, to see whether people are sensitive to these characteristics. A similar study was carried out focusing on intelligence (Kleisner, Chvatalova, & Flegr, 2014). Researchers found that a broader distance between the eyes, a larger nose, a less rounded chin and other specific features were associated with perceived intelligence but no relationship between morphological traits and real intelligence was present. However, both sexes were able to accurately evaluate the intelligence of men. This suggests that raters were able to accurately assess the intelligence from faces through the use of visual cues other than those associated with face-shape variation, with researchers speculating that they may have instead used eyes, eye colour, and hair colour or skin texture. Their findings also suggested that both men and women use the same stereotypical morphological traits to make their judgements, with a narrower face and larger nose the stereotype for people with a high IQ; whilst a rounder, broader face with a smaller nose used to stereotype people as having a low IQ. That is to say, these participants were potentially using facial morphological cues to make their judgements, however they were not using morphological facial cues that were actually indicative of intelligence. This method could also be used to test SOI. As stated above, it is not yet known what facial cues people are using to assess sociosexuality and whether or not the cues people are using are actually indicative of sociosexuality. A similar methodology to what was used by Kleisner, Chvatalova and Flegr (2014) could be used to answer these questions and thus give a more detailed mechanistic explanation for how and why this behaviour is occurring.

The Present Study

The aim of this study was to examine the relationship between facial morphology and SOI. Specifically, it was to examine: a) if SOI is reflected in facial morphology, and b) whether observers can recognize SOI from these facial cues. To do this, two studies were conducted, with two different sets of participants and two different sets of hypotheses.

Study One

Study One aimed to examine the relationship between facial shape and SOI.

Specifically, the aim was to develop a model that predicted SOI from facial morphology. It was hypothesised that a model would be produced that significantly predicted participants' SOI score. It was also used to collect stimuli to use in study two. The data for this study was collected as part of a larger project to collect a database of face and body photographs and associated data on physiological and mental health and health behaviours ("Perceiving Health from Faces and Bodies"). The addition of the SOI-R scale and of Joseph Antar as an investigator was approved by the Macquarie University Human Research Ethics Committee in April of 2017. In addition to the tasks described below, participants completed a number of health-related questionnaires for inclusion in the database.

Participants

In total, 123 participants had photographs taken of them in the first phase of the study, 63 females and 60 males (*M* = 20.21 years, *SD* = 3.56). Participants that participated in the study were either personal acquaintances of the researchers and took part for a reimbursement of $10 or were Macquarie University undergraduates that had been recruited through SONA and were given 2 credit points for completing this study. Only Caucasian participants were recruited between the ages of 18 and 30 to control for confounding variables such as ethnicity and age (Demarest & Allen, 2000).

Power calculations indicated that the study would have a power of .80 to detect a medium effect when using up to 11 predictors in a regression model.

Materials

Participants completed their online surveys through Qualtrics (www.qualtrics.com; Qualtrics Labs Inc., Provo, UT) on a Windows 10 ASUS desktop computer in a room with blacked out windows and no other people besides the experimenter. A 51×29cm screen was used and participants were seated approximately 60 centimetres from the screen. Participants were provided with grey Bonds singlets and shorts in their own size (selected from size XS to XL) to wear and were asked to stand in an illuminated 117 x 90 x 210cm booth located 3 metres away from the camera. The booth was painted with Munsell N5 Neutral Grey paint and to minimize the effects of flicker, it was illuminated using 15 Verivide T12/D65 daylight simulating fluorescent tubes in high frequency fixtures. To ensure even light distribution, the light was diffused using Perspex and, to ensure there were no other sources of light in the room, the door was shut, and the overhead lighting switched off. 2D photographs of the participants were taken through the EOS Utility program on the aforementioned computer. A Canon EOS 70D DSLR camera with an 18-55mm lens (focal length held constant for all images) mounted on a tripod one metre above the ground was used. For all images camera settings were set at a 1/50 exposure time, a lens aperture of F/5.6, white balance set at 6500K and an ISO speed rating of 200. Some participants were also given a black headband to ensure their hair was not on their face. Faces were analysed using two computer programs: Psychomorph (Tiddeman, Burt & Perrett, 2001) and Geomorph (Adams, Collyer, Kaliontzopoulou & Sherratt, 2017). Geomorph was downloaded as a package through RStudio which is a development environment for R (a programming language used for statistics and graphics). Further statistical analyses were completed using IBM SPSS version 24.

Measures

The SOI-R was used to measure sociosexuality (Penke & Asendorpf, 2008). The *higher* or more *unrestricted* one's score on the SOI-R, the less commitment one requires in order to take part in sexual relations, and the *lower* or more *restricted* their score, the more commitment one needs. The instrument consists of 9-items (one reverse coded) and measures overall sociosexual orientation. This overall score is also broken into three subcomponents which measure sociosexual behaviour, sociosexual desire and sociosexual attitude. Three items measure each of these components and include questions or statements such as “With how many different partners have you had sexual intercourse on one and only one occasion?” (behaviour), “In everyday life, how often do you have spontaneous fantasies about having sex with someone you have just met?” (desire) and “Sex without love is OK” (attitude). For 3 items participants indicate how much they agree with a statement on a 9-point Likert style rating from “strongly disagree” to “strongly agree”. For the questions that require a numerical answer, participants also have 9 options from “0” to “20 or more”. For the last three questions participants give their answer on a 9-point scale from “never” to “at least once a day”. On each of the subscales scores could range from 3-27 and on the SOI-R overall scores could range from 9-81, with higher scores indicating a more unrestricted sociosexual orientation. The instrument is scored as per the SOI-R Short Manual (Penke & Asendorpf, 2008).

Procedure

SOI and image collection. Participants were recruited through SONA or known personally to the experimenter and arranged to meet outside the laboratory. In the room, participants were provided with information and consent forms (see Appendix A). They then completed the online survey which contained the SOI-R and health-related questionnaires for the database. This process usually took 10-20 minutes.

Following this, participants were asked to remove any jewellery or make-up they had on. Some participants either could not take out certain piercings, indicated that it would be too difficult, or stated that it would take too long to take out certain piercings. Therefore, 11 females and 4 males were photographed with piercings. For these participants, their data was still used, and their piercings were digitally removed so they would not be visible in phase two of the study. See *Figure 2* below for an example.

Figure 2: An example of a participant with piercings can be seen on the left and then an example of the photograph retouched to exclude the piercings can be seen on the right.

Following this, participants were provided with standard grey singlet and shorts (to avoid a colour cast to the face from light reflected off the clothing) to change into whilst the experimenter was outside the room. Once they had changed, participants had 2D images taken of themselves. Pictures were taken with participants in the anatomical position (body upright facing the camera with feet flat directed forward and palms of the hands facing forwards) and they were instructed to maintain a neutral expression on their face by the experimenter.

Geometric morphometric methodology. When using GMM, landmarks are digitized on each image to describe overall facial form (Kleisner, Chvatalova, & Flegr, 2014; Mitteroecker, Gunz, Windhager & Schaefer, 2013). This is a method that has been used to analyse facial shape and its relation to other variables such as intelligence and health (Kleisner, Chvatalova, & Flegr, 2014; Stephen, Hiew, Coetzee, Tiddeman, & Perrett, 2017).

Similar studies have used images of participants with a neutral expression from the front and these were also chosen in this study to be analysed (Kleisner, Chvatalova & Flegr, 2014). Each image was loaded into Psychomorph, which allows researchers to manually place landmarks on the face that are then converted into coordinates along the x and y-axis by the program. For each of the facial images, 138 landmarks were placed at points around the neck and face and can be seen numbered in *Figure 3.* This data was then exported and organised into a .txt file so it could be loaded into Geomorph.

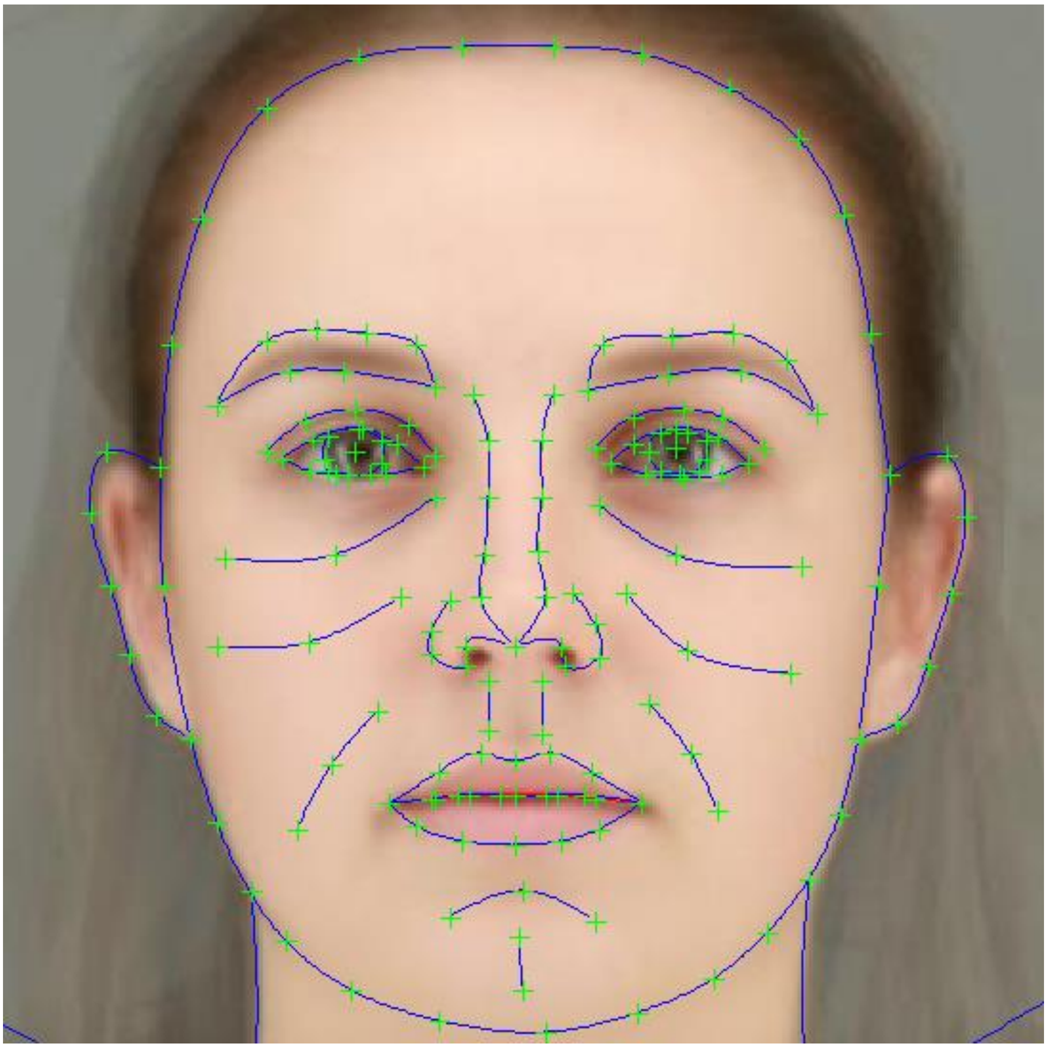


Figure 3: All 138 landmarks that were analysed can be seen in the composite above.

In Geomorph, all arrangements of landmarks were superimposed by generalised Procrustes analysis (GPA). This involves translating all landmarks to the same central point, then rotating all configurations until the summed squared distances between the landmarks and their corresponding sample average is a minimum between the faces (Mitteroecker, Gunz, Windhager & Schaefer, 2013). Thus, variation in the location, size and orientation of each face's landmark configuration is removed and shape alone can be measured and analysed.

A principal components analysis (PCA) was then carried out using Geomorph to identify the latent dimensions of variation in landmark data (Stephen et al., 2017). Principle components immediately beyond the straight scree line or "below the elbow" were removed (Cattell, 1966). Nine principal components (PCs) fitted this criterion, which together explained 81.6% of the variance. Geomorph also allows the user to visualize the PCs thus enabling the researcher to understand what each of the PCs represent. PC1 and PC2 seem to be related to gender, PC3 appears to be related to head tilt and PC4 appears to be explaining forehead length or hairline (see *Figure 4*).

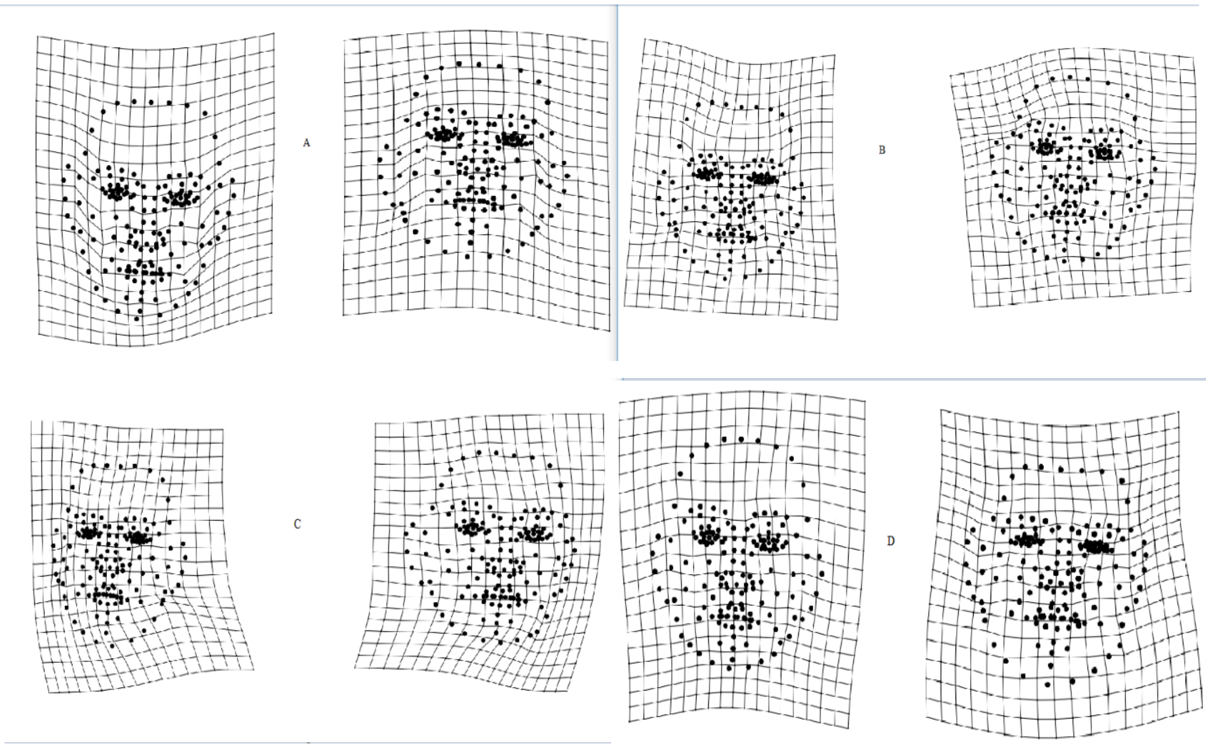


Figure 4: Depicted are illustrations of the first 4 PCs. A: Low (left) and high (right) scores on the first principal component. This PC explained 27.1% of the variance in face shape. B: Low (left) and high (right) scores on the second principal component. This PC explained 8.46% of the variance in face shape. C: Low (left) and high (right) scores on the third principal component. This PC explained 7.34% of the variance in face shape. D: Low (left) and high (right) scores on the fourth principal component. This PC explained 5.88% of the variance in face shape.

The aim of study one was to examine the relationship between facial morphology and SOI. Head tilt is clearly not related to facial morphology and is usually removed before statistical analyses are carried out. However, the illustrations above illustrate that PC3 seems to be measuring head tilt. Removing this component from analyses did not change the pattern of results, thus results are reported with PC3 included. For analyses carried out with PC3 excluded see Appendix C.

Statistical Methods. To examine the hypothesis of study one (that a model would be produced that significantly predicted participants' self-reported SOI score), a linear regression was carried out. Overall self-reported SOI was the dependent variable and all 21 PCs identified above were included as independent variables. For analyses of each of the subscales see Appendix D.

Results

Data Screening. Several participants were removed for a number of reasons. Four female participants were removed from analysis in due to clearly not being of Caucasian appearance, and another female was also excluded because she had her mouth open during the photograph, this meant that her face could not be delineated properly. One male participant was excluded due to clearly not being of Caucasian appearance and another male was excluded due to having extensive scarring across his face.

Do men have a more unrestricted SOI than women? An Independent Samples t-test indicated that there was a significant difference between male (M = 29.327, SD = 12.278) and female (M = 21.517, SD = 8.527) SOI scores (t (95.724) = -3.908, p < 0.001), with males scoring significantly higher than females. This is in line with previous research (Schmitt, 2005). For males some normality tests indicated that the SOI scores were not normally distributed whilst others did, thus statistics reported above are from the equal variances not assumed row of the t-test table for males. The difference in SOI scores between males and females can be seen in *Figure 5.*

Figure 5: The mean SOI score by males and females in the SOI-R.

Do facial features predict SOI? The aim of Study One was to develop a model predicting SOI from facial features. Thus, separate multiple linear regressions for each sex were run using overall SOI score as the DV and the principal components (PCs) as the predictors. A regression model for both sexes together was also carried out with overall SOI score as the DV and the principal components as the predictors. An alpha level of p=.05 was used for all statistical analyses.

Assumption checking. Before analysing the results, the assumptions of regression were tested. A visual examination of normal probability plots showed that SOI had approximately normally distributed residuals and homoscedascity was met. A visual examination of scatterplots of SOI against each of the PCs suggested no evidence of non-linearity. The assumptions of linearity of residuals and homoscedasticity were met in both men and women. Multicollinearity was not an issue (all variance inflation factors <2.93).

Models predicting SOI. In males, a regression model predicting scores on the SOI based on the PC scores was calculated. A significant regression equation was found (R^2 = .316, Adjusted R^2 = .179, F (9,45) = .2.308, *p* = .031) and explained 17.9% of the variance in SOI. PC2 (β = -2.078, p = .043) and PC6 (β = -2.947, *p* = .005) were identified as having a statistically significant effect. In females, a similar model was created. This regression model, predicting scores on the SOI from the PC scores, was not significant (R^2 = .106, Adjusted R^2 = -.061, F (9,48) = .635, *p* = .761).

A regression model predicting scores on the SOI based on the PC scores was also calculated for both male and female data together. A significant regression equation was found and explained 24.3% of the variance (R^2 = .243, F (9,103) = 3.67, *p* = .001). Both PC1 (β = .226, *p* = .01), PC2 (β = -.269, p = .002) and PC4 (β = .273, *p* = .002) had an independent statistically significant influence on overall SOI score (β = .51, *p* = .002), indicating that higher scores on PC1 and PC4 respectively, were associated with higher SOI scores, whereas an inverse relationship was present between PC2 scores and SOI scores. All PCs can be seen in *Table 1*.

Variable	*B*	*SE B*	*β*
PC1	47.276	17.941	0.226*
PC2	-101	32.259	-0.269**
PC3	-36.52	34.64	-0.09
PC4	122.2	38.42	0.273**
PC5	-39.26	47.355	-0.071
PC6	-84.01	47.45	-0.152
PC7	-21.12	53.149	-0.034
PC8	-62.11	53.378	-0.096
PC9	-22.23	57.745	-0.033

*p<0.05. **p<.01.

Table 1: Summary of Regression Analysis for PCs Predicting Self-Reported SOI score (N = 112)

However, since PC1 and PC2 appear to be describing sexual dimorphism and men have higher SOI scores than women, a hierarchical linear regression was run to determine if facial morphology predicts variance in SOI over and above the sex of the participants. Again, tests for multicollinearity indicated there was no issue of multicollinearity (all VIFs < 3.34). Sex was the first variable entered, followed by all of the PCs in the following model. The hierarchical multiple regression revealed that at Stage one, sex contributed significantly to the regression model (Adjusted R^2 = .115, F (1,111) =15.559, $p < 0.001$) and accounted for 12.3% of the variation in SOI (according to the R^2 change). Introducing the PC variables explained an additional 14% of the variation in SOI and this change in R^2 was statistically significant (Adjusted R^2 = .189, F (10, 102) = 3.604, p = <0.001). Only PC6 (β = -.205, p = .027), which appears to be related to facial robustness, was identified as having an independent statistically significant influence on overall SOI score over and above the sex of the participants. All PCs can be seen *Table 2.*

Variable	Model 1 *B*	*SE B*	*β*	Model 2 *B*	*SE B*	*β*
Sex	7.810	1.980	0.351**	5.067	3.191	0.227
PC1				35.918	19.192	0.172
PC2				-69.69	37.603	-0.185
PC3				.885	41.681	0.002
PC4				86.215	44.367	0.192
PC5				-25.12	47.844	-0.045
PC6				-113.2	50.558	-0.205**
PC7				21.803	59.283	0.035
PC8				-62.05	54.974	-0.096
PC9				-26.18	57.377	-0.039

*p<0.05, **p<.01.

Table 2: Summary of Hierarchical Regression Analysis for PCs Predicting Self-Reported SOI score (N = 114)

Do the models that predict SOI correlate with self-reported SOI? Unstandardised predicted values were saved from the regression models predicting self-reported SOI in each sex. Pearson's correlation coefficient was calculated to assess the relationship between self-reported SOI and self-reported SOI predicted by the PCs. In females, a positive relationship was found and this relationship was statistically significant (r = .326, n = 58, p =.012). In males, a positive relationship was found and this relationship was also statistically significant (r = .562, n = 55, p <0.005). This suggests that the aspects of facial shape associated with self-reported SOI are similar to those associated with the self-reported SOI of both men and women, providing further evidence to suggest that facial cues are valid predictors of SOI.

Discussion

Study One aimed to examine the relationship between facial shape and SOI. The aim was to develop a regression model that predicted SOI from facial morphology. It was hypothesised that scores on the SOI-R could be predicted from the PCs that denote the variation in face shape.

This hypothesis was supported in the both sexes together model. Furthermore, a significant regression equation was found when a hierarchical regression was performed with sex in the first step, showing that facial shape predicted SOI over and above the variance predicted by sex. However when the data was split by sex, only the male data was significant, suggesting the main effect was being driven by the male data. This result is consistent with recent research that provided a link between the sociosexual orientation of men and their facial morphology (Arnocky et al., 2017). The implications of this will be discussed in further detail in the general discussion.

Study Two

Study two had three related aims. Firstly, it aimed to test whether people could accurately perceive the SOI of strangers. This would be examined by testing whether a statistically significant, positive relationship was present between what people perceived the targets SOI to be and their actual SOI. Secondly, it aimed to test whether facial morphology predicted perceived SOI. This would be examined by testing whether the PCs identified earlier produced a statistically significant regression model that predicted perceived SOI. Lastly, it aimed to test whether people make accurate judgements of SOI based on face shape. If the model predicting perceived SOI from facial shape was found to be statistically significant, this would be examined by testing whether the saved predicted values from this model correlate with actual SOI.

It was hypothesised that the actual SOI score of participants in study one would be significantly correlated with perceived SOI score made by the raters of these participants in study two (Boothroyd et al., 2011; Boothroyd et al., 2008; Gangestad, Simpson, DiGeronimo

& Bink, 1992). Furthermore, it was hypothesised that specific facial features of the participants would predict their perceived SOI scores made by the raters. Additionally, in study two it was also hypothesised that participants would be able to correctly judge which composite had an unresticted SOI at a level greater than chance (Boothroyd et al., 2008).

This study was approved by the Macquarie University Human Research Ethics Committee in October of 2017.

Participants

65 Caucasian participants (45 female) between the ages of 18-31 took part in Study Two (*M* = 22.03, *SD* = 2.68). Participants that participated in the study were Macquarie University undergraduates that had been recruited through SONA and were given 2 credit points for completing this study. Alternatively, some participants were either personal acquaintances of one of the researchers or recruited via paper advertisements set-up throughout the campus (see Appendix E) and took part for a reimbursement of $10. All participants were naïve to the hypotheses.

Materials

Participants completed their online surveys through Qualtrics on a Windows 10 ASUS desktop computer. A 51 × 29cm screen was again used and participants were seated approximately 60 centimetres from the screen. They completed the study in a room with blacked out windows and no other people besides the experimenter.

Stimuli

This study contained two types of facial image stimuli. First, images of participants' faces from the first study, which had been cropped and delineated using Psychomorph (*Figure 6)* were used in a rating paradigm.

Second, a pair of facial composites, that had been built using the same program, were used in a two-alternative forced choice paradigm. Composites were built from the individuals in study one that had scored in the highest quartile on the SOI (unrestricted individuals; i.e. those most open to short term relationships; mean score for males: 46.1, mean score for females: 35.55) and a composite of the individuals scoring in the lowest quartile on the SOI (restricted individuals; i.e., those least open to short term relationships; mean score for males: 13.93, females: 10.75), as per previous studies that have used composites (Boothroyd et al., 2008). 15 faces were used for each composite. For each landmark, the average coordinates across the 15 faces were calculated. Then, each face was warped by Psychomorph to this average shape. Next, the colour of each pixel then averaged across the 15 faces. Finally, average texture was added back to create the composite.

Figure 6: An example of a participant's image before and after they'd been cropped and delineated. Participants in Study Two were shown images of the same size as the image shown on the right.

Measures

Participants completed three blocks of ratings. In one, they rated the SOI of the real faces collected in Study 1 (e.g *Figure 6*). Five SOI questions were following Boothroyd et al

(2008), and each was answered on a 7-point Likert scale from very unlikely to very likely. In the second, they rated the attractiveness of the faces on a 7-point Likert scale, from very unattractive to very attractive. Along with these ratings participants were also given the option to indicate that they knew the person in the photograph, and thus were not required to rate them. In the third block, participants were presented with the pair of facial composites (high SOI and low SOI) and asked to rate which they thought was more likely to fit each of the 5 SOI descriptions, on a 6-point Likert scale from left image highly more to right image highly more.

For all questions, males were only scored by females and females only scored by males. The order of the blocks was randomised and the order of presentation of the faces within each block was randomised. For the composite task, the sides of the screen that each face appeared on was randomised. A screen shot of the questions can be seen in *Figure 7* and the facial composites along with the questions can be seen in *Figure 8*.

	Very Unlikely	Unlikely	Slightly Unlikely	Neither likely nor unlikely	Slightly likely	Likely	Very Likely	I know this person
How likely is this person to fantasise about someone other than their current partner?	○	○	○	○	○	○	○	○
How likely do you think this person would be to have a one night stand?	○	○	○	○	○	○	○	○
How likely do you think it is that this person would require a strong relationship commitment before they would engage in sexual contact?	○	○	○	○	○	○	○	○
How likely is this person to think sex without love is okay?	○	○	○	○	○	○	○	○
How likely is it that this person would have (or had) a lot of sexual partners?	○	○	○	○	○	○	○	○

Figure 7: The questions that were asked to participants below a photograph of each face.

Figure 8: The questions that were asked to participants below the side by side images of high and low composites.

Procedure

In the room, participants were provided with information and consent forms (see Appendix B). Participants then completed a Qualtrics survey on the computer during which they were asked to rate the SOI and attractiveness of the participants that had been recruited in phase one and the high and low composites that had been built using these faces.

Design and Data Analysis

In this study, perceived SOI score was calculated for each real face by averaging each question across all raters for each face (with one reverse scored), and then summing across the five questions for each face. In order to test whether participants' perceived SOI ratings were accurate, Pearson's correlations were used to correlate between perceived SOI and actual SOI scores. To see if the face shape PCs successfully predict perceived SOI, three linear regression models were produced, one for each sex of face and one overall model, with perceived SOI score as the DV, and the 21 PCs as the predictor variables. Analyses were again carried out without PC3 (which seemed to be related to head tilt) and it was found that this did not change the results. Predicted values of perceived SOI were saved from the model, as Perceived SOI_{pred}. To see whether the model that predicted perceived SOI also predicts actual SOI (which would indicate that the facial shape cues that people use to perceive SOI are also the cues that reflect actual SOI, and are therefore valid cues to SOI), Pearson's correlations were used between Perceived SOI_{pred} and actual SOI.

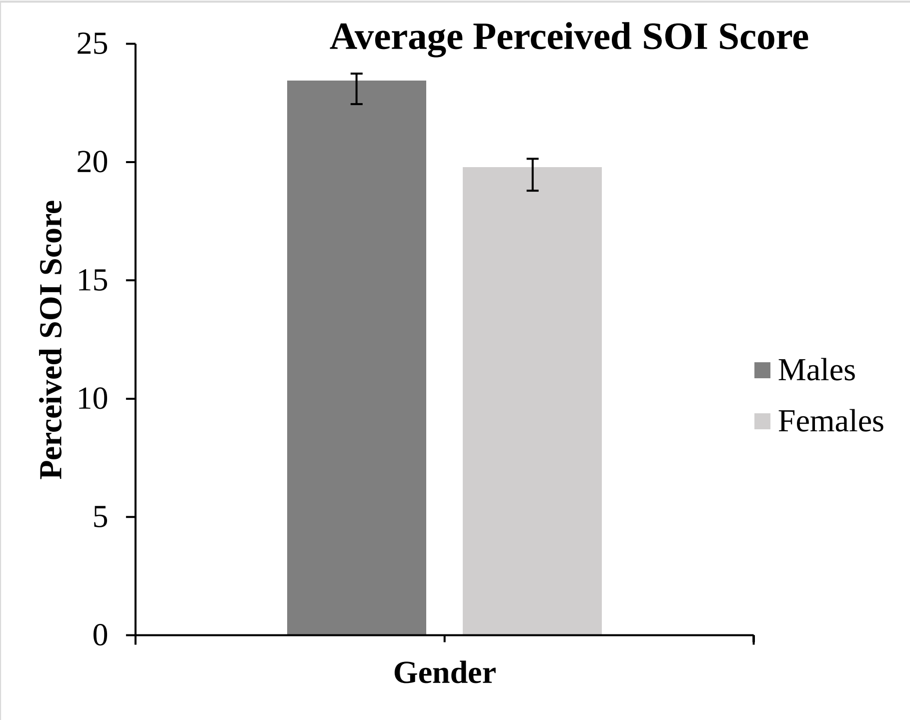
Based on the work of Kleisner et al (2014) it was estimated that we would find a medium effect (*d*= 0.2) of PC scores on perceived SOI. We were aiming for a power estimate of .80, and to reach that level of power with our estimated effect size, we collected data from 123 participants.

For the composite rating data, since participants answered 5 questions, each on a 6-point Likert scale from 1-6, possible scores ranged from 5 (in which participants perceived the low SOI face as definitely high SOI on every question) to 30 (in which participants perceived the high SOI face as definitely high SOI on every question), with a midpoint of 17.5. To determine if participants could correctly recognise the higher SOI composite, a one-sample t-test was used against the midpoint value of 17.5.

Results

Data Screening. Seven females indicated that they were homosexual, and their data was removed from the analysis. However, including them in analyses did not change the pattern of results. Any time a rater indicated that they knew the participant in the photograph, they did not rate the participant's SOI or attractiveness and thus, these ratings were excluded when calculating the averaged perceived SOI and attractiveness of these photographed participants. Four raters indicated that they knew the participant in the photograph on at least one occasion.

Are men perceived as having a more unrestricted SOI than women? Before carrying out the analysis, the assumptions of an independent samples t-test were tested and all were satisfied. An Independent Samples t-test indicated that there was a significant difference between the perceived SOI of males (M = 23.45, SD=2.16) and females (M = 19.79, SD = 2.66) ($t(109)$ = 7.956, p <0.001) with males scoring significantly higher than females. The difference in perceived SOI scores between male and female faces can be seen in *Figure 9.*



Is there a relationship between actual SOI score and perceived SOI score? A Pearson's correlation coefficient was calculated to assess the relationship between actual SOI score and perceived SOI score. A statistically significant, positive relationship between the two variables was present in the sample overall, $r = .36$, $p < 0.001$ ($n = 111$). When the relationship between actual SOI and perceived SOI score was tested in women only, a non-significant relationship was present between the two variables, $r = -.08$, $p = .556$ ($n = 56$). In men, a medium, statistically significant, positive relationship was observed between actual SOI score and perceived SOI score, suggesting this was the main contributor to the statistically significant correlation that was observed in the sample overall, $r = .426$, $p =.001$ ($n = 55$).

Do facial features predict perceived SOI? The aim of Study Two was to develop a model predicting perceived SOI from facial features. Thus, separate multiple linear regressions for each sex were run using overall perceived SOI score as the DV and the principal components (PCs) as the predictors. A regression model for both sexes together was also carried out with overall SOI score as the DV and the principal components as the predictors. An alpha level of p=.05 was used for all statistical analyses.

Assumption checking. Before analysing the results, the assumptions of regression were tested. A visual examination of normal probability plots showed that perceived SOI had approximately normally distributed residuals. A visual examination of scatterplots of perceived SOI against each of the PCs suggested no evidence of non-linearity. The assumptions of linearity of residuals and homoscedasticity were met in both men and women. Collinearity was not an issue, with the highest variance inflation factor being 3.21.

Models predicting perceived SOI. In females, a regression model predicting perceived SOI scores based on the PC scores was calculated. A marginally significant regression equation was found (Adjusted R^2 = .014, F (9,46) = 1.996, p = .061), with PCs 6 and 9 identified as being statistically significant in the model.

In males, a similar model was created. This regression model, predicting perceived SOI scores from the PCs, was statistically significant (Adjusted R^2 = .171, F (9,45) = 2.241, p = 0.036. The model indicated that three PCs were statistically significant, and these PCs can be seen in *Table 3*. Visualisations of each of the significant PCs can be found in Appendix G.

Variable	*B*	*SE B*	*β*
PC1	18.134	5.897	0.445**
PC2	-31.62	10.911	-0.417**
PC3	-7.466	11.287	-0.09
PC4	12.574	12.333	0.141
PC5	-8.694	11.975	-0.092
PC6	-5.184	14.229	-0.048
PC7	-14.93	16.496	-0.128
PC8	-38.94	15.034	-0.344*
PC9	12.919	16.355	0.11

*p<0.05. **p<.01.

Table 3: Summary of Regression Analysis for PCs Predicting Male's Perceived SOI scores (N = 114)

A regression model predicting perceived SOI scores based on the PC scores was also calculated for both male and female data together. A significant regression equation was found and explained 45.3% of the variance (R^2 = .453, Adjusted R^2 = .407, F (9,108) = 9.928, p = <.000). PC1, PC2, PC3 and PC4 were all identified as having a significant effect on the model. As noted, PC1 and PC2 appear to be directly related to gender. PC4 however does not and was also a significant predictor in the model created in study one, predicting self-reported SOI score. Thus, perceivers may be accurately using forehead length to perceive the SOI of strangers.

However, since PC1 and PC2 appear to be describing facial femininity and masculinity, and men were perceived as having a higher SOI score than women, a hierarchical linear regression was run to determine if facial morphology predicts variance in SOI over and above the sex of the participants. Again, tests for multicollinearity indicated that a low level of multicollinearity was present, with the highest being sex in model 2 (VIF = 3.285). Sex was the first variable entered, followed by all of the PCs in the second step. The hierarchical multiple regression revealed that at Stage one, sex contributed significantly to the regression model (R^2 = .367, Adjusted R^2 = .362, F (1,109) = 63.297, p < .001) and accounted for 36.7% of the variation in perceived SOI. Introducing the PC variables explained an additional 6.9% of the variation in perceived SOI, however this change in R^2 was not significant, (R^2 = .436, Adjusted R^2 = .380, F (9,100) = 7.736, p = .218). Furthermore, only PC6 (β = -.156, p = .055) was identified as having a marginal, independent statistically significant influence on perceived SOI score over and above the sex of the participants and any implications drawn from this should be done so cautiously although the model was statistically significant, the change in variance explained was not significant. The entire regression model can be seen in *Table 4*.

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Sex	3.658	0.46	0.606**	3.9	0.76	0.646**
PC1				2.217	4.633	0.039
PC2				-0.320	9.014	-0.003
PC3				0.439	9.984	0.004
PC4				4.139	10.546	0.034
PC5				2.991	11.453	0.02
PC6				-23.38	12.043	-0.156
PC7				12.378	14.318	0.073
PC8				-25.3	13.142	-0.145
PC9				-24.19	13.698	-0.133

*p<0.05. **p<0.01

Table 4: Summary of Hierarchical Regression Analysis for PCs Predicting Perceived SOI score (*N* = 114)

Do the models that predict perceived SOI correlate with self-reported SOI? Unstandardised predicted values were saved from the regression models predicting self-reported SOI and perceived SOI in each sex. Pearson's correlation coefficient was calculated to assess the relationship between self-reported SOI and perceived SOI predicted by the PCs. In females, a small positive relationship was found, however this relationship was not statistically significant (r = -.092, n = 58, p =.491). In males, a positive relationship was found and this relationship was statistically significant (r = .386, n = 55, p =.004). This suggests that the aspects of facial shape associated with self-reported SOI are similar to those associated with perceived SOI in men, providing further support to the hypothesis that perceptions of SOI in men are accurate.

Do people who are perceived as being more attractive have a more unrestricted SOI? A Pearson's correlation coefficient was calculated to assess the relationship between self-reported SOI and attractiveness. A small negative relationship between the two variables was present in the sample overall, however this relationship was not statistically significant ($r = -.095$, $n = 111$, $p =.321$). Similarly, when the relationship between self-reported SOI and attractiveness was tested in women only, a negative, non-significant relationship was again present between the two variables ($r = -.118$, $n = 57$, $p = .162$). In men, a positive relationship was observed between self-reported SOI score and attractiveness, although this was also not statistically significant ($r = .103$, $n = 55$, $p =.453$).

Are people who are perceived as more attractive also perceived as higher SOI? A Pearson's correlation coefficient was calculated to assess the relationship between perceived SOI and attractiveness. A statistically significant, positive relationship between the two variables was present in the sample overall ($r = .298$, $n = 112$, $p =.001$). Similarly, when the relationship between perceived SOI and attractiveness was tested in women only; a strong, positive, statistically significant relationship was present between the two variables ($r = 606$, $n = 56$, $p < .001$). In men, a positive relationship was also observed between perceived SOI score and attractiveness and again, this was statistically significant ($r = .438$, $n = 55$, $p =.001$).

Can people distinguish between restricted and unrestricted composites? Tests of normality indicated that data accrued from all the raters together and for participants rating male faces (female raters) alone was normally distributed, however a Shapiro-Wilk test suggested that normality had been violated for data provided from participants rating female faces (males; ($t(12) = .778$, $p = .005$) and when the data was graphed two outliers were identified. However, a One Sample t-test was computed with the aforementioned outliers excluded and the same pattern of results were observed. Thus, for participants rating male faces a One Sample t-test was computed to test whether there was a statistically significant difference between their perceived SOI score of the composites and the scale midpoint of

17.5. A statistically significant difference was observed ($t(24) = -2.848$, $p = .009$), with participants correctly believing the unrestricted male composite had a higher SOI than the restricted composite (*M* = 19.4, *SD* = 3.335). A One Sample t-test indicated that the difference between perceived SOI of the female composites and the scale midpoint was not statistically significant ($t(11) = -.209$, $p = .838$), (*M* = 17.333, *SD* = 2.766).

Additional Explanatory Analyses

Since sex was a significant predictor of perceived SOI, an additional exploratory analysis was conducted to examine whether perceived SOI was predicted by morphological masculinity. Masculinity indices were calculated within the sample using a discriminant analysis in line with previous research (Stephen et al., 2012; Scott et al, 2010). The PCs were used as predictor variables in a discriminant function analysis with sex as the classification variable. The resulting discriminant function incorporated all of the PCs (Wilks' $\lambda = .353$; $df = 9$; $\chi^2 = 110.876$, $p < .001$) and yielded correct sex classifications for 94.8% of females and 85.5% of males. Discriminant scores were saved for each face and used as morphological masculinity scores. A Pearson's correlation coefficient was calculated to assess the relationship between perceived SOI and masculinity score. A statistically significant relationship was found between perceived SOI and masculinity ($r = .397$, $p < 0.005$) and between self-reported SOI and masculinity ($r = .364$, $p = <0.005$) when both sexes were tested together. When a Pearson's correlation coefficient was calculated to assess this relationship in each sex separately, a statistically significant relationship between the two was found for women ($r = 0.283$, $p = .031$), however not for men ($r = .045$, $p = .746$) for self-reported SOI. When the relationship between perceived SOI and masculinity score was examined using a Pearson's correlation coefficient, non-significant results were computed for both women ($r = -0.149$, $p = .274$) and men ($r = .190$, $p = .164$).

Discussion

Study Two aimed to test whether people could accurately perceive the SOI of strangers. This was examined by a) testing whether a statistically significant, positive relationship was present between what people perceived the target's SOI to be and their self-reported SOI. It was hypothesised that the self-reported SOI score of participants in study one would be significantly correlated with perceived SOI score made by the raters of these participants in study two. Unexpectedly, this hypothesis was not supported in female faces. This result is inconsistent with some previous research that has suggested people can correctly estimate women's self-reported SOI score (Boothroyd et al., 2008). The implications of this will be discussed in further detail in the general discussion. However, it was supported in men, as hypothesised.

Determining whether people could accurately perceive the SOI of strangers was also carried out by testing whether participants could accurately discern which composite was built from high SOI people and which composite was built from low SOI people. It was hypothesized that participants would score the high SOI composite as having a more unrestricted SOI than the adjacent low SOI composite.

This hypothesis was supported for men but not women. This result is somewhat consistent with other research that have been carried out in a similar manner (Boothroyd et al., 2008). A discussion on why this may have occurred will be elaborated on in greater detail in the general discussion of this paper.

The hypothesis that the self-reported SOI score of participants in study one would be significantly correlated with perceived SOI score made by the female raters in study two was supported in male targets. This is consistent with some research (Boothroyd et al., 2008; Gangestad et al., 1992; Stillman & Maner, 2009).

Study Two also aimed to test whether facial morphology predicted perceived SOI. This would be examined by testing whether the PCs identified earlier produced a statistically significant regression model that predicted perceived SOI. It was hypothesized that specific facial features of the participants would predict their perceived SOI scores made by the raters.

This hypothesis was supported in both sexes, although only marginally in women. A significant regression equation was found when both sexes were tested together and when a hierarchical regression was performed, this showed that the sex of the participant was predicting perceived SOI along with facial features.

The final aim of this study was to predict perceived SOI from facial features and examine whether they correlated with self-reported SOI. This was carried out by saving the unstandardized predicted values for men and women separately using the regression equation and then correlating them with the self-reported SOI scores of men and women. It was hypothesized that these scores would correlate with one another. This hypothesis was supported in male faces but not female faces, indicating that women were correctly using the facial features that predict SOI to perceive the SOI of men they did not know.

General Discussion

Summary of Findings

The aim of this study was to examine the relationship between facial morphology and SOI. Specifically, it was to see examine: a) SOI is reflected in facial morphology, and b) whether observers can recognize SOI from these facial cues. The studies investigated this by photographing participants who had completed the SOI-R in study one. The objective in study one was to develop a model that predicted self-reported SOI score from facial morphology. This was developed and then the scores predicted from the model were correlated with the self-reported SOI score of participants. In both men and women, the correlation between the predicted scores and their self-reported SOI scores were statistically significant and as a result valid cues to SOI could be identified.

Study Two aimed to test whether people could accurately perceive the SOI of strangers. This was examined by raters estimating the SOI of participants' photographs from Study One, and then testing whether a statistically significant, positive relationship was present between what people perceived the targets' SOI to be and their self-reported SOI. In men, there was a significant positive correlation between perceived SOI and self-reported SOI. For women, however, no relationships were found between self-rated and perceived SOI.

Participants also chose which of two facial composites built from low and high SOI participants fro Study 1 looked higher in SOI. High SOI male composites were rated as being significantly more unrestricted than low composites by women, but men were unable to correctly identify the higher SOI women's face composite.

Secondly, Study 2 aimed to test whether facial morphology predicted perceived SOI. This was examined by testing whether the PCs identified earlier produced a statistically significant regression model that predicted perceived SOI. As predicted, perceived SOI was found to be reflected in the facial morphology of men and marginally in women.

Thirdly, Study 2 aimed to test whether people make accurate judgements of SOI based on face shape. This was examined by testing whether the saved predicted values from this model correlate with self-reported SOI. As predicted, the saved predicted values from the model correlated with self-reported SOI.

People Can Perceive the SOI of Male Faces but not Female Faces

Due to raters only rating opposite-sex faces, the findings in Study One and Study Two suggested that people are either able to accurately perceive the SOI of male faces but not female faces; or that females are generally better than males at detecting the SOI of strangers' faces; or both. These findings are similar to other studies that have shown that females are generally better than males at identifying the SOI of faces and that people are better at judging the SOI of male strangers than female strangers. For example, Boothroyd et al. (2008), using the same methodology to what was used in the current study but with participants judging same-sex faces too, found strong evidence for the ability of women to identify SOI in others and limited evidence for this ability in men. Our findings contrast with previous studies showing greater accuracy in assessing female than male SOI. For example, Boothroyd et al. (2011) found that female faces were more likely to be accurately judged for sociosexuality than male faces using static images and Stillman and Maner (2009) found the same effect using video clips. Initially, however, researchers found the opposite. Using a 1-minute videotaped interviews of targets with an opposite-sex confederate, they found that SOI was more likely to be perceived in male faces and that male raters performed better than females at judging the SOI of faces (Gangestad, Simpson, DiGeronimo & Bink, 1992). However, it is important to note that studies that have employed a video paradigm are not directly comparable to studies which have used photographs, such as the current study, because raters may have been making their judgement based on certain behaviours in the video, as opposed to physical appearance.

The associations (and disassociations) between the current study and the studies mentioned above, may have occurred because females are better than males at recognizing unrestricted faces due to facing stronger selection pressures in this regard than men specifically related to parental investment theory (Trivers, 1972). That is to say, it may have a functional benefit. Having the ability to accurately assess the sociosexuality of strangers is likely to help women in mate selection as this would increase their chances of choosing men that were more likely to partake in long-term relationships, thus decreasing the chances of abandonment following conception (Boothroyd et al., 2011). Research on attractiveness seems to corroborate this idea too, with females generally rating physical attractiveness and masculinity as being of more importance for short-term relationships as opposed to long-term relationships (Li & Kenrick, 2006; Penton-Voak et al., 1999; Regan & Joshi, 2003) and women who score higher on the SOI tend to prefer more masculine faces (Provost, Kormos, Kosakoski & Quinsey, 2006). Thus people, and specifically women, may be self-selecting (either consciously or subconsciously) partners with high SOI for short-term encounters and partners with low SOI for long-term encounters. One could test this hypothesis using a similar paradigm to previous studies. For example, Provost, Kormos, Kosakoski, & Quinsey, (2006) used a forced-choice relative judgement questionnaire with a Likert scale to compare faces to one another so participants could indicate which face they would prefer to date, have a short-term relationship with and a long-term relationship with. Using this method with high and low SOI faces, as opposed to high and low masculinized faces as the previous study had, would allow this mixed mating strategy hypothesis to be tested empirically.

This is also consistent with parental investment theory (Trivers, 1972). Parental investment theory stipulates that the sex that invests the most will have more to lose by choosing poorly when mate-selecting and thus, will be choosier when selecting a sexual partner. Therefore, women’s reproductive interests should generally be skewed to males that are both genetically fit (e.g. males who have symmetric faces; Shackelford & Larsen, 1997) and who are more likely to invest in parenting once the child is born, which is more likely to be somebody with low SOI (Gangestad & Simpson, 2000; Trivers, 1972). Consequently, women are thought to have developed mechanisms which facilitate them in choosing mates that are willing to invest more time and resources (Cashdan, 1996). For example, women generally prefer men with relatively more resources and partners who are either successful or have the potential to become successful and therefore accrue more resources (Borgerhoff

Mulder, 2000; Buss, 1989). Thus, women having the ability to detect the SOI of men may be another evolutionary mechanism that assists them in choosing mates that are more likely to provide parental support and not pursue other sexual interests once the child is born. Whether more sociosexually unrestricted people and specifically males, are less likely to be present as parents could be answered through a longitudinal study that attempts to correlate divorce rates with previous self-reported SOI ratings before they met their romantic partner. This is necessary as SOI fluctuates as people age and based on whether they are or are not in relationship (Meskó, Láng & Kocsor, 2014; Penke & Asendorpf, 2008; Simpson & Gangestad, 1991).

Contrary to predictions, males were not able to correctly perceive the SOI of female faces. These initial predictions were made based on previous research and because evolutionarily, it seems plausible for men to have this ability (Boothroyd et al., 2011; Gangestad et al, 1992; Stillman & Maner, 2009). If men were to have the ability to detect females who were more open to short-term sexual encounters, this would facilitate them when attempting to find a partner for a short-term sexual encounter. Similarly, males would also benefit from being able to identify women with a more restricted sociosexuality when attempting to find a partner for a long-term relationship. This would have specific benefits when it came to raising children for men, just as it did for females. Reproductive success can be measured by the proliferation of genes into direct and indirect offspring and despite the advent of modern contraception, men still unknowingly raise children whom they are not genetically related to at rates of up to 30% in some samples, with a median of 3.7% across 17 studies (Hamilton, 1963; Bellis, Hughes, Hughes & Ashton, 2005). Incidences of paternal uncertainty would presumably increase in populations with more unrestricted women because of the positive relationship between SOI score and infidelity (Rodrigues, Lopes & Pereira, 2016). We thus predicted that men may have developed a mechanism to assist them in choosing less promiscuous women for long-term relationships. However, no support was found for this hypothesis in the current study. Future studies should seek to understand this effect in a diverse of range of samples, particularly considering instances of paternal uncertainty differ between cultures.

GMM Predicts Perceived SOI and the Self-Reported SOI of Men

Since perceived SOI, as rated from neutral expression, still photographs, were found to be accurate (at least in men), participants must be basing these perceptions on facial appearance. Our attempt to produce models predicting self-reported SOI and perceived SOI from facial shape were successful in men and somewhat successful in women. In men we were able to predict both self-reported SOI and perceived SOI using facial features, whilst in women we were unable to predict self-reported SOI and only marginally predicted perceived SOI using facial features.

These hypotheses were made based on the relationship between hormones, face shape and self-reported SOI score. Exposure to testosterone whilst developing in the uterus can be quantified through the measurement of one's 2D:4D (the ratio of one's second and fourth finger). Generally, males have a lower 2D:4D and similarly, individuals with more masculine 2D:4D ratios tend to provide more unrestricted SOI scores. This suggests that a division of brain areas involved with sociosexuality occurs very early in development due to in utero testosterone (Charles & Alexander, 2011; Clark, 2004). Particular facial features also seem to be influenced by early testosterone exposure. For example, low 2D:4D ratios are associated with relatively robust and prominent lower faces (Schaefer, Fink, Mitteroecker, Neave & Bookstein, 2005). Based on this information, it was predicted that through the use of GMM, a direct relationship would be observed between both self-reported SOI and facial morphology; and perceived SOI and facial morphology. This ontegenic hypothesis was supported in men and somewhat in women, and explanations regarding these results should be discussed within the context of the secondary hypothesis.

The secondary hypothesis of Study Two stipulated the self-reported SOI score of participants in study one would be significantly correlated with perceived SOI score made by the raters of these participants in study two. This hypothesis was partially supported, with perceived SOI score correlating significantly with self-reported SOI score in males but not females. However, unlike previous studies, the findings of the current study can be interpreted in relation to the morphological features of these participants, which indicated that there was a relationship between facial morphology and perceived SOI in men and marginally in women. This suggests that people and specifically women in the current study were using specific shape features of the face to make their SOI judgements.

Based on the specific PCs that were statistically significant in the model predicting male perceived SOI (PC1, PC2 and PC8), female raters appear to be using something associated with the size of men’s foreheads to make their judgements, or perhaps just the general length of their faces. This in line with a host of recent research. For example, research has indicated that individual differences in one’s facial width-to-height ratio (FWHR) is related to aggressive behaviour in men and that individual differences in this variable also predicted reactive aggression in men. This is an indication that facial morphology is linked to behaviour and thus makes it more likely that humans may have developed a mechanism to recognize people who are more likely to exhibit a certain behaviour via their facial morphology. Furthermore, FWHR has also been linked to SOI in previous research. Using a sample of 314 Canadian university students, Arnocky et al. (2017) found that FWHR predicted sociosexuality among men but not women. Whilst FWHR is measured in a way that excludes forehead length, the findings of Arnocky et al. (2017), along with the findings in the current study, provide evidence to suggest some sort of generalized face length, sociososexuality correlation is present and that female raters are sensitive to this effect. .

While we examined the contribution of shape to perceived SOI, people may have also been using other cues with associations to attractiveness (which is linked to perceived SOI score; Boothroyd et al., 2008), such as skin texture or skin colour, to make their SOI judgements (Fink & Thornhill, 2001; Pawlowski & Szymanczyk, 2008). Whilst the current study used GMM to analyse face shape in relation to SOI, future studies could employ a similar methodology to examine facial skin texture and colour in relation to SOI. Ideally, skin texture, skin colour and facial shape would be examined together in the same model to gain an understanding of how these morphological features are functioning and interacting together to form a person's perception of SOI in strangers. Facial expression may need to be more stringently controlled too. Although all participants were instructed to hold a neutral expression for their photograph it's possible that some expressed subtle expressions that were hard to detect using GMM.

Secondly, the hairstyle or hair colour of women (and men) may also have influenced SOI ratings. All women that were rated in this study had their hair behind their ears and were not covering any facial features. However, some had their hair in a bun (high or low), a ponytail, and those with relatively shorter hair, did not have their hair tied up at all. With the hair colour and hair style of women associated with how men behave around women (Gueguen, 2015) and how attractive they are rated (Swami, Furnham & Joshi, 2008), it seems plausible that these may also be influencing SOI perception. Future research should either control the hairstyle or hair colour of participants more stringently or add these elements as independent variables into their experimental design.

Limitations and Avenues for Future Research

Along with those mentioned above, it is also important to note some limitations associated with the collection of the SOI scores in Study One. Firstly, all participants were Caucasian and aged between 18 and 31. This ensures that any relationships found between shape and SOI are not confounded by nationality or age, however it also decreases the generalizability of the findings beyond this demographic group. Research suggests that sociosexual orientation varies dramatically between countries and this is at least partly attributable to the sex ratio of the environment (Schmitt, 2005).

Sex ratio theory stipulates that when an environment has more sexually and romantically eligible males than females, people should generally be more monogamous and therefore demonstrate a lower SOI. This is because in this environment, due to the intensified competition to find a prospective female, males must be more willing to fit with the desires of females which is generally for long-term monogamous relationships and vice versa for female-skewed ratios (Pedersen, 1991). In Schmitt's (2005) vast cross-cultural study, this theory was tested on a global scale and provided empirical evidence supporting this theory. Negative correlations between sex ratios and national SOI levels were statistically significant and countries with low sex ratios such as Estonia and Lithuania scored comparatively higher on SOI than countries with less women such as Hong Kong and Taiwan. Just as SOI fluctuates in relation to sex ratio, future research should test whether the effect size of SOI perception at zero acquaintance fluctuates in relation to the sex-ratio of different samples. In populations with more males than females (where SOI is more restricted), finding an unrestricted female before your competitors would be particularly valuable for short-term sexual encounters and thus the effect size may be larger in these samples for male raters. On the other hand, in populations with comparatively more females (where SOI is more unrestricted), finding a restricted female before your competitors would be particularly valuable for a long-term relationship and thus the effect size may be larger in these samples for male raters.

Furthermore, limited research has been carried out examining how self-reported SOI score and SOI perception changes with age. It would be useful to test how this effect functions when the age of the rated participants are added into the experimental design as variables. Previous studies have derived composite faces that have had their skin texture altered to make them look younger (Jones, Little, Burt & Perret, 2004). This resulted in participants rating these composites as 5.8 years younger than the actual age of the participant. Thus, future research could change the apparent age of faces and examine whether perceived SOI changes with it. If the accurate self-perception of SOI is an adaptive behaviour for both sexes (which still is not entirely clear), presumably it is only advantageous to be able to tell the SOI of people who are still able to reproduce. Thus, one would expect the correlation between self-reported SOI and perceived SOI to decrease as age increases.

Secondly, SOI scores were mainly collected with the presence of a male experimenter, however some were collected with a female researcher. Previous research suggests that the sex of the researcher may influence sociosexual orientation and sexual arousal in general. For example, previous studies testing SOI perception has specifically used opposite-sex researchers when testing SOI to evoke sociosexual behaviour (Gangestad, Simpson, DiGeronimo & Biek, 1992; Stillman & Maner, 2009); males have reported having more sexual partners in the presence of female researchers than male researchers (Fisher, 2006); and people exhibit heightened levels of physiological arousal as measured through facial temperature when there is an opposite-sex experimenter as opposed to one of the same-sex (Hahn, Whitehead, Albrecht, Lefevre, & Perrett, 2012). Thus, the presence of an opposite sex researcher for some participants may have caused changes in their SOI that was not attributable to any aspects of the study design. Where practical, future studies should ensure that the sex of the experimenter is kept constant through each phase of the study. Additionally, in Study One, participants were required to dress in tight shorts and singlets (for the photographs) and thus only people comfortable with doing this had their SOI score collected. These factors which were not controlled in the current study, may also have influenced the results. For example, a relationship seems to exist between clothing choice and sociosexuality in women and thus, women with a more unrestricted SOI may have been more likely to sign-up for the study (Durante, Li & Haselton, 2008). Finally, the SOI or SOI-R is generally considered to be the best measure of variation in human mating behaviour, however limitations associated with this tool are present (Jackson & Kirkpatrick, 2007). Firstly, SOI may be better split across multiple components because people's beliefs and behaviours often differ, thus their sociosexual attitudes and sociosexual behaviours should not be measured under the one factor (Bailey, Gaulin, Agyei, & Gladue, 1994). Secondly, research suggests people are able to implement both long and short-term and mating tactics depending on whether their local environment placed more weight on the investment potential of prospective mates or the indicators of their genetic fitness (Gangestad & Simpson, 2000). Thus, Jackson and Kirkpatrick (2007) proposed that the unidimensional method currently used was inadequate to measure the multidimensional nature of human sexual strategy. Lastly, Jackson and Kirkpatrick provided strong evidence that a revised, multidimensional version of the SOI is a valid way to test multiple, separate factors associated with human sexual strategy. Instead of a unidimensional score used by the SOI-R, their revised SOI included three factors: short-term mating orientation, long-term mating orientation and past sexual behaviour, all of which were shown to be independent and correlate appropriately with other relevant variables. Future research could consider the use of this measure to cross-validate SOI scores.

Conclusions

Human beings make both personality and behavioural assumptions of strangers based on their appearance and research has demonstrated that sometimes these perceptions are accurate. For example, people seem to be able to correctly perceive the sociosexuality of people that they are unacquainted with (Boothroyd et al., 2008; Gangestad, Simpson, DiGeronimo & Biek, 1992; Stillman & Maner, 2009). The present study aimed to find out *how* people were doing this and whether people were using valid cues to make their judgements. Using GMM, multiple regression models were created for each sex and both sexes together, with 9PCs as the independent variables and both SOI and perceived SOI as the dependent variables in different models. The results indicated that facial morphology was not related to SOI or perceived SOI in any of the models for females. For men however, the results indicated that facial morphology was related to both SOI and perceived SOI. Furthermore, when men's self-reported SOI scores were correlated with their perceived SOI scores predicted by the regression model, a statistically significant relationship was present. A significant relationship was also found between SOI and perceived SOI in both male faces and male facial composites. This suggests that female participants were able to correctly deduce the SOI of men and were correctly using facial morphology to do so. Future studies should elucidate how exactly people are making these ratings by accruing enough participants to add further variables such as skin texture, hair colour and hair style, and testing this across different ethnicities and ages.

Appendix A

Information and Consent Forms Study One

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Faculty of Human Sciences

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Participant ID: CF2017000

Chief Investigator's / Supervisor's Name: Dr Ian Stephen

Co-investigator's Names: Daniel Sturman, Joe Antar, Zoe Powell, Lewis Gould-Fensom, Fiona Lieu, Edwina Keen, Syed Jafar, Jena Cartwright, Peter Jonason, Eva Tzschaschel

Participant Information and Consent Form (phase 1)

Name of Project: Objective face and body cues to health

You are invited to participate in a study investigating the relationship between health and physical appearance. The purpose of the study is to examine how our health is reflected in our face and body.

This study is being conducted as part of a research programme led by Dr Ian Stephen (phone: 8950 8001, email: ian.stephen@mq.edu.au) of the Department of Psychology at Macquarie University.

If you decide to participate, measurements including your height and weight, waist circumference, chest circumference (males only), hip circumference (females only), body fat % and body muscle % will be recorded. Full length photographs will then be taken of you, wearing a pair of grey shorts and a grey singlet, in both 2D and 3D. You may be recognizable in your photographs. We will also use a harmless, painless and non-invasive device to measure your skin colour, and you will be asked to fill in a short questionnaire about your health behaviours.

The whole process should take approximately 60 minutes and for your participation you will receive 60 minutes of course credit. You will also be offered a copy of your 3D head image and a free app on which to view it.

What will happen to my data?

Your photographs will be used in HREC-approved studies related to the Visual Adaptation Model of Body Size Misperception Project by members of the body image and person perception research teams and their collaborators. This will include them being presented to participants who will be asked to make judgements of normality, health and attractiveness. If you consent, your images may also be used in future projects by members of the body image and person perception research teams and their collaborators.

Your data may be used in follow-up HREC-approved studies conducted by the members of the body image and person perception teams and their collaborators. However, it will not be possible to link your data to your name or contact details. No individual will be identified in any publication of the results.

Data and images will be kept on password-protected computers at all times (this will include the researchers' computers until October 2020). A summary of the results can be made available to you on request by emailing Ian Stephen.

Participation in this study is entirely voluntary: you are not obliged to participate and if you decide to participate, you are free to withdraw at any time without having to give a reason and without consequence. If you decide to withdraw from the study we will honour this request and delete your photograph and you will still receive your incentive.

I, *(participant's name*) have read *(or, where appropriate, have had read to me)* and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

○ I consent to my images being used in future HREC-approved studies by the members of the body image and person perception teams and their collaborators.

Participant's Name:____

(Block letters)

Participant's Signature: Date:____________________

Investigator's Name:____

(Block letters)

Investigator's Signature: Date:____________________

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics and Integrity (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

If you have been distressed by any part of this experiment, support is available from Campus Wellbeing, Level 2, Lincoln Building (C8A), Macquarie University (telephone 02 9850 7497).

(INVESTIGATOR'S [OR PARTICIPANT'S] COPY)

Appendix B

Information and Consent Forms Study Two

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Email: joseph.antar @students.mq.edu.au

Chief Investigator's / Supervisor's Name & Title: Dr Ian Stephen

Co-investigator's Name: Joseph Antar

Participant ID: CF2017016

Participant Information and Consent Form

Name of Project: Perceiving Sociosexuality: How is it done?

You are invited to participate in a study of sociosexuality and faces. The purpose of the study is to determine how face based ratings are associated with a model predicting people's sociosexuality. Socioexuality or sociosexual orientation is a behavioural variable indicating how willing somebody is to engage in sexual activity outside of a committed relationship.

The study is being conducted by Joseph Antar to meet the requirements of a Masters of Research under the supervision of Dr Ian Stephen (phone: 9850 8001), email: ian.stephen@mq.edu.au) of the Department of Psychology at Macquarie University.

If you decide to participate, you will be presented with a short survey asking demographical questions and questions relating to your sociosexuality. You will then be shown a number of images of people and asked to rate them on different criteria. The entire study should not take longer than 30 minutes. You will receive either 30 minutes of participation credit (for SONA participants) or $10 in remuneration.

Any information or personal details gathered in the course of the study are confidential, except as required by law. No individual will be identified in any publication of the results. Only the body image research team will have access to the data recorded, which will be kept on password-protected computers. A summary of the results of the data can be made available to you on request by emailing Joseph Antar.

Participation in this study is entirely voluntary: you are not obliged to participate and if you decide to participate, you are free to withdraw at any time without having to give a reason and without consequence. If you decide to withdraw from the study we will honour this request and delete your data and you will still receive course credit.

I, *(participant's name*) have read *(or, where appropriate, have had read to me)* and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Name:____

(Block letters)

Participant's Signature: ________________________ Date:___________________

Investigator's Name:____

(Block letters)

Investigator's Signature: ____________________ __ Date:___________________

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics & Integrity (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

If you have been distressed by any part of this experiment, support is available from Campus Wellbeing, Level 2, 16 Wally's Walk, Macquarie University (telephone 02 9850 7497). Other support services are also available and include Beyond Blue (telephone 1300 22 4636) and Lifeline (telephone 13 11 14).

(INVESTIGATOR'S [OR PARTICIPANT'S] COPY)

Appendix C

Analyses without PC3 (Study One)

Models predicting SOI. In males, a regression model predicting scores on the SOI based on the PC scores was calculated. A significant regression equation was found (Adjusted R^2 = .194, F (8,46) = 2.629, *p* = .018. In females, a similar model was created. This regression model, predicting scores on the SOI from the PC scores, was not significant (Adjusted R^2 = -.05, F (8,49) = .658, *p* = .725).

A regression model predicting scores on the SOI based on the PC scores was also calculated for both male and female data together. A significant regression equation was found (Adjusted R^2 = 0.176, F (8,104) = 3.986, *p* = <.005).

Appendix D

Subscale Analyses

Models Predicting Attitude

In males, a regression model predicting scores on the Attitude subscale based on the PC scores was calculated. A non-significant regression equation was found (Adjusted R^2 = .017, F (9, 45) = 1.105, p = .379). In females, a similar model was created. This regression model, predicting scores on the Attitude subscale from the PC scores, was also not significant (Adjusted R^2 = -.044, F (9, 48) = .731, p = .679).

A regression model predicting scores on the Attitude subscale based on the PC scores was also calculated for both male and female data together. A non-significant regression equation was found (Adjusted R^2 =.034, F (9, 103) = 1.012, p = .181).

Models Predicting Behaviour

In males, a regression model predicting scores on the Behaviour subscale based on the PC scores was calculated. A significant regression equation was found (Adjusted R^2 = .213, F (9, 45) = 2.624, p = .016). In females, a similar model was created. This regression model, predicting scores on the Behaviour subscale from the PC scores, was also not significant (Adjusted R^2 = -.022, F (9, 48) = .865, p = .562).

A regression model predicting scores on the Behaviour subscale based on the PC scores was also calculated for both male and female data together. A significant regression equation was found (Adjusted R^2 = .135, F (9, 103) = 1.676, p = .004).

Models Predicting Desire

In males, a regression model predicting scores on the Desire subscale based on the PC scores was calculated. A non-significant regression equation was found (Adjusted R^2 = .022, F (9, 45) = 1.135 *p* = .359). In females, a similar model was created. This regression model, predicting scores on the Desire subscale from the PC scores, was also not significant (Adjusted R^2 = -.061, F (9, 48) = .637 *p* =.76).

A regression model predicting scores on the Desire subscale based on the PC scores was also calculated for both male and female data together. A statistically significant regression equation was found (Adjusted R^2 = .055 F (9, 103) = 1.981, *p* =.049).

Appendix E

Paper Advertisement for the Study

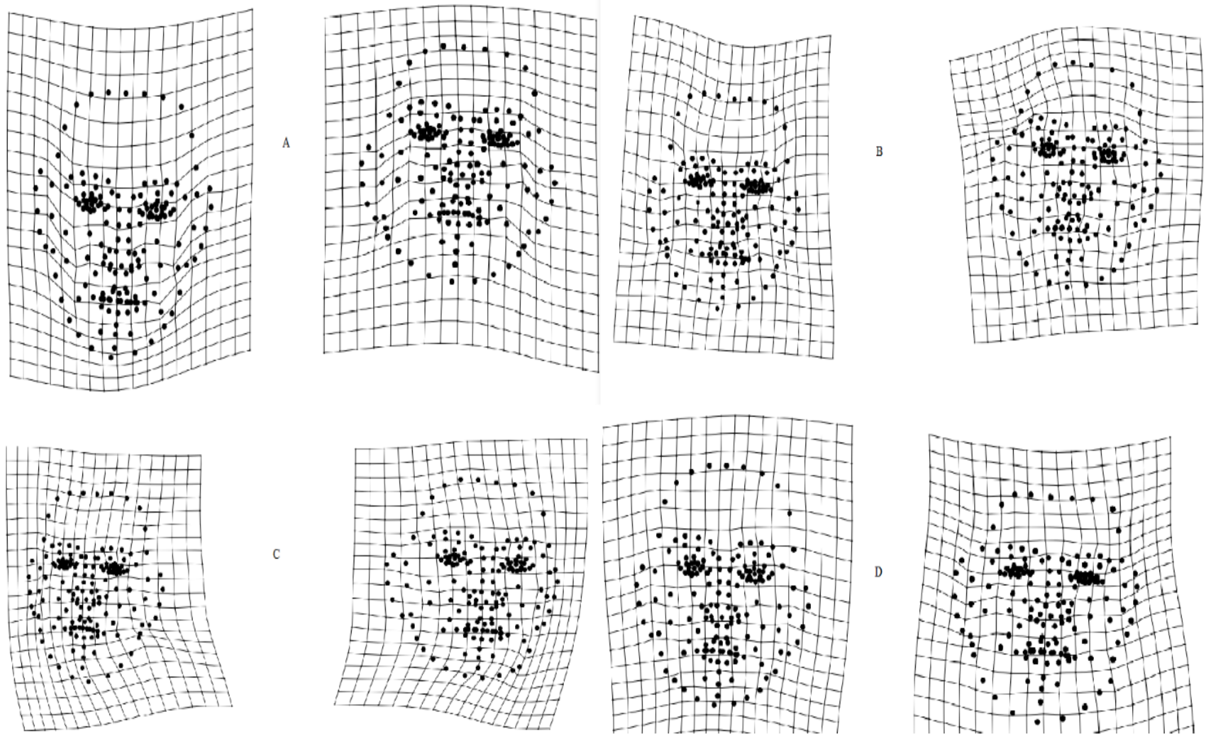
Appendix F

Analyses without PC3 (Study Two)

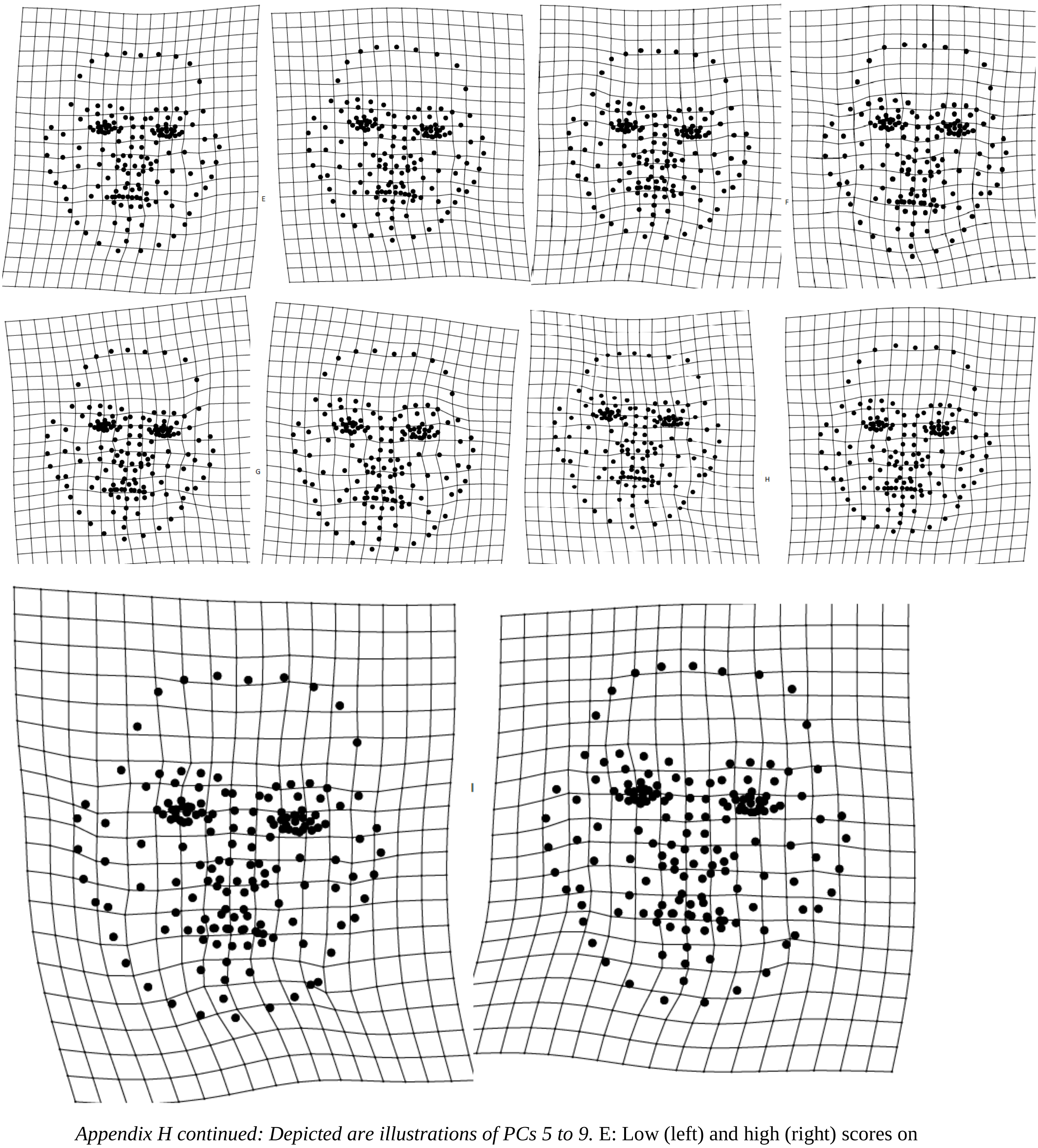
Models predicting Perceived SOI. In males, a regression model predicting Perceived SOI scores based on the PC scores was calculated. A significant regression equation was found (*Adjusted* R^2 =.182, F (8, 46) = 2.497, p = .024). In females, a similar model was created. This regression model, predicting Perceived SOI score from the PC scores, was statistically significant (*Adjusted* R^2= .146, F (8, 47) = 2.175, p = .047).

A regression model predicting Perceived SOI scores based on the PC scores was also calculated for both male and female data together. A significant regression equation was found (*Adjusted* R^2 = .403, F (8, 109) = 10.883, p = <.005).

Appendix G
Visualisations of all PCs



Appendix H: Depicted are illustrations of PCs 1 to 4. A: Low (left) and high (right) scores on PC1. This PC explained 27.1% of the variance in face shape. High scores on PC1 represent a more robust chin, wider face, smaller forehead, and lower eye brows, suggesting that this PC may represent an aspect of sexual dimorphism, with high values being more masculine and low values being more feminine. B: Low and high scores on the PC2. This PC explained 8.46% of the variance in face shape. High scores on PC2 represent a longer forehead and a wider nose bridge. C: Low (left) and high (right) scores on the PC3. This PC explained 7.34% of the variance in face shape. PC3 appears to be related to head tilt. D: Low (left) and high scores on PC4. This PC explained 5.88% of the variance in face shape. High scores on PC4 represent a smaller forehead length, smaller eyes and wider jaw width.



Appendix H continued: Depicted are illustrations of PCs 5 to 9. E: Low (left) and high (right) scores on PC5. This PC explained 3.92% of the variance in face shape. High scores on PC5 represent larger eyes. F: Low and high scores on the PC6. This PC explained 3.88% of the variance in face shape. High scores on PC6 represent a narrower and generally longer face. G: Low (left) and high (right) scores on the PC7. This PC explained 3.08% of the variance in face shape. Higher scores on PC7 represent higher eyebrows and larger eyes. H: Low (left) and high scores on PC8. This PC explained 2.83% of the variance in face shape. Higher scores on PC8 represent a longer forehead. I: Low (left) and high (right) scores on the PC9. This PC explained 2.62% of the variance in face shape.

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