

Eye Fixations Indicate Men's Preference for Female Breasts or Buttocks

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Received: 7 May 2010 / Revised: 15 December 2011 / Accepted: 30 December 2011 / Published online: 3 May 2012
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Abstract Evolutionary psychologists have been interested in male preferences for particular female traits that are thought to signal health and reproductive potential. While the majority of studies have focused on what makes specific body traits attractive—such as the waist-to-hip ratio, the body mass index, and breasts shape and size—there is little empirical research that has examined individual differences in male preferences for specific traits (e.g., favoring breasts over buttocks). The current study begins to fill this empirical gap. In the first experiment (Study 1), 184 male participants were asked to report their preference between breasts and buttocks on a continuous scale. We found that (1) the distribution of preference was bimodal, indicating that Argentinean males tended to define themselves as favoring breasts or buttocks but rarely thinking that these traits contributed equally to their choice and (2) the distribution was biased towards buttocks. In a second experiment (Study 2), 19 male participants were asked to rate pictures of female breasts and buttocks. This study was necessary to generate three categories of pictures with statistically different ratings (high, medium, and low). In a third experiment (Study 3), we recorded eye-movements of 25 male participants while they chose the more attractive between two women, only seeing their breasts and buttock. We found that the first and last fixations were systematically directed towards the self-reported preferred trait.

Keywords Breasts · Buttocks · Eye tracking · Sexual preference · Sexual choice

Introduction

Evolutionary psychologists have been interested in male preferences for particular female traits that are thought to signal health and reproductive potential (Buss, 2003; Grammer, Fink, Moller, & Thornhill, 2003; Jasienska, Ziomkiewicz, Ellison, Lipson, & Thune, 2004; Symons, 1979; Zaadstra et al., 1993). Most of this work focuses on traits in isolation, such as the waist-to-hip ratio (WHR), the body mass index (BMI) (Singh, 1993a, 1993b; Tovee, Maisey, Emery, & Cornelissen, 1999), and breast shape and size (Furnham & Swami, 2007; Furnham, Swami, & Shah, 2006).

Markers of preference can be obtained from questionnaires and also from direct behavioral measures, such as eye movements, which provide additional information of the temporal course of attention to different traits (Dixson, Grimshaw, Linklater, & Dixson, 2010). For example, men look more often at faces they judge to be more attractive (Fink et al., 2008; Shimojo, Simion, Shimojo, & Scheier, 2003) and direct the first fixation to the breasts or the waist more often than the face or the lower body of a front-posed woman (Dixson, Grimshaw, Linklater, & Dixson, 2009).

While the majority of studies have focused on what makes a specific body trait attractive, there is little empirical research that has examined individual differences in male preferences (e.g., favoring breasts over buttocks). The current study begins to fill this empirical gap. We used self-report and eye-movements to examine whether there were individual differences among Argentinean males in their preference for buttocks versus breasts and assessed whether self-reported preferences correlated with non-verbal behavioral markers.

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Study 1

Method

Participants

A total of 184 men participated in the first study. All men were self-reported heterosexual and none of them had participated in any previous study on female attractiveness judgment.

Procedure and Measures

Participants were asked to judge the relative contributions of breasts and buttocks in their female attractiveness judgments. They were asked to click on the leftmost point of a bar if they considered that, between these two traits, they solely relied on buttocks to determine whether a woman was attractive and on the rightmost point if they considered that they relied solely on breasts. Participants were asked to click in the center if they thought that breasts and buttocks equally contributed to their determination of a woman's attractiveness and in intermediate positions between these extremes to indicate the relative contributions of breasts and buttocks in their female attractiveness judgments. We refer to this measure as subjective preference report (SPR). The range of possible values of SPR was $[-1, 1]$ (Fig. 1a). A SPR of 1 indicates that the participant self-report of preference was completely biased towards breasts and a SPR of -1 towards buttocks.

Results

Reports of Preferences Between Breasts or Buttocks

We first investigated the distribution of the relative contribution of breasts and buttocks in determining female attractiveness as measured by the SPR. The distribution of SPR (Fig. 1a) was clearly bimodal. Of 184 participants, 109 reported a preference for buttocks and 71 a preference for breasts. The probability that this asymmetry resulted from chance, estimated from a two-tailed test of the binomial distribution was $p < .01$. Only four participants responded with an SPR of 0, indicating that they estimated that breasts and buttocks had equal weights in their determination of female attractiveness. We then defined the preference intensity (PI) as the absolute value of SPR and investigated whether this measure was different for men preferring breasts and buttocks (Fig. 1b). The distribution of PI indicates that, at higher levels of preference, men preferring buttocks report a more marked preference (9 participants had a buttocks preference with a $PI > 0.8$ and, in sharp contrast, only 1 participant had a breast preference with a $PI > 0.8$). The mean of PI (MPI) confirmed this observation (Fig. 1c). For participants

with a breast preference, $MPI = (0.45 \pm 0.21)$ while for participants with a buttocks preference, $MPI = (0.53 \pm 0.26)$. This effect was significant, $t(181) = 2.22$, $p < .05$.

Study 2

Method

Participants

The participants in Study 2 were male undergraduate and graduate students ($N = 19$, M age, 25.7 years, SD 4.2). None of the participants from Study 1 were included in Study 2. All participants were self-reported heterosexual and none of them had participated in any previous study on female attractiveness judgment.

Procedure

A total of 180 publicly available color photographs were downloaded from different sites on the Internet. Images showing standing women in underwear were downloaded from different websites, including sites with erotic and pornographic pictures (<http://supertangas.com/>). Ninety images corresponded to the breasts of a standing woman seen from the front in underwear (breast images). The downloaded photographs were cropped to the minimal square window in which the breasts were visible. The nipples were not visible in any of the images used in this study. None of the pictures contained any portion of the face (the chin) or the belly button. Ninety images corresponded to a standing woman seen from behind in underwear (buttocks images). Images were cropped to the minimal square window in which the buttocks were fully visible, including the lower back and the upper portion of the legs. Figure 1a shows schematic drawings, but real pictures were used in this study.

Pictures were used only if, after cropping to the relevant portion containing the breasts or the buttocks, the resolution was larger than 250×250 pixels. All images were downsampled to 250×250 pixels using the bicubic spline interpolation of Matlab (see <http://www.cs.ait.ac.th/~mdailey/matlab/> for a tutorial and code for image downsampling using Matlab).

The images were embedded as a patch in the center of a 1024×768 image of uniform gray background. (i.e., the pictures covered about one-third of the vertical extension and about one-fourth of the horizontal extension of the screen). Images were presented in the center of the screen of a 19-inch ViewSonic CRT screen. The screen resolution was always 1024×768 pixels. The viewing distance was always 57 cm. Patches containing the breasts or the buttocks had an overall size of $15(H) \times 15(V)$ degrees of visual angle.

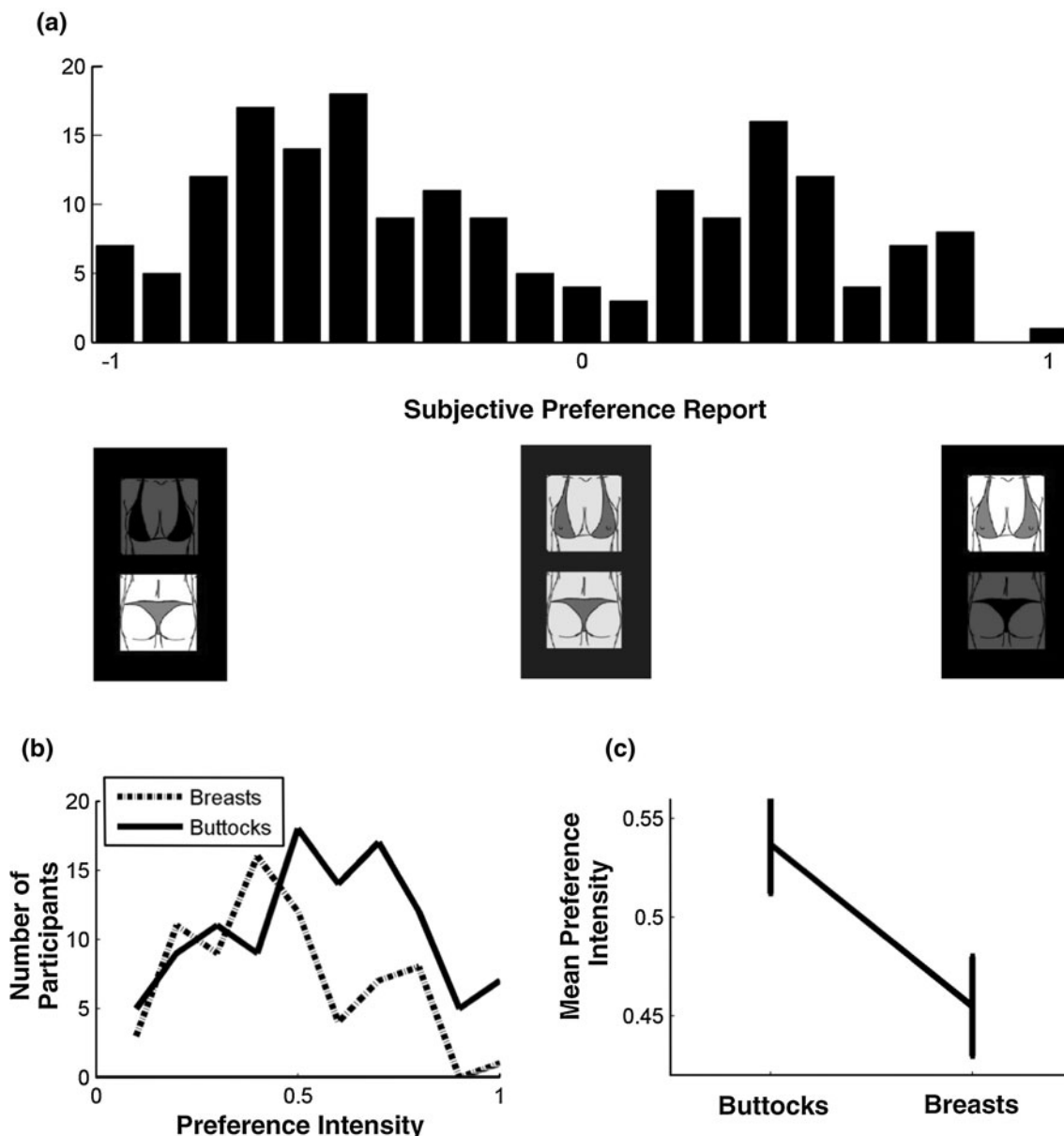


Fig. 1 Biases in the relative contribution of breasts and buttocks derived from self-reports of preference: **a** Histogram of participants' SPR shows a clear bimodal distribution. The brightness of the breast and buttock images simply sketches the contribution of each trait at different SPRs. **b** Histogram of PI for participants with a preference biased towards buttocks (SPR < 0)

Measures

Participants were asked to rate breasts and buttocks images in separate blocks of trials. The order of blocks was varied randomly across participants. Within each block, the order of presentation of the images also varied randomly. Before starting the study, participants were shown 15 images (chosen randomly and independently for each participant from the 90 images), each one for a period of 2.4 s, in order to provide an idea of the dispersion in the pool of images. During the study, participants

and breasts (SPR > 0). At higher levels the distribution for buttocks is shifted towards higher values than the distribution for breasts. **c** Difference in the mean value of PI for participants with a preference biased towards breasts and buttocks

could respond with no time pressure. Participants were asked to rate the attractiveness of the breasts or buttocks on a continuous scale from 0 to 10, by freely moving the mouse on a horizontal line with 20 vertical tick-marks for reference.

Results

The mean and SE of response times were 4.8 ± 2.2 s. We grouped the images of our database in three categories (low, medium, and high rated images) using a 33% percentile split of the average

attractiveness distribution. This was done independently for the breasts and buttocks images. Naturally, there was variability in participants' judgment of attractiveness. To assure that, despite this variability, the distributions of attractiveness of the three categories were significantly different, we submitted the ratings of attractiveness to an ANOVA with category (low, medium, and high) and image type (breasts or buttocks) as main factors. This analysis showed a significant effect of category, $F(2, 3306) = 8.23, p < .01$. The breasts–buttocks factor, $F(1, 3306) < 1$, and the interaction, $F(36, 3306) = 1.05$, were not significant. The mean and SE for each category were: “breasts high” (7.48 ± 0.08), “breasts medium” (6.65 ± 0.04), “breasts low” (5.37 ± 0.13), “buttocks high” (7.43 ± 0.10), “buttocks medium” (6.24 ± 0.05), “buttocks low” (5.07 ± 0.10).

Study 3

Method

Participants

A third set of 25 male participants (M age 25.6 years, SD 2.9 years) took part in Study 3. None of these participants had been included in the previous experiments or any previous study on female attractiveness judgment. All participants were self-reported heterosexual.

Procedure

Participants performed a total of 40 trials. In each trial, participants saw breast images in the top-left and top-right quadrants and buttock images in the lower-left and the lower-right quadrants of the visual field. The images used in Study 3 were the same as the ones used in Study 2. Participants were asked to indicate whether they judged that a woman whose buttocks and breasts were those presented on the left was more or less attractive than a woman whose buttocks and breasts were those presented on the right (see Fig. 2). Participants indicated their preference clicking the left (right) button of the mouse if they thought that the woman in the left (right) was more attractive.

After completing all trials, participants were asked to judge the relative contributions of breasts and buttocks in their female attractiveness judgments. The way in which we asked participants to report their preference was exactly the same as in Study 1.

Symmetrical and Asymmetrical Trials Study 3 was designed in a factorial manner. On asymmetrical trials participants had to choose between a woman with high-rated breasts and low-rated buttocks and a woman with low-rated breasts and high-rated buttocks (ratings and categories were derived from Study 2). On symmetrical trials, participants chose between women with breasts and buttocks in the same category. Symmetrical trials were included only for gaze data analysis.

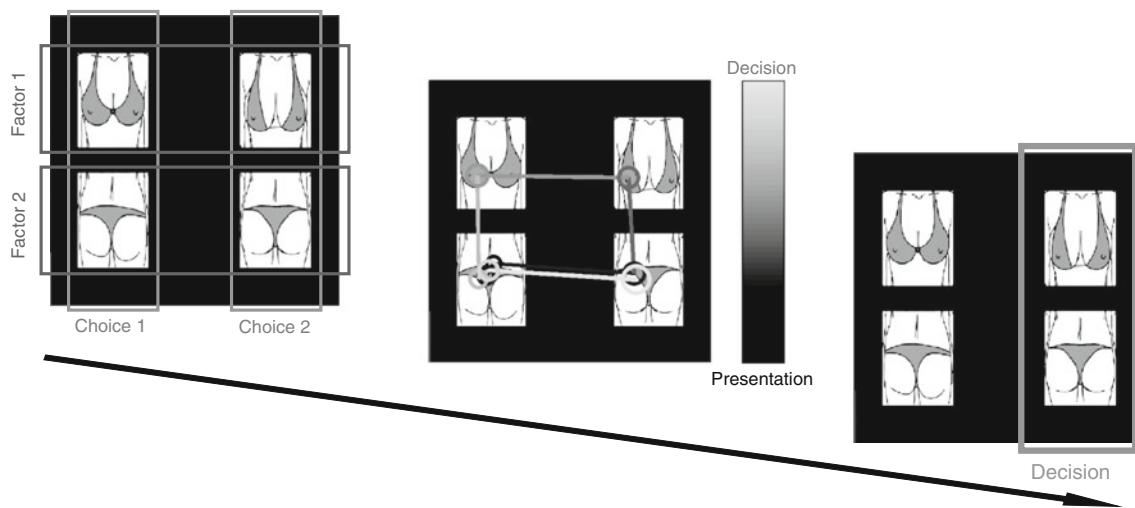


Fig. 2 Sketch of the experimental design of Study 3, aimed to investigate relative weights of gaze towards breasts and buttocks and their contribution to female choice. In each trial participants saw breasts images in the *top-left* and *top-right* quadrants and buttocks images in the *lower-left* and the *lower-right* quadrants of the visual field. Participants were asked to indicate whether they judged that a woman whose buttocks and breasts were those presented in the *left* was more or less attractive than a woman whose buttocks and breasts were those presented on the *right*. Eye

movements were recorded during the course of the trial. The *central panel* of the figure illustrates the sequence of fixations of a typical trial overlaid on top of the stimulus screen. Each fixation is *color-coded* to illustrate the temporal sequence in which these fixations occurred. The *color bar* indicates, for this specific trial, the time from the presentation of the stimuli (*dark gray*) until the moment of decision-making (*light gray*). Participants indicated their choice clicking with the mouse button to indicate if they preferred the woman on the left or on the right

Behavioral Analysis For each asymmetrical trial, we assigned a value of 1 when participants chose the high-rated breasts woman and -1 when they chose the high-rated buttocks woman. We then averaged this value across trials to obtain, for each participant, the factor determining choice (FDC). A FDC of 1 (-1) signifies that a participant always chose the option with a high-rated breasts (buttocks) image. A FDC of 0 signified that the participant chose the high-rated breasts woman and the high-rated buttocks woman with equal probability.

Eye Tracking

Movements of the observers' left eye were recorded with a video-based eye tracker (SR Research EyeLink 2K, <http://www.sr-research.com/>) at a sample rate of 1,000 samples/s. All eye movements were labeled as fixations, saccades, and blinks according to the default parameters of the eye tracker's software.¹ The thresholds for saccade detection were 0.15° for motion, $30^\circ/s$ for velocity and $9500^\circ/s^2$ for acceleration.

Gaze Data Analysis To quantify whether participants gaze was directed towards breasts or buttocks we assigned, to each fixation, a value of 1 if it was directed towards breasts and -1 if it was directed towards buttocks. Fixations directed outside of the image were excluded from the average. We refer to this number as the preference value of a fixation. We were interested in quantifying gaze direction throughout the course of the trial. Thus, we indexed all fixations locked to the onset of the trial (for example F_1 corresponds to the first fixation of the trial). We then averaged for each index i (with $1 \leq i \leq 9$), and for each participant, the preference value of the corresponding fixations across all trials. We refer to this measure as fraction of gaze to factor, FGF_i . If for a given participant, FGF_i was close to 1, it indicates that the fixation i after the beginning of the trial was typically directed to breasts. Since fixation times were not very variable, an analysis based on time (after the onset of the trial and before the response respectively) instead of number of fixations yielded virtually identical results.

Results

Correlations Between Explicit Preferences for Breasts or Buttocks and the Factor Determining Choice

For all asymmetrical trials (high-rated breasts and low-rated buttocks versus low-rated breasts and high-rated buttocks), we

measured the FDC, which has a value of 1 for participants who always chose the woman with the higher rated breasts, a value of -1 when the woman with the higher rated buttocks was chosen in all trials and a value of 0 when choices were made evenly. The average FDC across all participants and SE were -0.196 ± 0.064 . In agreement with participants preference reports, the distribution of FDC was significantly biased towards buttocks choice, $t(24) = -3.03$, $p = .0058$. Although the correspondence between the two measures was not exact, there was a significant correlation between FDC and SPR. A linear correlation analysis revealed that these two measures were correlated by a slope significantly different than zero ($FDC = B * SPR + A$; $B = (0.42 \pm 0.11)$, $p < .05$; $A = (-0.14 \pm 0.05)$, $p < .05$) (Fig. 3a).

Correlations Between Explicit Preferences for Breasts or Buttocks and the Temporal Course of Gaze

We investigated the sequence of eye movements from the onset of the trial to the moment of choice. Previous studies had shown that the last fixations before choice are indicative of preference (Fink et al., 2008; Shimojo et al., 2003). We reasoned that this could be extended to analyze the contribution of different factors. We hypothesized that if a participant has a marked preference for breasts, the last fixations would be directed towards the upper quadrants, with the decision based on the breasts of both women. Conversely, if a participant had a marked preference for buttocks, last fixations should be directed to the lower quadrants. In addition, since in our study the location of breasts and buttocks was constant throughout the, we expected that the first fixation of the trial might also be indicative of preference for breasts or buttocks.

Figure 3b, c illustrate the course of gaze during the decision for all trials in the study for representative participants with high and low SPR, respectively. The total number of fixations varied widely in different trials but they suggest a consistent pattern: the locations of the first and last fixations of each trial were highly indicative of their individual subjective reports while intermediate fixations seemed less correlated with their preference.

This is only an illustration of a single (but representative) participant. To quantify this observation, we calculated for each fixation i (with $1 \leq i \leq 9$) the likelihood of a given participant to observe a breasts image (FGF_i). For each value of i , we then measured the linear correlation across all participants between FGF_i and SPR (Fig. 3d). For each index, a high correlation indicates that, across participants, those reporting a preference for breasts (buttocks) also tended to look to breasts (buttocks). A correlation close to zero indicates that there was no relation between reported preference and gaze direction. We observed that FGF_1 and SPR were highly correlated (Fig. 3d-i), ($\rho = 0.71$, $p < .001$). In addition, the y -intercept of this regression ($FGF_1 = B * SPR + A$; $B = (0.74 \pm 0.15)$, $p < .001$; $A = (0.55 \pm 0.07)$, $p < .001$) was positive, indicating that participants by default looked at the upper-portion of the screen. This reflects an initial location bias

¹ We collected only left eye because all subjects had normal vision, with no reported amblyopia or dysfunction of convergence which could make eye measurements from both eyes significantly different. Moreover, we only use eye-movements to know which image is being viewed (and not the precise pixel being looked at). Hence, discrepancies of a few pixels do not change the results. As a control, we recorded eye-movements binocularly from 11 (out of 25) participants and the results were identical.

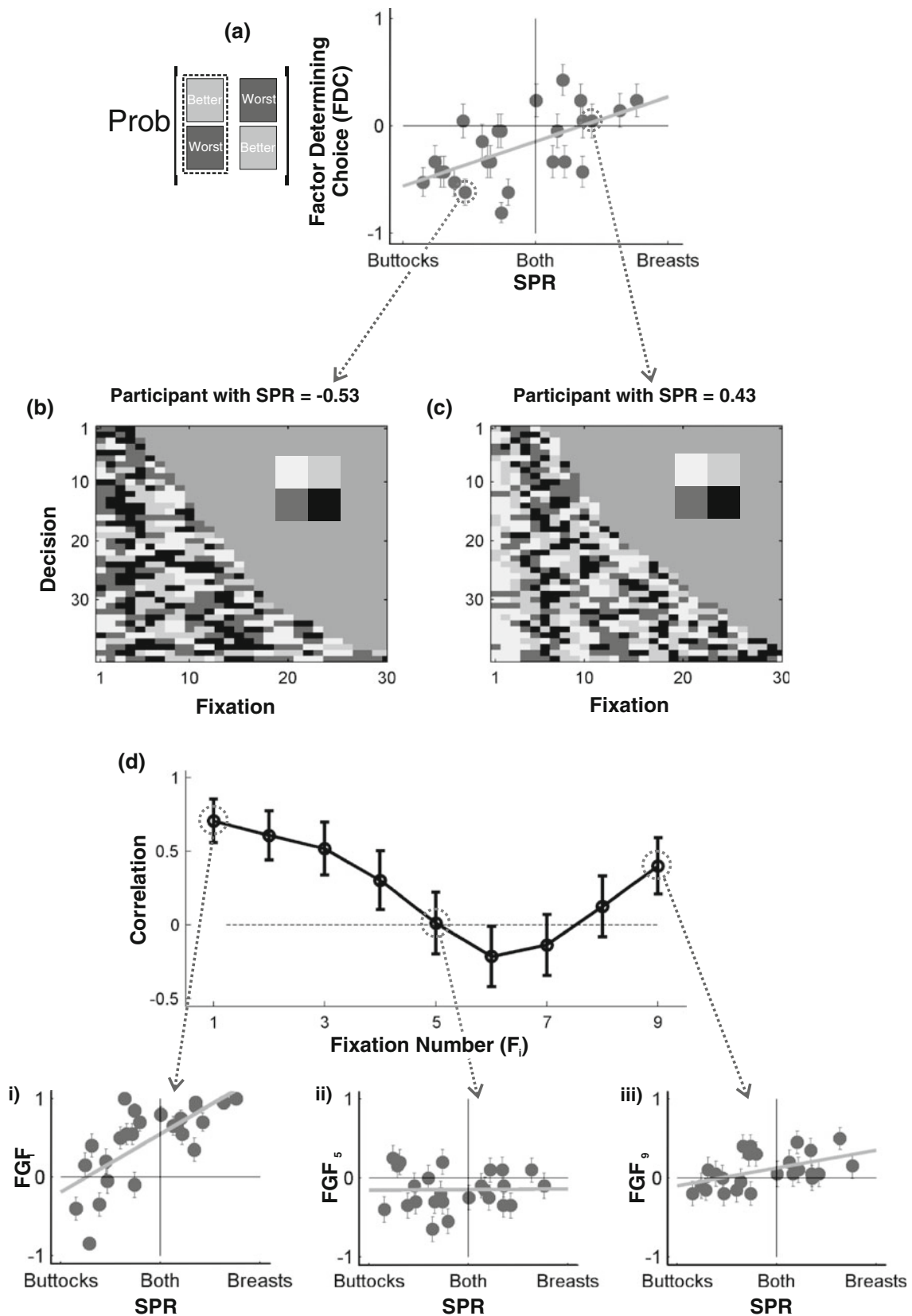


Fig. 3 Relation between self-reports of preference, gaze and the FDC. **a** Linear correlation between the FDC and SPR. While there was not a strict one to one correspondence these two measures were significantly correlated. **b, c** Raster plots showing qualitatively the dynamics of gaze fixations for a participant with marked buttocks (**b**) and breasts (**c**) preferences. Each row corresponds to a trial and each column to a fixation, indexed from the beginning of the trial. The *color code* (gray scale intensity) indicates which quadrant was observed at each fixation. **d** Correlation between FGF_i and SPR. For some values of i (i.e., for some fixations indices) the explicit correlations with the values for each individual participant of FGF_i and SPR are shown in a scatter plot. Correlation values close to 1 indicate a very tight correspondence between both measures. Correlation values close to zero indicate no relation between these two measures

(in our studies, breasts were always in the upper quadrants and buttocks in the lower quadrants) which was nevertheless modulated, as revealed by the linear correlation, by self-reports of preference.

This correlation decreased throughout the course of the trial (e.g., $FGF_5 = B * SPR + A$; $B = (0.01 \pm 0.11)$; $A = (-0.15 \pm 0.05)$, $p < .01$; $\rho = 0.01$, see Fig. 3d-ii) and became again positive during the last fixations (e.g., $FGF_9 = B * SPR + A$; $B = (0.20 \pm 0.09)$, $p < .05$; $A = (0.10 \pm 0.04)$, $p < .05$; $\rho = 0.40$, $p < .05$, see Fig. 3d-iii). We emphasize that in our study participants do not choose between breasts or buttocks images, but rather between pairs containing both factors. Thus, gaze to breasts or buttocks images is not indicative of choice or motor response, but rather of a bias in which of the two factors had a greater influence determining choice.

Discussion

While there are numerous investigations focused on what makes a specific body trait attractive, understanding how these traits combine on a global judgment of attractiveness remains largely unexplored. The main objective of this study was to fill this empirical gap. Specifically, we asked a narrow and concrete question: Do Argentinean males rely more on breasts or buttocks when deciding if a woman is attractive?

Our results showed that: (1) When Argentinean males were asked whether they rely more on breasts, on buttocks, or equally among them, when judging attractiveness, responses showed a bimodal distribution with a significant tendency towards buttocks. (2) Participants who responded with a preference for buttocks responded, on average, with a more marked preference than participants who reported a preference for breasts. (3) When choosing between highly rated-breasts and low rated-buttocks and low rated breasts and high rated buttocks women, participants tended to rely on the factor that they reported as preferred. The correlation between this objective measure of choice and a report of confidence was not perfect but was significant, showing that non-verbal reports are informative of male preferences for specific traits. (4) The dynamics of gaze also correlated with individual preference. The first fixations of a trial tended to be directed

to a participant's preferred trait. Intermediate fixations were directed homogeneously to breasts and buttocks, regardless of preference. The last fixations of a trial, close to the moment of choice, are redirect to a participant's preferred trait.

Implications for Human Decision Making

First, at a purely methodological level, our results showed that analysis of eye-movements to determine preference (Fink et al., 2008; Shimojo et al., 2003) can be extended to disentangle contributions of individual factors in complex choices. Second, our results argue that metacognition (the ability of a person to know which elements govern their choices) for this specific aspect of decision making is relatively accurate. This observation is not self-evident, since considerable research has shown marked dissociations between one's meta-understanding of one's own preferences and the preferences themselves (Ariely & Wertenbroch, 2002). Such dissociations include sexual behavior and choice in different states of arousal (Ariely & Loewenstein, 2006). Our results showed that subjects' awareness of their preferences regarding the relative contribution of breasts and buttocks in female choice were consistent with behavioral and gaze makers of preference.

Third, our results have implications in complex decision making involving many simultaneous factors. A broad literature has examined the following question: When we face a complex important decision, how should we deal with it in order for the outcome to be highly rewarding or for it to maximize happiness and to minimize negative emotions such as regret (Dijksterhuis, Bos, Nordgren, & Van Baaren, 2006)? Dijksterhuis et al. have shown that in decisions involving many parameters, conscious deliberation of choice may not optimize happiness, while unconscious choices (hunches) may be more efficient. Part of the rationale for this argument is the impossibility of the cognitive system to consciously weigh all the factors due to its limited capacity. Our results showed that different factors are segregated in time, allocating the initial and last moments of the decision according to the specific preferences.

Sociological, Cultural, and Individual Variability in Sexual Preference for Breasts or Buttocks

The selection of a sexual partner involves a complex comparison among possible choices. The result of this selection, as happens with other social judgments, is highly dependent on previous knowledge retrieved during the comparison process (Mussweiler, 2003). At the same time, this previous knowledge depends strongly on each particular culture, leading to different sexual preferences based on sociological, geographical, and temporal determinants. For instance, the optimal WHR has been shown to be 0.7 for some industrialized societies (Dixson, Dixson, Li, & Anderson, 2007; Henss, 2000) while it is higher for less industrialized cultures (e.g., 0.9 among the Matsigenka

of Peru; 0.8 in Bakossiland in Cameroon (Dixson, Dixon, Morgan, & Anderson, 2007)). There is also evidence showing that men from the same culture may prefer different features of a trait depending on their civil status. A study by Dixon et al. (2010) reported that married men in New Zealand preferred larger breasts than unmarried when asked to rate the attractiveness of pictures of breasts. In the same line, a study conducted in the United Kingdom (Furnham & Swami, 2007) showed that breast but not buttock size played an important role in attractiveness judgments made by British undergraduate students.

These observations raise questions which can only be responded in future studies. What is the origin of the bias towards buttock preference in Argentinean males? Would this tendency persist in a cross-cultural study? While the methodology of the studies discussed above is not directly comparable, they suggest that there may be significant variability in the relative contributions of breasts and buttocks in different cultural settings.

Moreover, trends in the elements which make a female attractive can change, as revealed by studies measuring Playboy Playmates (Pettijohn & Jungeberg, 2004), Miss America contest winners (Wiseman, Gray, Mosimann, & Ahrens, 1992), and models in popular women's magazines (e.g., Vogue, Ladies Home Journal) and advertisements across time (Garner, Garfinkel, Schwartz, & Thompson, 1980; Owen & Laurel-Seller, 2000; Voracek & Fisher, 2002). Consistent trends have been found and related to popular culture and dieting or clothing fads. In Argentina, one of the most popular men magazines (Revista Hombre, <http://www.revista-hombre.com.ar>) has progressively shifted its covers to images of buttocks (66% of its 18 publications in 2009 were buttocks images). This individual measure by itself does not resolve the fundamental issue of causality, which remains for further investigation. However, it remains possible that popular women's magazines and commercials do not simply reflect current notions of attractiveness; they also contribute to shape them.

We emphasize that the choice of our study by no means implies that these two traits are the most relevant or especially distinctive female traits. We simply sought to determine whether they contribute differentially to male choice because we identified that this was—in Argentina—a matter of folkloric debate which had not been the subject of rigorous investigation. Indeed, the relevance of the shape of breasts and buttocks in modern culture is evident by the number of cosmetic surgical procedures, more than 1,500,000 in 2008 in the United States. The most popular procedure is breasts augmentation, with more than 300,000 procedures in 2008. This corresponds to an increase of 46% in the last decade and more than a billion dollars of expenditure (American Society of Plastic Surgeons, <http://plasticsurgery.org/>). Our study thus addresses in a quantitative and formal manner a question of natural science, with broad economical and health relevance, which has been mostly left to folklore and anecdote.

Acknowledgments Bruno Dagnino and Joaquin Navajas contributed equally to this work.

References

- Ariely, D., & Loewenstein, G. (2006). The heat of the moment: The effect of sexual arousal on sexual decision making. *Journal of Behavioral Decision Making*, *19*, 87–98.
- Ariely, D., & Wertenbroch, K. (2002). Procrastination, deadlines, and performance: Self-control by precommitment. *Psychological Science*, *13*, 219–224.
- Buss, D. M. (2003). *The evolution of desire* (rev. ed.). New York: Basic Books.
- Dijksterhuis, A., Bos, M. W., Nordgren, L. F., & Van Baaren, R. B. (2006). On making the right choice: The deliberation-without-attention effect. *Science*, *311*, 1005–1007.
- Dixson, B. J., Dixon, A. F., Li, B., & Anderson, M. J. (2007a). Studies of human physique and sexual attractiveness: Sexual preferences of men and women in China. *American Journal of Human Biology*, *19*, 88–95.
- Dixson, B. J., Dixon, A. F., Morgan, B., & Anderson, M. J. (2007b). Human physique and sexual attractiveness: Sexual preferences of men and women in Bakossiland, Cameroon. *Archives of Sexual Behavior*, *36*, 369–375.
- Dixson, B. J., Grimshaw, G. M., Linklater, W. L., & Dixon, A. F. (2009). Eye-tracking of men's preferences for waist-to-hip ratio and breast size of women. *Archives of Sexual Behavior*, *40*, 43–50.
- Dixson, B. J., Grimshaw, G. M., Linklater, W. L., & Dixon, A. F. (2010). Eye tracking of men's preferences for female breast size and areola pigmentation. *Archives of Sexual Behavior*, *40*, 51–58.
- Fink, B., Matts, P. J., Klingenberg, H., Kuntze, S., Weege, B., & Grammer, K. (2008). Visual attention to variation in female facial skin color distribution. *Journal of Cosmetic Dermatology*, *7*, 155–161.
- Furnham, A., & Swami, V. (2007). Perception of female buttocks and breast size in profile. *Social Behavior and Personality*, *35*, 1–8.
- Furnham, A., Swami, V., & Shah, K. (2006). Body weight, waist-to-hip ratio and breast size correlates of ratings of attractiveness and health. *Personality and Individual Differences*, *41*, 443–454.
- Garner, D. M., Garfinkel, P. E., Schwartz, D., & Thompson, M. (1980). Cultural expectations of thinness in women. *Psychological Reports*, *47*, 483–491.
- Grammer, K., Fink, B., Moller, A. P., & Thornhill, R. (2003). Darwinian aesthetics: Sexual selection and the biology of beauty. *Biological Reviews*, *78*, 385–407.
- Henss, R. (2000). Waist-to-hip ratio and female attractiveness: Evidence from photographic stimuli and methodological considerations. *Personality and Individual Differences*, *28*, 501–513.
- Jasienska, G., Ziolkiewicz, A., Ellison, P. T., Lipson, S. F., & Thune, I. (2004). Large breasts and narrow waists indicate high reproductive potential in women. *Proceedings of the Royal Society B: Biological Sciences*, *271*, 1213–1217.
- Mussweiler, T. (2003). Comparison processes in social judgment: Mechanisms and consequences. *Psychological Review*, *110*, 472–488.
- Owen, P. R., & Laurel-Seller, E. (2000). Weight and shape ideals: Thin is dangerously in. *Journal of Applied Social Psychology*, *30*, 979–990.
- Pettijohn, T. F., & Jungeberg, B. J. (2004). Playboy playmate curves: Changes in facial and body feature preferences across social and economic conditions. *Personality and Social Psychology Bulletin*, *30*, 1186–1197.
- Shimojo, S., Simion, C., Shimojo, E., & Scheier, C. (2003). Gaze bias both reflects and influences preference. *Nature Neuroscience*, *6*, 1317–1322.

- Singh, D. (1993a). Adaptive significance of female physical attractiveness: Role of waist-to-hip ratio. *Journal of Personality and Social Psychology*, *65*, 293–307.
- Singh, D. (1993b). Body shape and women's attractiveness. *Human Nature*, *4*, 297–321.
- Symons, D. (1979). *The evolution of human sexuality*. New York: Oxford University Press.
- Tovee, M. J., Maisey, D. S., Emery, J. L., & Cornelissen, P. L. (1999). Visual cues to female physical attractiveness. *Proceedings of the Royal Society of London Series B: Biological Sciences*, *266*, 211–218.
- Voracek, M., & Fisher, M. L. (2002). Shapely centrefolds? Temporal change in body measures: Trend analysis. *British Medical Journal*, *325*, 1447–1448.
- Wiseman, C. V., Gray, J. J., Mosimann, J. E., & Ahrens, A. H. (1992). Cultural expectations of thinness in women: An update. *International Journal of Eating Disorders*, *11*, 85–89.
- Zaadstra, B. M., Seidell, J. C., Van Noord, P. A., te Velde, E. R., Habbema, J. D., Vrieswijk, B., et al. (1993). Fat and female fecundity: Prospective study of effect of body fat distribution on conception rates. *British Medical Journal*, *306*, 484–487.