The Journal of Social Psychology, 2008, *148*(6), 765–773

Beauty Is Mostly in the Eye of the Beholder: Olfactory Versus Visual Cues of Attractiveness

JOSHUA D. FOSTER
University of South Alabama

ABSTRACT. Olfaction is an important determinant of attractiveness, possibly even more so than vision when judgments are made by women. However, research that directly compares these cues using actual stimuli (e.g., t-shirt odors) is lacking. In this study, 44 women rated the attractiveness of t-shirt odors and facial photographs of 21 men either independently (i.e., first rated t-shirts, then rated photographs) or together (i.e., made overall ratings on the basis of t-shirts and photographs presented simultaneously). Photograph ratings were far more predictive of overall attractiveness than were t-shirt ratings. This was true for female participants who were fertile or infertile (i.e., using hormonal birth control). Body odor only predicted overall attractiveness when fertile women made the ratings.

Keywords: attraction, evolution, fertility, olfaction, vision

RESEARCH ON HOW BODY ODORS CONTRIBUTE to attractiveness judgments has resulted in several important findings. In a now-classic study, Thornhill and Gangestad (1999; also, see Rikowski & Grammer, 1999) demonstrated that the attractiveness of male body odor correlates positively with facial attractiveness and negatively with fluctuating asymmetry. This suggests that female attractiveness judgments are guided at least in part by olfactory information. Consistent with this theme, several survey studies have also shown that women report that body odor powerfully influences their attractiveness judgments (Franzoi & Herzog, 1987; Regan & Berscheid, 1995). In fact, research by Herz and colleagues (Herz & Cahill, 1997; Herz & Inzlicht, 2002) and others (e.g., Sergeant, Davies, Dickins, & Griffiths, 2005) suggests that body odor may be as, if not more, important than all other physical attractiveness cues, including visual (e.g., facial attractiveness).[1] For example, Herz and Inzlicht showed that, on average, women report that how men smell is the most important physical criterion for "initially choosing someone as a potential lover" (p. 362). In sum, there is growing scholarly support for the

Address correspondence to Joshua D. Foster, Psychology Department, University of South Alabama, Mobile, AL 36688, USA; foster@usouthal.edu (e-mail).

position that body odor is important and perhaps even the most important physical determinant of female attractiveness judgments.

It is notable that research directly comparing the importance of visual and olfactory cues of attractiveness has generally relied on retrospective self-report methods that ask participants to recall the importance of attractiveness cues (Herz & Cahill, 1997; Herz & Inzlicht, 2002; Sergeant et al., 2005). Survey research of this type may produce responses not entirely reflective of the real world. For example, estimates of importance may be inflated when assessing sensory stimuli that are more prominently stored in memory. Therefore, it is necessary to conduct research that assesses attractiveness judgments that are made online. In the present study, I did this by exposing female participants to tangible olfactory and visual stimuli collected from men (i.e., body odors collected on clothing; facial photographs). Thus, women in this study made judgments on the basis of what they were experiencing at the moment, not recollections of what they experienced. This method is a departure from much of the prior research on this topic and more accurately reflects how attractiveness judgments are made in the natural environment.

I believe that prior research has overestimated, to some degree, the role that olfaction plays on female judgments of attractiveness. I am not suggesting that the role of olfaction in the process of attraction is nil or even trivial. Olfaction plays a critical role; research by Thornhill and Gangestad (1999) and many other researchers supports this position. Nevertheless, from an evolutionary perspective, it is reasonable to assume that humans would rely on their more highly developed sensory system (i.e., visual system) when making judgments crucial to mate selection and, ultimately, reproductive fitness. Consequently, I hypothesized that women rely more on visual than olfactory cues when making attractiveness judgments of men.

Furthermore, prior research suggests that body odor may only contribute to the attractiveness judgments of women to the extent that they exhibit high levels of fertility (e.g., Rikowski & Grammer, 1999; Thornhill & Gangestad, 1999). This may be because infertile women (e.g., those using hormonal birth control) are less sensitive to olfactory cues specifically related to sexual mate preference (e.g., dissimilar major histocompatibility complex; Wedekind & Furi, 1997). Therefore, it was necessary to test my general hypothesis using samples of women who reported being fertile or infertile. I predicted that attractiveness would be better predicted by visual than olfactory cues for both fertile and infertile women. However, it was also possible that olfaction would play a larger role in the attractiveness judgments of fertile women.

In the present study, I used a method similar to that of Thornhill and Gangestad (1999) to test these hypotheses. Male participants submitted facial photographs (visual cue) and previously worn t-shirts (olfactory cue). Female participants rated these cues in terms of attractiveness either independently (i.e., t-shirts rated separately from photographs) or simultaneously (i.e., t-shirts and photographs rated at same time). I then used the independent cue ratings to predict overall attractiveness ratings (made by judging attractiveness on the basis

of both photographs and t-shirts presented simultaneously). Thus, I could make a direct comparison to determine whether sight or smell better predicts overall attractiveness perceptions.

Method

Participants

A total of 44 women (*M* age = 24 years, *SD* = 6.9 years) and 21 men (*M* age = 23 years, *SD* = 3.3 years) participated in the study. Participants were reimbursed $10 for their participation.

Materials and Procedure

Male participants. Male participants arrived individually at the place where the study was conducted. On signing a consent agreement, I asked them to pose for a photograph. I took all photographs from a distance of approximately 1 m. I asked them to remove hats or glasses and maintain a neutral facial expression for the photograph. They were then issued a closed freezer bag containing a new white cotton t-shirt, a plastic bag containing 2 ounces of unscented laundry detergent, and a bar of unscented soap, and given instructions to follow over the next 2 days and nights.

The instructions stated that they were to wear the t-shirts to bed for the following 2 consecutive nights, returning them to the closed freezer bag during the day. The instructions also asked participants to refrain from the following activities during the time that they were in possession of their t-shirts: (a) using scented soaps, deodorant, after-shave, or cologne; (b) eating foods that contain garlic, pepperoni, onion, pungent herbs and spices, green chile, strong cheeses, cabbage, celery, yogurt, asparagus, or lamb; (c) drinking alcohol or using recreational drugs; (d) smoking tobacco while wearing the t-shirt; (e) having sexual intercourse with another person while wearing the t-shirt; and (f) sleeping with another person while wearing the t-shirt. The instructions further stated that they use the unscented soap when washing and wash their bed sheets with the unscented laundry detergent before going to sleep on the first night.

Following the 2 consecutive nights of wearing the t-shirts, the men returned them in the sealed freezer bag to me. I asked the male participants whether they had followed all of the guidelines during the time that they were in possession of their t-shirts and assured them that failure to follow any of the guidelines would not result in penalty. In all, 6 of the male participants reported violations of the guidelines. These violations consisted of not washing their bed sheets with the unscented detergent, using recreational drugs, sleeping with another person while wearing the t-shirt, using scented deodorants during the day, and eating foods they were asked not to eat. I conducted tests to determine whether the t-shirts of rule violators differed from the remainder of the sample in terms of any of the

odor attractiveness ratings that women would later make. The results indicated no significant differences, *t*s(20) < 1. Furthermore, I asked female raters whether any of the t-shirts contained apparent unnatural odors. Again, ratings of rule violators did not differ from rule followers, $t(20) < 1$. Last, female raters assessed the strength of the odors contained on the t-shirts. Again, no differences between rule violators and rule followers were found, $t(20) < 1$. As failing to follow all of the directions did not appear to significantly affect odor quality or strength, I retained the t-shirts of all 21 men for use in later statistical analyses.

Female participants. Female participants began reporting to the experiment the day after male participants returned the t-shirts. The room in which I conducted the experiment was divided into 21 different stations positioned around the room. Each station consisted of a closed freezer bag containing a t-shirt and a photograph turned face down. T-shirts and photographs were numbered, but with random numbers used only to identify them for later analyses. Therefore, it was impossible for female participants to associate photographs of male participants with their t-shirts. Last, t-shirts and photographs were paired together at each station in a random fashion, rather than according to the males that provided them (e.g., t-shirt from male Participant 8 may have been paired with male Participant 19's photograph). However, again, the way in which these stimuli were labeled prevented female participants from identifying which t-shirts correlated with which photographs. I informed female participants that the t-shirts and photographs were paired at random at each station.

Female participation occurred over the next 2 days. On an alternating basis determined by the order that they arrived at the laboratory, I asked them to follow one of two procedures. I asked one group of females ($n = 21$)[2] to follow what is referred to in this article as *independent ratings*. That is, I asked them to rate t-shirt scents and facial photographs independently in terms of pleasantness, sexiness, and attractiveness using Likert-type scales ranging from 1 (*extremely unpleasant, unsexy, or unattractive*) to 7 (*extremely pleasant, sexy, or attractive*). Independent raters rated all t-shirts followed by all photographs. When rating t-shirt scents, I asked them to unzip the freezer bag, smell the t-shirt odor without touching the t-shirt, close the bag, and then make ratings. When rating photographs, they turned the photograph face up, made all ratings, and then turned the photograph face down. I used this procedure to ensure that photographs positioned at each station did not influence body scent ratings made by future independent raters. Furthermore, to reduce the possibility that clothing or hairstyle may have influenced facial attractiveness ratings, I applied opaque tape to each photograph that covered the area from the chin down and hairline up. Therefore, female participants were only able to rate photographs on the basis of the actual face of each male participant. Last, to reduce the possibility of order effects, I created 25 different randomized orders and issued them to female participants before they began rating items at each station, which I asked them to visit in their specified order. Thus, no more than 2 female

participants followed each randomized station order (i.e., because there were a total of 44 female participants and 25 random orders).

I asked the second group of female participants (n = 23) to complete what is referred to here as *combined ratings*. I asked female participants in this group to visit each station, smell the t-shirt while simultaneously looking at the photograph, and imagine that the photographed man wore the t-shirt. This group made ratings using the same scales as independent raters. The only exception was that this group made ratings on the basis of both the photograph images and t-shirt odors presented simultaneously. Therefore, this group of female participants made one rating for each scale per station (i.e., overall rating), whereas the group of independent raters made two ratings for each scale per station (i.e., body scent rating, facial rating).

Results

Creating Fertility Groups

I divided female participants into two groups depending on their reported fertility levels. One group consisted of infertile women who made independent (n = 14) or combined (n = 9) ratings. Infertility was defined as using hormonal birth control (e.g., birth control pill) or not otherwise experiencing menstrual cycles because of physical or medical reasons (e.g., pregnancy). The other group consisted of all fertile women who made independent (n = 7) or combined (n = 14) ratings.[3]

Assessing Attractiveness

Women made body odor and facial attractiveness ratings in terms of *pleasantness*, *sexiness*, and *attractiveness*. Ratings in these dimensions were highly correlated (for ratings of t-shirt odors, photographs, and combined t-shirt and photograph, rs > .79, .89, and .88, respectively). Principal component analyses also revealed that all three rating dimensions loaded onto a single component regardless of cue type. (All principal components had eigenvalues greater than 2.6 and accounted for more than 88% of the variance.) Therefore, I averaged ratings to create composite indexes referred to as *body odor attractiveness*, *facial attractiveness*, and *overall attractiveness*.

Data Structure

Pairings of t-shirts and photographs at individual stations represented the unit of analysis for this study. For example, if a t-shirt from Participant 10 and a photograph of Participant 3 were paired together at a station, this combination represented a single unit of analysis. Again, female participants rated stimuli in one of four groups: (a) fertile, independent raters; (b) fertile, combined raters;

(c) infertile, independent raters; and (d) infertile, combined raters. I used these ratings to create two independent data sets: one that contained ratings made by fertile female participants and another that contained ratings made by infertile female participants. In each data set, I averaged body odor attractiveness ratings (made by independent raters) together for each unit of analysis, resulting in 21 separate body odor attractiveness ratings (e.g., I averaged ratings of T-shirt 6 made by the 14 infertile independent raters together to make a single body odor attractiveness rating for this unit of analysis). I also averaged facial attractiveness ratings together for each unit of analysis, resulting in an additional 21 facial attractiveness ratings (i.e., one for each photograph). Last, I averaged overall attractiveness ratings (made by combined raters) together for each unit of analysis, resulting in 21 overall attractiveness ratings. Thus, three data points existed for each unit of analysis: an average body odor attractiveness rating, an average facial attractiveness rating, and an average overall attractiveness rating.

Hypothesis Testing

In this study, I sought to answer two primary questions. First, what is more important to female judgments of attractiveness, olfactory or visual cues? Second, do fertile and infertile women utilize these cues differentially when making attractiveness judgments? To answer these questions, I regressed overall attractiveness ratings onto both cue-type ratings (i.e., olfactory and visual) simultaneously. I ran these regression models twice, once for each fertility sample.

Table 1 shows the results. The first question of this study was answered unambiguously. Regardless of whether fertile or infertile women made the ratings, facial attractiveness predicted overall attractiveness more strongly than did body odor attractiveness. That is, the standardized regression coefficient representing the link between facial and overall attractiveness was larger than that representing the link between body odor and overall attractiveness: fertile sample, $t(18) = 2.35$, $p < .05$; infertile sample, $t(18) = 2.63$, $p < .05$. This suggests that visual cues influenced attractiveness judgments more than olfactory cues. It also suggests that prior reports of the importance that women place on body odor when making judgments of attractiveness may have been inflated because of the methodology of the research (e.g., Herz & Cahill, 1997; Herz & Inzlicht, 2002). When judgments of attractiveness are made without the filter of memory, visual cues are significantly more important than olfactory cues.

Given the present data, the answer to the second question was far more ambiguous. For fertile female participants, both body odor and facial attractiveness significantly predicted overall attractiveness (see Table 1). For nonfertile female participants, only facial attractiveness significantly predicted overall attractiveness. On the basis of these analyses, researchers may conclude that body odor is an attractiveness cue utilized only by fertile women. This finding would be consistent

TABLE 1. Regressing Overall Attractiveness Onto Body Odor Attractiveness and Facial Attractiveness Using Samples of Infertile and Fertile Women

Variable	*B*	*SE B*	β
Infertile women			
Constant	–0.862	1.142	—
Body odor attractiveness	0.301	0.261	.184†
Facial attractiveness	0.919	0.204	.718***
Fertile women			
Constant	0.156	0.704	—
Body odor attractiveness	0.389	0.162	.308*
Facial attractiveness	0.540	0.087	.793***

Note. For infertile women, $R^2 = .542$, Adjusted $R^2 = .492$, $F(2, 18) = 10.672$, $p < .01$. For fertile women, $R^2 = .704$, Adjusted $R^2 = .671$, $F(2, 18) = 21.392$, $p < .001$.
$^{\dagger}p > .25$. $^{*}p < .05$. $^{***}p < .001$.

with prior studies suggesting that increased fertility magnifies the role that olfaction plays in attractiveness judgments (e.g., Thornhill & Grammer, 1999).

However, when I compared the magnitude of the regression coefficients across fertility samples, I found that neither attractiveness cue differentially predicted overall attractiveness. In other words, it was inconclusive whether body odor and facial attractiveness more strongly predicted overall attractiveness for fertile compared with infertile women. On the basis of this analysis, researchers may conclude that fertile and nonfertile women use body odor and facial attractiveness similarly.

The seeming inconsistency between these two sets of analyses most likely stems from the small sample of male participants used in the present study. Assuming that the regression coefficients reported herein are relatively stable (which is admittedly a tenuous assumption), it is likely that, given a large enough sample, one would find that body odor (a) significantly predicts overall attractiveness for both fertile and infertile women and (b) more strongly predicts overall attractiveness for fertile compared with infertile women. Of course, future studies should investigate these possibilities using considerably larger samples of male participants.

Discussion

Summary, Limitations, and Conclusion

In summary, the results of the present study suggest that, when tested under conditions that approximate how attractiveness perceptions are made in the natural environment, sight is more important than smell when women judge the attractiveness of men. Female participants in the present study appeared to rely more heavily on the facial attractiveness of male participants than on their body

odors when making overall attractiveness judgments. This finding contradicts prior findings suggesting that olfactory information plays a more important role in attractiveness judgments than does visual information. Again, I exposed participants in the present study to actual stimuli, whereas participants in prior studies (e.g., Herz & Inzlicht, 2002) completed retrospective survey measures of the importance of sight and smell when making mate decisions.

In addition, a trend existed in the data suggesting that fertility may play a role in the extent to which women use olfactory information when making attractiveness judgments. Although there were not enough male participants to make a conclusive statement regarding this trend, it suggested that smell may influence the attractiveness judgments of fertile more than infertile women. Researchers have reported findings consistent with this. For example, Thornhill and Gangestad (1999) found that correlations between body odor attractiveness and fluctuating asymmetry were stronger for fertile women. Thus, although the results of the present study do not offer indisputable evidence of a link between fertility and the usage of olfactory attractiveness cues, they are consistent with it.

It is important to note several limitations of the present study. As previously noted, this study used a relatively small sample of male participants. However, the sample size was similar to those used by previous researchers of this general topic (e.g., Rikowski & Grammer, 1999). Nonetheless, future studies should make every effort to recruit as many male participants as possible to increase statistical power. (On the basis of my calculations, researchers may need to collect body odor and photograph samples from 80 to 100 or more male participants to achieve .80 power in a study similar to the present one.) Also, although this study assessed two important aspects of physical attraction (i.e., facial appearance and body scent), it did not cover all potential determinants of physical attractiveness. It is possible that the importance of either or both facial appearance and body odor decreases if other aspects of physical attractiveness are assessed concurrently. Future studies may test this by tapping a more complete selection of physical attractiveness cues. Last, although I thought the current procedure to be more externally valid than those used by similar prior studies, it is still less than a perfect representation of what occurs when people actually become attracted to one another. As always, there is a tradeoff between internal and external validity. I sought to increase the external validity of the results without completely destroying the internal control associated with laboratory studies. Future researchers may develop and utilize procedures that more accurately reflect what occurs in the real world without sacrificing internal validity.

In conclusion, the present study suggests that olfactory cues are important determinants of general attractiveness (particularly with regard to fertile women) but that visual cues, which act on one of our most highly developed sensory systems, are significantly better predictors of attractiveness judgments. These results add to the growing body of literature concerning how humans judge attractiveness and suggest that future researchers of this nature use designs that accurately reflect how attraction manifests itself in the natural environment.

NOTES

1. The rationale behind this prediction is in part from research suggesting that human females can olfactorally discriminate among men with different major histocompatibility complex (MHC) genetic schemas, which determine the extent to which individuals are resistant to various types of disease (Wedekind & Furi, 1997). Accordingly, women prefer to mate with men who possess MHC schemas that are different from their own, in part because this increases the probability that potential offspring will inherit MHC schemas that are more varied and thus will provide resistance to a wider variety of diseases.

2. Originally, there were 22 female participants in this group. However, 1 became ill during the procedure and was not able to complete her ratings.

3. I tried to assess fertility and infertility that had underlying chemical causes, such as those that were caused by changes in hormone production or levels. Thus, I limited the infertile group to those participants who were not able to reproduce because they were either using hormonal birth control or were otherwise biologically incapable of reproduction (e.g., currently pregnant). I did not want to include in this group women who were using physical mechanisms of birth control, such as condoms or birth control sponges, because I thought the underlying biology of these participants was identical to participants not using any form of birth control.

AUTHOR NOTE

Joshua D. Foster is an assistant professor of social psychology at the University of South Alabama. His research focuses primarily on issues related to personality, self-esteem, and close relationships.

REFERENCES

Franzoi, S. L., & Herzog, M. E. (1987). Judging physical attractiveness: What body aspects do we use? *Personality and Social Psychology Bulletin, 13,* 19–33.

Herz, R. S., & Cahill, E. D. (1997). Differential use of sensory information in sexual behavior as a function of gender. *Human Nature, 8,* 275–286.

Herz, R. S., & Inzlicht, M. (2002). Sex differences in response to physical and social factors involved in human mate selection: The importance of smell for women. *Evolution and Human Behavior, 23,* 359–364.

Regan, P., & Berscheid, E. (1995). Gender differences in beliefs about the causes of male and female desire. *Personal Relationships, 2,* 345–358.

Rikowski, A., & Grammer, K. (1999). Human body odour, symmetry, and attractiveness. *Proceedings of the Royal Society of London: Series B, 266,* 869–874.

Sergeant, M. J. T., Davies, M. N. O., Dickins, T. E., & Griffiths, M. D. (2005). The self-reported importance of olfaction during human mate choice. *Sexualities, Evolution, & Gender, 7,* 199–213.

Thornhill, R., & Gangestad, S. W. (1999). The scent of symmetry: A human sex pheromone that signals fitness? *Evolution and Human Behavior, 20,* 175–201.

Wedekind, C., & Furi, S. (1997). Body odour preferences in men and women: Do they aim for specific MHC combinations or simply heterozygosity? *Proceedings of the Royal Society of London, Series B, Biological Sciences, 264,* 1471–1479.

Received December 13, 2006
Accepted November 9, 2007