

## ORIGINAL RESEARCH—DESIRE

## Perception of Men's Beauty and Attractiveness by Women with Low Sexual Desire

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### ABSTRACT

**Introduction.** Despite the high prevalence of hypoactive sexual desire disorder (HSDD), especially among women, this sexual disorder remains poorly understood. Among the multiple factors possibly involved in HSDD, particularities in the cognitive evaluations of social stimuli need to be better characterized. Especially, beauty and attractiveness judgments, two dimensions of interpersonal perception that are related but differ on their underlying motivational aspects, may vary according to the level of sexual desire.

**Aim.** The main goal of this study was to investigate whether women with and without HSDD differ in their evaluations of beauty and attractiveness of men's faces and voices.

**Methods.** Young women from the general population (controls, n = 16) and with HSDD (patients, n = 16) took part in the study. They were presented with a series of neutral/nonerotic voices and faces of young men from the GENEVA Faces And Voices database.

**Main Outcome Measures.** Ratings of beauty (i.e., assessments of aesthetic pleasure) and of attractiveness (i.e., assessments of the personal propensity to feel attracted to someone) and the frequency to which the participants pressed a key to see or listen to each stimulus again were the main outcome measures.

**Results.** Ratings of attractiveness were lower than ratings of beauty in both groups of women. The dissociation between beauty and attractiveness was larger in women with HSDD than in control participants. Patients gave lower attractiveness ratings than the controls and replayed the stimuli significantly less often.

**Conclusion.** These results suggest that women with HSDD are characterized by specific alterations of the motivational component of men's perception, very early in the process of interpersonal relationships. Our findings have significant implications, both in better understanding the specific cognitive processes underlying hypoactive sexual desire and more largely the evaluative processes involved in human mate choice. **Ferdenzi C, Delplanque S, Vorontsova-Wenger O, Pool E, Bianchi-Demicheli F, and Sander D. Perception of men's beauty and attractiveness by women with low sexual desire. J Sex Med 2015;12:946–955.**

**Key Words.** Sexual Desire; Mate Choice; Attractiveness; Face and Voice Perception; Motivation

### Introduction

Hypoactive sexual desire disorder (HSDD) can be defined as “diminished feelings of sexual interest or desire, absent sexual thoughts or fantasies and a lack of responsive desire. Motivations [ . . . ] for attempting to have sexual arousal are

scarce or absent. The lack of interest is considered to be beyond the normative lessening with life cycle and relationship duration” [1]. It is one of the most common sexual dysfunctions in women and has a relatively high prevalence in the population (low desire: about 20–30% of the female European population; HSDD: about 10% [2]). Because it can

severely impair quality of life, it represents a frequent motive for clinical consultation [3,4]. This sexual disorder is believed to have multifactorial causes (psychological, relational, environmental, and biological) (e.g., Bitzer et al. [5]). Despite the fact that attentional and affective processing of sexual stimuli in HSDD is increasingly studied at the behavior and brain levels [6,7], the role of motivational mechanisms in this sexual dysfunction [5] remains poorly understood. In addition, studies investigating HSDD mechanisms often preferentially focus on physiological and subjective sexual response to erotic stimuli. However, cognitive aspects involving person perception in general (i.e., in nonerotic context) need to be further explored in women with HSDD in order to establish whether the response to male stimuli would deteriorate in a more general fashion than merely in explicit sexual situations. The aim of the present study was therefore to investigate how nonerotic male stimuli were perceived by heterosexual women with and without HSDD.

More specifically, we investigated whether HSDD is characterized by a general impairment of the assessment of a man's physical appearance (i.e., the pleasure elicited by looking at or listening to that man) or by a more specific alteration of judgments involving motivational aspects (like the propensity to feel attracted to that man). There is accumulating evidence in humans and animals suggesting that pleasure (i.e., *liking*) and motivation (i.e., *wanting*) represent two distinct components of reward processing. They are usually strongly correlated, but can be dissociated under some particular circumstances [8]. Indeed, it has been suggested that extremely strong desires that lead to pathological reward consumption (e.g., drug addiction) are driven by an increase of motivation without a parallel increase of pleasure [9]. Individual differences in the processing of rewarding stimuli, such as faces or erotic pictures, may underlie variations in the intensity of sexual desire [10] from extremely low desire as in HSDD to extremely strong desire. Moreover, sexual liking and wanting have been shown to be distinct constructs in a nonclinical population [11], but their role in extreme variations of sexual desire such as HSDD remains unexplored.

The distinction between aesthetic pleasure and motivation elicited by nonerotic stimuli (female faces) has been highlighted, for example, in a study with heterosexual men who, despite the fact that they found beautiful male faces as much aesthetically pleasing as beautiful female faces, displayed

more effort (e.g., motivation, measured via a "keypress" procedure) to increase female pictures' viewing time [12]. Aesthetic pleasure and motivation can also be measured with simple rating scales quantifying perceived beauty and attractiveness, respectively. Indeed, despite the fact that the terms "attractiveness" and "prettiness" or "beauty" or "cuteness" are often used indifferently in the popular language as well as by scholars, they are far from being equivalent. One can find someone beautiful without being personally attracted to him or her. This is, a fortiori, the case for a person viewing someone sexually incompatible with his or her sexual orientation (a heterosexual male toward another male, for instance). Inversely, as advocated by David Perrett [13], one can be attracted to someone who is not beautiful. Judgments of beauty reflect aesthetic pleasure triggered by the features of the face or the body, whereas judgments of attractiveness reflect "the personal desire to approach and be with someone" (Perrett [13], p. 231). This distinction is corroborated by nonverbal cues, as visual attention is stronger toward more attractive but not toward more beautiful faces [14]. A behavioral setting involving beauty and attractiveness evaluations thus seems adequate as a first attempt to investigate aesthetic pleasure and motivation associated with nonerotic male stimuli in heterosexual women with and without HSDD.

In this study, to distinguish between aesthetic pleasure and motivation for a potential male sexual partner, we collected women's beauty and attractiveness judgments of men. As vision and audition are two major channels in social interactions, male faces and voices were used as stimuli to be evaluated. Beauty judgments reflected the women's evaluation of what is generally agreed to be judged as beautiful or pleasant, whereas attractiveness referred to the participants' own propensity to be attracted to the man for a relationship of short or long duration. Long- and short-term contexts were used because they are known to be significant sources of variation in women's judgments of men [15]. Participants were also allowed to press a key to repeat stimulus presentation ("keypress" paradigm), which was used as a behavioral measure of the motivation to see/listen to the stimuli. Women with HSDD were compared with women without HSDD, both groups being similar in terms of age, contraception, and relationship status (factors influencing face and voice perception [15–18]). We hypothesized that beauty and attractiveness judgments of a man would not necessarily be

equivalent in the general population of women, as suggested by Perrett [13]. This would be illustrated by significant differences between average ratings of beauty and attractiveness of the same men. More importantly, we also predicted that HSDD would be accompanied by motivational impairment of person perception and that the beauty–attractiveness dissociation would thus be more marked in women with HSDD. In concrete terms, (i) attractiveness but not beauty ratings should be lower in women with HSDD; (ii) they should replay the stimuli less, showing decreased motivation; and (iii) correlations between beauty and attractiveness should be lower in women with HSDD compared with control participants.

## Method

### Participants

Female patients ( $n = 16$ , aged 21–37 years) diagnosed with HSDD were recruited in the psychosomatic gynecology and sexology unit of the Geneva University Hospital. Diagnosis was made in the consultation during a detailed structured interview based on nine items gathering Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV criteria for HSDD (the distress and interpersonal difficulties criteria were included) and the proposed criteria for DSM-V for hyperactive sexual desire [19]. It must be noted that the interviews came before the publication of the DSM-V where female hypoactive desire dysfunction was incorporated into a syndrome now called sexual interest/arousal disorder. Answers to the nine items provide insights into the participants' interest and engagement in sexual activities and allow classifying their desire as pathologically low, low, normal, high, or pathologically high. All patients belonged to the “pathologically low” category. The Hospital Anxiety and Depression Scale [20,21] was used to verify the absence of associated depressive disorder in patients (scores on the seven-item depression subscale did not exceed 11 out of 21).

Control women ( $n = 16$ , aged 20–36 years) were students and staff of the University of Geneva. They were first recruited for a larger study [22] by means of posters and web announcements and were asked whether they would also take part in the present study. Forty-one out of 57 female participants agreed to take part. We paired the patients with 16 of these by matching them at best for age, contraception and fertility, and relationship status. Absence of hypoactive sexual disorder

(according to the participants' self-completion of the nine items cited in the paragraph above) was verified in the control group who displayed normal ( $n = 8$ ) to high ( $n = 8$ ) levels of desire. In addition, participants of both groups completed the Sexual Desire Inventory-2 [23], which showed that the level of interest in sexual activity (represented by an average score from 0 to 109) was significantly lower in patients (mean  $\pm$  standard deviation =  $8.7 \pm 4.6$ ) than in control participants ( $60.3 \pm 19.3$ ;  $t_{30} = 10.41$ ,  $P < 0.001$ ).

Participants of both groups were of European type, self-declared as heterosexuals, and French native speakers or with good mastering of French. Patients and control groups did not differ on age ( $27.1 \pm 5.0$  vs.  $25.8 \pm 4.8$  years old,  $t_{30} = 0.76$ ,  $P = 0.456$ ), on the proportion of women engaged in a relationship ( $n = 11$  out of 16 in both groups), and on the duration of the relationship (average duration  $23.1 \pm 17.5$  in patients vs.  $26.5 \pm 20.6$  months in control women,  $t_{20} = 0.42$ ,  $P = 0.676$ ). Both groups were similar in terms of hormonal contraception (eight patients and nine control participants were on the pill) and phase of the menstrual cycle for women who did not take hormonal contraception (all but one patient and two control participants were in the fertile phase of their menstrual cycle). Indeed, the latter were asked to attend the experimental session insofar as possible during that particular phase of the cycle (for the estimation method, see Ferdenzi et al. [24]). None of the participants were pregnant.

Participants gave written informed consent, and the study was approved by the ethical committees of the Geneva University Hospital and of the Psychology Department of the University of Geneva.

### Stimuli

Two types of visual stimuli and two types of auditory stimuli from 73 young European men of the GENEVA Faces And Voices database were used [22]. Visual stimuli were a neutral picture of the face and a soundless video sequence of the face pronouncing a neutral sentence. Both conditions were used because they represent two different ways—static and dynamic—of encountering faces in real life and because they may provide different information. Pictures provide information on the structural properties of the face, which are known to be involved in facial attractiveness (such as symmetry or averageness [25]), and dynamic faces provide additional behavioral information. Therefore, attractiveness of the same faces presented in static and dynamic conditions is not necessarily alike

[26]. Auditory stimuli were audio recordings of a three-vowel sequence (/i/-/a/-/o/) and of a word, namely “Bonjour,” which is *Hi* in French. To date, little is known about how various voice sample types from the same individual (e.g., word vs. vowel) differ in perceived attractiveness. A recent study showed that attractiveness of words is correlated with, but higher than, attractiveness of vowels [27]. The use of vowels in attractiveness studies is often preferred because they prevent perceptual judgments of voice quality from being influenced by contextual factors like semantic meaning or intonation. They are also preferred for acoustics measures [28] that are then put in relation with subjective ratings. Using these four types of stimuli allowed us to test at which level group differences occur, namely as soon as the simple access to a limited number of “basic” information on the properties of faces and voices (face symmetry, voice frequency) or only when more (behavioral) information is available.

#### *Rating Procedure*

Participants were presented with a rating interface created with E-Prime v.2.0 (Psychology Software Tools, Pittsburgh, PA, USA). Faces were presented on a screen and voices through headphones. At the beginning of the session, the raters had a quick glimpse at the faces and voices they were about to evaluate, so that they have an idea of the attractiveness range. Blocks of the same stimulus type were presented, separated by minimum 30-second breaks, in the following order: voices pronouncing vowels, voices pronouncing words, static faces, and dynamic faces. Raters were presented with stimuli from the same men in the four blocks, but were not informed that the voices and faces came from the same individuals. We used random sample presentation within each block. Each of the 16 control participants was randomly assigned to 1 of the 21 different sets of male stimuli constituted for the need of the larger study [22]. These sets, comprising 19 to 20 men randomly taken from 40 available men, partially overlapped with each other. Each patient received the exact same set of stimuli as the control participant she was paired with. Overall, the ratings of the two experimental groups were thus based on the same stimuli (same 16 sets) and can thus be compared.

Each stimulus was evaluated on a visual analog scale (cursor position converted into 0–100 scores) for beauty, attractiveness for a short-term relationship, and attractiveness for a long-term

relationship. For beauty, participants were asked the following question: “According to you, is this man pleasant to listen/look at for most women?” (from not pleasant at all to very pleasant). They were therefore asked to rely on what is generally agreed to be judged as beautiful or pleasant (according to social norms). For attractiveness, participants were asked “Could you be personally attracted to this man for a relationship of short/long duration?” (from not attractive at all to very attractive). They were explained that “Unlike the question on beauty, please rely here on your own perception, and assess to what extent you could feel attracted to the presented person, assuming that it is for a casual/longstanding relationship. Note: A person may be attractive to you but not to someone else.” Additional scales (masculinity and trustworthiness) were also presented for the purpose of the larger study [22] but will not be analyzed here. To limit cross-influence of the ratings, the scales were presented separately on five successive screens: beauty and attractiveness in random order on the first, third, and fifth screen, and masculinity and trustworthiness in random order on the second and fourth screen. Participants were instructed to skip the ratings for faces of people they personally knew, and ratings of the corresponding voices were then also removed from the analyses. Static faces were displayed until the ratings were given, while voices and video samples could be replayed ad libitum: the number of replays was recorded.

#### **Results**

##### *Group Differences in Beauty and Attractiveness Ratings*

This first series of analyses aimed at testing to what extent beauty and attractiveness judgments of a given set of male stimuli differed and whether this difference was larger in one of the experimental groups (patients vs. controls). Analyses were conducted on scores averaged by rater (male stimuli pooled) with STATISTICA v.11 (Statsoft Inc., Tulsa, OK, USA). Greenhouse-Geisser-corrected repeated-measures analyses of variance (ANOVAS) were conducted on the four types of stimuli, with desire level (patients, controls) as between-subject factor and type of rating (attractiveness for short-term relationship, attractiveness for long-term relationship, beauty) as within-subject factor. We found a significant interaction between desire level and type of rating for all stimulus types (Table 1). Post hoc planned comparisons showed that



**Table 1** Effects of desire group (women with vs. without HSDD), type of rating (beauty, short-term attractiveness, long-term attractiveness), and interaction between desire group and type of rating on the judgments of male faces and voices (Greenhouse-Geisser corrected repeated-measures ANOVAs)

	Desire group	Type of rating	Desire group × type of rating
Faces			
Static	$F_{(1,30)} = 0.91$ $P = 0.347$	$F_{(1,21,36,45)} = 95.59$ $P < 0.001$	$F_{(1,21,36,45)} = 15.99$ $P < 0.001$
Dynamic	$F_{(1,30)} = 3.36$ $P = 0.077$	$F_{(1,17,35,23)} = 102.42$ $P < 0.001$	$F_{(1,17,35,23)} = 14.97$ $P < 0.001$
Voices			
Word	$F_{(1,30)} = 22.63$ $P < 0.001$	$F_{(1,18,35,42)} = 77.75$ $P < 0.001$	$F_{(1,18,35,42)} = 27.17$ $P < 0.001$
Vowels	$F_{(1,30)} = 18.41$ $P < 0.001$	$F_{(1,18,35,54)} = 103.25$ $P < 0.001$	$F_{(1,18,35,54)} = 44.21$ $P < 0.001$

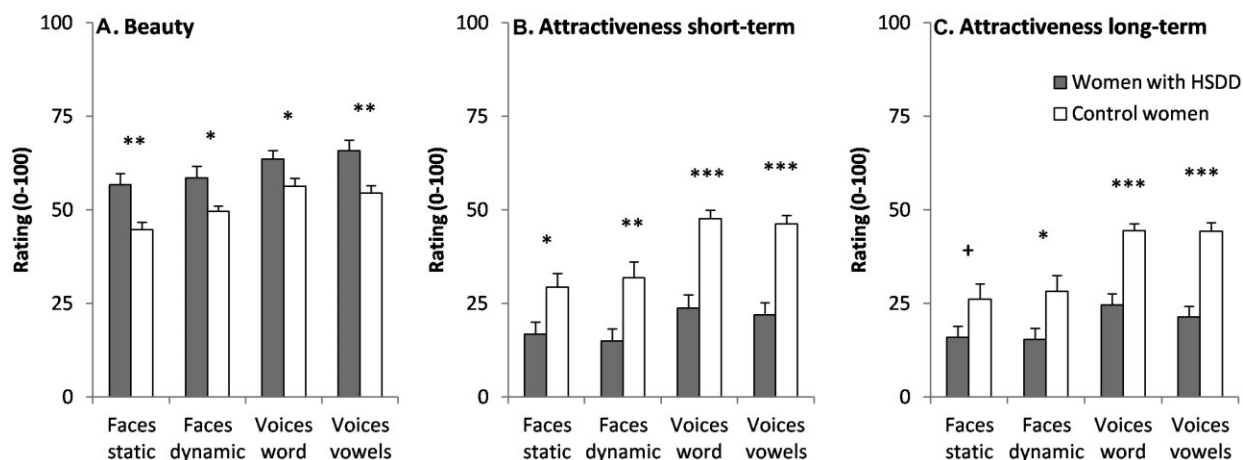
ANOVA = analysis of variance; HSDD = hypoactive sexual desire disorder

compared with the control participants, patients gave significantly lower ratings of short-term attractiveness (probabilities  $< 0.05$  for all stimulus types), lower ratings of long-term attractiveness ( $P_s < 0.051$ ), and higher ratings of beauty ( $P_s < 0.05$ ) (see Figure 1). Another series of post hoc planned comparisons showed that beauty ratings were higher than short-term attractiveness ratings (patients: probabilities  $< 0.001$  for all stimulus types; controls:  $P_s < 0.001$  for facial stimuli and  $P_s < 0.05$  for vocal stimuli) and higher than long-term attractiveness ratings (patients:  $P_s < 0.001$  for all stimulus types; controls:  $P_s < 0.001$  for facial stimuli and  $P_s < 0.01$  for vocal stimuli). There was no significant difference between short-term and long-term attractiveness in patients ( $P_s > 0.561$ ), whereas short-term attractiveness ratings were in some cases higher than long-term attractiveness in control participants (dynamic faces and word:  $P_s < 0.05$ , static faces:

$P = 0.054$ , vowels:  $P = 0.168$ ). Note that similar ANOVAs including stimulus type (static vs. dynamic faces, and word vs. vowels) did not reveal any significant difference between stimulus types.

#### Group Differences in Frequency of Stimulus Replay

This second series of analyses aimed at testing whether there was some kind of motivational impairment of person perception in women with HSDD. We compared control women and patients on the number of stimuli they replayed at least once during the attractiveness and beauty ratings. Patients replayed significantly fewer stimuli than control women did (voices: word  $8.4 \pm 23.2\%$  vs.  $48.6 \pm 39.5\%$ ,  $t_{30} = 3.51$ ,  $P < 0.01$ ; and vowels  $8.6 \pm 19.4\%$  vs.  $35.9 \pm 23.2\%$ ,  $t_{30} = 2.88$ ,  $P < 0.01$ ; faces:  $3.6 \pm 8.3\%$  vs.  $25.1 \pm 21.4\%$ ,  $t_{30} = 3.75$ ,  $P < 0.001$ ; independent  $t$ -tests on rater's individual percentages). We then tested whether

**Figure 1** Average ratings (means, standard errors) of male faces and voices for (A) beauty, (B) attractiveness for a short-term relationship, and (C) attractiveness for a long-term relationship, by female raters with and without hypoactive sexual desire disorder (HSDD). Post hoc planned comparisons between the two groups of women:  $+P < 0.10$ ,  $*P < 0.05$ ,  $**P < 0.01$ ,  $***P < 0.001$

the replay behavior was a measure of motivation as expected (namely, that attractive stimuli were replayed more) or whether it was an expression of participants' uncertainty. Therefore, among the stimuli that were replayed at least once during the attractiveness and beauty ratings, we computed how many were attractive and how many were unattractive, for each rater. To perform this categorization, for each stimulus, we computed the average attractiveness score from the beauty, short-term attractiveness, and long-term attractiveness ratings given by a rater: stimuli being above vs. below the median score were categorized as attractive vs. unattractive for that rater. On average, for all stimulus types combined, 56% of the replayed stimuli (55.5% in control women and 58.7% in patients) were attractive and 44% were unattractive, which was marginally different from a 50-50% distribution ( $\chi^2 = 2.73$ ,  $P = 0.099$ ).

#### Group Differences in Beauty–Attractiveness Correlation

The last series of analyses tested how well were beauty and attractiveness ratings correlated in control participants and whether this correlation was lower in women with HSDD. These analyses were conducted on scores averaged by male donor, where evaluations of all raters of each group were pooled. Pearson correlation coefficients were computed between average short-term attractiveness and beauty and between average long-term attractiveness and beauty of the 40 men for each of the four stimulus types. Correlations were higher in the control group than in the patients, and this difference was significant for all stimulus types except videos, as shown by statistical test of the difference between two correlation coefficients run with STATISTICA v.11 (see Table 2 and an illustration of the relationship between beauty and attractiveness for the men's voices in Figure 2).

#### Discussion

In this study, our aim was to investigate person perception in women with HSDD in order to better understand the cognitive implications of this sexual dysfunction. We were interested in how women with HSDD evaluate male faces and voices. More specifically, we tested the idea that motivational aspects of men's evaluation would be particularly impaired in heterosexual women with HSDD compared with heterosexual healthy women, but that more general aesthetic judgments would be less degraded. Attractiveness vs. beauty judgments of male faces and voices were used, respectively, as measures of motivation to personally approach the person vs. aesthetic pleasure.

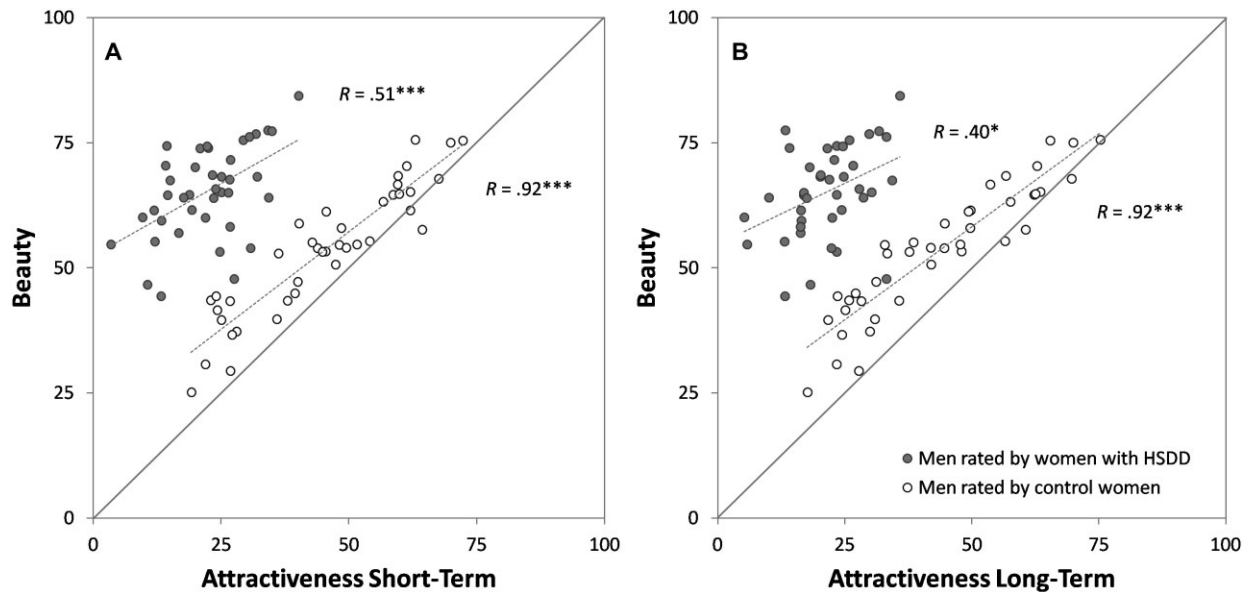
In both groups of women, we found that attractiveness judgments were lower than judgments of beauty for both faces and voices. Women appeared to be more stringent when it came to evaluating a personal tendency to be attracted to someone (especially in the context of a committed long-term relationship; see also Buss and Schmitt [29]) as compared with a more general aesthetic judgment, probably because the former has higher personal implication. The main result of this study is that this difference between beauty and attractiveness was enhanced in women with HSDD compared with women without HSDD.

Indeed, the mean level of attractiveness was noticeably lowered in women with HSDD compared with controls. As predicted, this was likely to be due to lower motivation to see/listen to the stimuli, as shown by lower investment in the key-press paradigm. An additional evidence of the larger beauty–attractiveness dissociation was the lowest correlation between the two measures in women with HSDD compared with controls, in accordance with our hypotheses. In other words, whereas men rated as more beautiful were very likely to also be more attractive to control women, this is less likely to be the case in women with

**Table 2** Pearson correlations (coefficients and levels of significance: \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ ) between beauty and short-term attractiveness, and between beauty and long-term attractiveness of men's faces and voices ( $n = 40$  for static faces and vowels, and  $n = 38$  for dynamic faces and word)

	Beauty/short-term attractiveness			Beauty/long-term attractiveness		
	Controls	Patients	Difference	Controls	Patients	Difference
Static faces	0.89***	0.48**	$P < 0.001$	0.83***	0.50**	$P < 0.01$
Dynamic faces	0.76***	0.66***	$P = 0.398$	0.77***	0.64***	$P = 0.276$
Voices word	0.89***	0.63***	$P < 0.01$	0.89***	0.56***	$P < 0.01$
Voices vowels	0.92***	0.51***	$P < 0.001$	0.92***	0.40*	$P < 0.001$

"Difference" indicates the probability that controls' and patients' correlation coefficients differ.



**Figure 2** Relationship between average beauty and short-term attractiveness (A) and between beauty and long-term attractiveness (B) for vocal excerpts (vowels) of 40 different men. Each dot represents a man, who was evaluated by 5 to 11 women with hypoactive sexual desire disorder (HSDD) and 5 to 10 women without HSDD. Pearson correlation coefficients ( $R$ ) and their level of significance ( $*P < 0.05$ ;  $***P < 0.001$ ) are given (see also Table 2).

HSDD. Taken together, these findings suggest that the decrease of sexual desire in women with HSDD would not be driven by a global decrease in the processing of sexual reward but rather by a selective modification of motivation without a parallel modification of aesthetic pleasure. Such results are consistent with the notion that aesthetic pleasure (i.e., *liking*) and motivation (i.e., *wanting*) represent two distinct components of sexual reward processing [10] that are strongly correlated in control participants, but can be more distinct in participants with HSDD. Few studies have investigated and highlighted this beauty–attractiveness distinction through face and voice perception. One study [12] showed that although men attributed similar beauty levels to men’s and women’s faces, they were more motivated to view faces of the sex they are expected to be attracted to according to their sexual orientation (females) than male faces. In our study, HSDD women behaved toward men’s stimuli as if they were not attracted to them as much as expected owing to their sexual orientation: they had an unaltered perception of facial aesthetics, but as soon as attraction was concerned, their evaluations fell down. In addition, they were not systematically more attracted by the most beautiful men, or at least not as much as control women. In sum, patients wanted less interaction

with men (i.e., observe them, listen to them), even if they found them at least as beautiful as controls did. It was shown before that women with HSDD rate erotic stimuli as less desirable than control women [7]. However, the fact that significant differences occur earlier in the sexual response, i.e., with nonerotic stimuli, and that the motivational rather than the purely contemplative/aesthetic facet of the judgment is impaired represents new findings and provides interesting insights into the cognitive underpinnings of hypoactive sexual desire.

Some limitations of this study must be acknowledged, however. First, the sample was small and not representative of the female population diagnosed with HSDD, notably in terms of age. Indeed, many HSDD patients are older than the age range used in our study (20–37 years), probably because of several physiological and psychological factors that occur around menopause and that often induce a marked decrease of sexual desire at this period of life [30]. To have a better understanding of the cognitive mechanisms of HSDD, it therefore seems crucial to include participants of this age range in the future and to use age-assorted male stimuli for evaluation. Second, a more thorough pairing of the control and clinical groups on demographic variables that were not

taken into account here, like educational level, occupation, or socioeconomic background, would make a validation study more powerful.

In spite of the small size of the clinical sample used in this study, the findings seem to be robust, as they are consistent across types of conducted analyses and across all stimulus types. They have significant implications for both the clinical population with HSDD and the general population. First, our study may contribute to adjust therapeutic management (often cognitive behavioral therapy [31] or drugs [32]) of this under-recognized and undertreated disorder [33]. Namely, it should be taken into account that there might be a lack of motivation to engage in sexual activities, which originates in the very early stages of interaction with a person of the opposite sex. This would explain less contact taking and more social inhibition to find a sexual partner in single women, and possibly a decrease of the partner's attractiveness in women engaged in a long-standing relationship. For the latter, it is likely that the degradation observed in our study with stimuli from unknown men also applies to the current partner, although it remains to be tested in the future. Most importantly, our results suggest that in women engaged in a long-standing relationship, low sexual desire (and notably HSDD) may not be solely due to a particularly strong habituation to the repeated same sexual stimuli (partner)—a phenomenon occurring in the general population [34]. Indeed, a decreased attractiveness response was observed for novel stimuli in our study compared with control women, suggesting that more general cognitive mechanisms are involved in HSDD, probably related to reward processing. In the sexotherapeutic approach of HSDD, therapists should complete current interventions (e.g., Trudel et al. [35]) by helping the patient to feel less guilty about the situation and the partner to better understand the phenomenon. This objective can be reached by including the partner in therapeutic sessions: therapists may not only encourage both individuals to find different ways of sexual stimulation with each other, but especially, they may explain that the phenomenon is not specific to the perception of the partner (decrease of the response to novel stimuli too) and not limited to explicit sexual situations (decrease of attractiveness responses to neutral faces). More generally, the second implication is that the distinction between beauty and attractiveness may help in understanding their respective contributions to the different steps of healthy and pathological social perception:

first impression, declared motivation to approach a new potential partner or current partner, actual choice of a new partner, which may differ from declared preferences [36] and, eventually, sexual response. Additional perspectives entail studies in healthy participants and patients with HSDD investigating sex differences in the beauty-attractiveness dissociation. Indeed, as men give more credit to physical appearance when choosing mates, the motivational value of a beautiful female face may be higher [37] and beauty-attractiveness dissociation could thus be less marked in men than in women. It could have implications for the management of HSDD as cognitive characteristics of person perception in men and women with hypoactive sexual desire might thus differ. Finally, methodological implications of our findings for person perception research are that beauty and attractiveness should not be interchangeably used in experimental designs as they sometimes are, and the choice of a scale should be made with full knowledge of the difference between the two.

### Conclusion

The present study showed that women with HSDD expressed lower attraction toward faces and voices of men and lower effort to replay the stimuli, whereas interestingly, beauty judgments were unimpaired. Attractiveness toward social stimuli falls within the motivational component of reward processing (i.e., *wanting*), whereas beauty rather taps purely aesthetic pleasure (i.e., *liking*). Therefore, we believe that female HSDD may be characterized by specific alterations of the motivational component of men's perception. The results of this study help in understanding normal and pathological cognitive mechanisms involved in person perception in romantic and sexual relationships, and may provide new perspectives for the management of abnormal processing in this context.

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*Conflict of Interest:* The authors report no conflicts of interest.

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#### (b) Revising It for Intellectual Content

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### Category 3

#### (a) Final Approval of the Completed Article

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## References

- Basson R, Leiblum S, Brotto L, Derogatis L, Fourcroy J, Fugl-Meyer K, Graziottin A, Heiman JR, Laan E, Meston C, Shover L, van Lankveld J, Schultz WW. Revised definitions of women's sexual dysfunction. *J Sex Med* 2004;1:40-8.
- Graziottin A. Prevalence and evaluation of sexual health problems—HSDD in Europe. *J Sex Med* 2007;4(suppl 3):211-9.
- Bianchi-Demicheli F, Ortigue S, Meyer P. Désir sexuel hypoactif chez l'homme: Prise en charge en médecine sexuelle. *Rev Med Suisse* 2010;6:614-9.
- Kingsberg SA, Rezaee RL. Hypoactive sexual desire in women. *Menopause* 2013;20:1284-300.
- Bitzer J, Giraldi A, Pfaus J. Sexual desire and hypoactive sexual desire disorder in women. Introduction and overview. Standard operating procedure (SOP Part 1). *J Sex Med* 2013;10:36-49.
- Brauer M, van Leeuwen M, Janssen E, Newhouse SK, Heiman JR, Laan E. Attentional and affective processing of sexual stimuli in women with hypoactive sexual desire disorder. *Arch Sex Behav* 2012;41:891-905.
- Bianchi-Demicheli F, Cojan Y, Waber L, Recordon N, Vuilleumier P, Ortigue S. Neural bases of hypoactive sexual desire disorder in women: An event-related fMRI study. *J Sex Med* 2011;8:2546-59.
- Berridge KC. Food reward: Brain substrates of wanting and liking. *Neurosci Biobehav Rev* 1996;20:1-25.
- Robinson TE, Berridge KC. Addiction. *Annu Rev Psychol* 2003;54:25-53.
- Toates F. An integrative theoretical framework for understanding sexual motivation, arousal, and behavior. *J Sex Res* 2009;46:168-93.
- Krishnamurti T, Loewenstein G. The partner-specific sexual liking and sexual wanting scale: Psychometric properties. *Arch Sex Behav* 2012;41:467-76.
- Aharon I, Etcoff N, Ariely D, Chabris CF, O'Connor E, Breiter HC. Beautiful faces have variable reward value: fMRI and behavioral evidence. *Neuron* 2001;32:537-51.
- Perrett DI. In your face: The new science of human attraction. Basingstoke: Palgrave MacMillan; 2010. 305pp.
- Geldart S. That woman looks pretty, but is she attractive? Female perceptions of facial beauty and the impact of cultural labels. *Eur Rev Appl Psychol* 2010;60:79-87.
- Little AC, Jones BC, Penton-Voak IS, Burt DM, Perrett DI. Partnership status and the temporal context of relationships influence human female preferences for sexual dimorphism in male face shape. *Proc R Soc Lond B Biol Sci* 2002;269:1095-100.
- Alvergne A, Lummaa V. Does the contraceptive pill alter mate choice in humans? *Trends Ecol Evol* 2010;25:171-9.
- Feinberg DR, Jones BC, Law Smith MJ, Moore FR, DeBruine LM, Cornwell RE, Hillier SG, Perrett DI. Menstrual cycle, trait estrogen level, and masculinity preferences in the human voice. *Horm Behav* 2006;49:215-22.
- Ebner NC. Age of face matters: Age-group differences in ratings of young and old faces. *Behav Res Methods* 2008;40:130-6.
- Kafka MP. Hypersexual disorder: A proposed diagnosis for DSM-V. *Arch Sex Behav* 2010;39:377-400.
- Lépine JP, Godchau M, Brun P, Lempérière T. [Evaluation of anxiety and depression among patients hospitalized on an internal medicine service]. *Ann Med Psychol* 1985;143:175-89.
- Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67:361-70.
- Ferdenzi C, Delplanque S, Mehu-Blantar I, Da Paz Cabral KM, Domingos Felicio M, Sander D. The GENEVA Faces And Voices (GEFAV) database. *Behav Res Methods* 2014; doi: 10.3758/s13428-014-0545-0.
- Spector IP, Carey MP, Steinberg L. The sexual desire inventory: Development, factor structure, and evidence of reliability. *J Sex Marital Ther* 1996;22:175-90.
- Ferdenzi C, Schaal B, Roberts SC. Human axillary odor: Are there side-related perceptual differences? *Chem Senses* 2009;34:565-71.
- Little AC, Jones BC, DeBruine LM. Facial attractiveness: Evolutionary based research. *Philos Trans R Soc Lond B Biol Sci* 2011;366:1638-59.
- Rubenstein AJ. Variation in perceived attractiveness: Differences between dynamic and static faces. *Psychol Sci* 2005;16:759-62.
- Ferdenzi C, Patel S, Mehu-Blantar I, Khidasheli M, Sander D, Delplanque S. Voice attractiveness: Influence of stimulus duration and type. *Behav Res Methods* 2013;45:405-13.
- Patel S, Scherer KR, Björkner E, Sundberg J. Mapping emotions into acoustic space: The role of voice production. *Biol Psychol* 2011;87:93-8.
- Buss DM, Schmitt DP. Sexual strategies theory: An evolutionary perspective on human mating. *Psychol Rev* 1993;100:204-32.
- Mimoun S. Ménopause, andropause et fonction sexuelle. *Gynecol Obstet Fertil* 2003;31:141-6.

- 31 Günzler C, Berner MM. Efficacy of psychosocial interventions in men and women with sexual dysfunctions—A systematic review of controlled clinical trials: Part 2—The efficacy of psychosocial interventions for female sexual dysfunction. *J Sex Med* 2012;9:3108–25.
- 32 Pfaus JG. Pathways of sexual desire. *J Sex Med* 2009;6:1506–33.
- 33 Montgomery KA. Sexual desire disorders. *Psychiatry* 2008;5:50–5.
- 34 Both S, Laan E, Everaerd W. Focusing “hot” or focusing “cool”: Attentional mechanisms in sexual arousal in men and women. *J Sex Med* 2011;8:167–79.
- 35 Trudel G, Marchand A, Ravart M, Aubin S, Turgeon L, Fortier P. The effect of a cognitive-behavioral group treatment program on hypoactive sexual desire in women. *Sex Relation Ther* 2001;16:145–64.
- 36 Todd PM, Penke L, Fasolo B, Lenton AP. Different cognitive processes underlie human mate choices and mate preferences. *Proc Natl Acad Sci U S A* 2007;104:15011–6.
- 37 Levy B, Ariely D, Mazar N, Chi W, Lukas S, Elman I. Gender differences in the motivational processing of facial beauty. *Learn Motiv* 2008;39:136–45.