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Automatic and Deliberate Affective Associations with Sexual Stimuli in Women with Superficial Dyspareunia

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Abstract Current views suggest that in women with superficial dyspareunia the prospect of penile–vaginal intercourse automatically activates fear-related associations. The automatic activation of negative associations is assumed to interfere with the development of sexual arousal. In turn, this may further aggravate the dyspareunia-related complaints. To assess whether automatic negative associations are involved in this sexual pain disorder, women with superficial dyspareunia ($n = 35$) and a control group ($n = 35$) completed a modified pictorial Affective Simon Task (AST). Questioning the role of dysfunctional automatic associations in superficial dyspareunia, the AST indicated that symptomatic women displayed relatively positive rather than negative automatic associations with sexual stimuli. At the self-report level, however, affective associations with sex cues were significantly more negative for women with dyspareunia than for controls. This discrepancy between "reflective" and "reflexive" affective associations with sexual stimuli in women with dyspareunia points to the relevance of conscious appraisal and deliberate rather than automatic processes in the onset and maintenance of dyspareunia.

Keywords Automatic affective associations ·
Affective Simon Task · Dyspareunia · Fear ·
Conscious appraisal

Introduction

Dyspareunia, pain associated with penile–vaginal intercourse, is a common problem in women, with community prevalence rates between 3% and 18% (e.g., Simons & Carey, 2001). In the vast majority of women with dyspareunia, pain is located at the entrance of the vagina, which is the distinguishing factor of superficial dyspareunia. To date, possible underlying somatic and psychological mechanisms have been explored, but a clear etiology has yet to be established (Binik, Meana, Berkely, & Khalifé, 1999; Lotery, McClure, & Galask, 2004).

Anxiety has been implicated as a core feature of sexual dysfunctions in general and dyspareunia in particular (Barlow, 1986; Meana & Binik, 1994; Spano & Lamont, 1975) by impairing sexual arousal. The cognitive theory of anxiety (e.g., Beck, 1976; Beck, Emery, & Greenberg, 1985) posits that fearful individuals are more attentive to emotionally negative, potentially threatening stimuli, which interferes with cognitive processes. Applied to sexual dysfunctions, it is assumed that when attention is preferentially allocated to threatening stimuli during sexual activity, fewer attentional resources will be available for the processing of sexually arousing stimuli. This distraction from sexually arousing stimuli might subsequently result in lack of sexual arousal (Barlow, 1986; Janssen, Everaerd, Spiering, & Janssen, 2000; Laan & Janssen, 2007; Sbrocco & Barlow, 1996; Van den Hout &

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Barlow, 2000). In women, lack of sexual arousal might lead to vaginal dryness and/or increased pelvic floor muscle tone (ter Kuile & Weijenborg, 2006; Van Lunsen & Ramakers, 2002). These reactions, in turn, may result in friction between penis and vulvar skin, which may cause pain (i.e., dyspareunia). Given the threatening nature of pain (e.g., Eccleston & Crombez, 1999; Vlaeyen & Linton, 2000), it is assumed that fear in women with dyspareunia is related to genital pain during intercourse.

The information-processing model of sexual arousal has been used to explain in more detail how cognitive processes might affect sexual responding (Janssen et al., 2000; Laan & Janssen, 2007). In this model different levels of cognitive processing are assumed to differentially affect subjective and physiological sexual arousal. That is, relatively automatic cognitions are linked to the physiological components of sexual arousal (e.g., genital arousal), whereas more deliberate cognitions are linked to the experience of sexual excitement.[1] This deliberate appraisal of sexual stimuli is, apart from situational factors, dependent upon recollections of sexual encounters, explicit attitudes towards sex, sexual costs and rewards, and sexual fantasies (Spiering, Everaerd, & Laan, 2004). Awareness of physiological arousal, along with a positive cognitive appraisal of sexual stimuli, may eventually result in the occurrence of full-blown genital and subjective sexual arousal responses. In sexually dysfunctional individuals on the other hand, it is proposed that when a personally relevant stimulus is identified, a threat processing template is automatically activated that serves to attract attention to nonsexual, threatening cues (e.g., cues related to pain during intercourse) and minimizes further processing of sexual stimuli (cf. Beck & Clark, 1997). Consequently, this might lead to low levels of genital and subjective sexual arousal (Janssen et al., 2000; Laan & Janssen, 2007).

The observation that women with dyspareunia report more negative affect, less positive affect, and less subjective sexual arousal than controls to exposure to sexual stimuli in a laboratory setting suggests that at least at the explicit level, negative, fear-related associations with sexual stimuli are present in symptomatic women (Brauer, Laan, & ter Kuile, 2006; Brauer, ter Kuile, Janssen, & Laan, 2007; Brauer, ter Kuile, & Laan, 2008; Payne et al., 2007). However, the critical question remains whether self-reported negative affect in symptomatic women is primarily related to a deliberate negative evaluation of sexual stimuli or that also automatic negative affective evaluations are involved in the processing of sexual cues. In line with the information-processing model of sexual arousal (Janssen et al., 2000; Laan &

Janssen, 2007), it can be assumed that, in women with superficial dyspareunia, the prospect of penile–vaginal intercourse automatically activates fear-related associations and that this automatic activation of negative associations interferes with the development of sexual arousal. In its turn, this may further aggravate the dyspareunia-related complaints. If so, this may have important clinical implications, since information processing models share the assumption that automatic associations are less susceptible to change than deliberate associations (e.g., Strack & Deutch, 2004; Wilson, Lindsey, & Schooler, 2000). This would imply that traditional cognitive-behavior therapy modalities, which are primarily focused on pain control (cf. ter Kuile & Weijenborg, 2006), might well fail to tap into and modify deeply ingrained automatic sex-related affective associations (e.g., Huijding & de Jong, 2008). Even if dyspareunia patients would report a strong attenuation of dysfunctional beliefs after treatment, residual dysfunctional automatic associations may remain and render patients vulnerable for relapse. Following this, an important first step is to examine whether automatic fear-related associations are indeed involved in this sexual pain disorder.

It is also on theoretical grounds important to assess automatic associations in women with dyspareunia. According to the information-processing model of sexual arousal, automatically elicited associations are assumed to be related to genital responses (e.g., lubrication) whereas deliberate, controlled associations are linked to the experience of sexual excitement and further strategic/planned behavior. Furthermore, it is stressed that automatically, reflexively elicited responses may diverge from more strategic, reflectively initiated responses. In agreement with this, there is often discordance between self-reported sexual arousal and genital arousal in women (for an overview, see Laan & Everaerd, 1995a). From here, it follows that in order to obtain a more comprehensive picture of the differential contribution of cognitive processes in the onset and/or maintenance of superficial dyspareunia, both deliberate and more automatically activated sex-related associations should be assessed.

It has been argued that automatic fear responses may be best predicted by indirect measures of automatic fear-relevant associations, whereas more controllable fear behaviors may be best predicted by direct, self-report measures (e.g., Egloff & Schmuckle, 2002; Huijding & de Jong, 2006). That is, self-report measures provide the opportunity to reflect on each response, whereas indirect measures of automatic associations leave little or no room for conscious reflection on a response because participants are urged to respond as quickly as possible to stimuli presented in quick succession. Participants' responses on these indirect measures will therefore primarily reflect automatically activated associations that are assumed to play a critical role in the

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[1] Automatic cognitive processes refer to fast and unintentional responses, whereas deliberate (or controlled) cognitive processes refer to responses that are under intentional control (cf. De Houwer, Crombez, Baeyens, & Hermans, 2001; Moors & De Houwer, 2006).

automatically initiated components of the fear response.[2] In support of this, recent work in the context of phobic fears showed that relatively controllable avoidance behavior was best predicted by self-reported associations, whereas relatively uncontrollable fear responses (startle probe reflex) were best predicted by automatically activated associations (Huijding & de Jong, 2006).

Thus far, research on cognitive-affective evaluations of sex-related stimuli has relied upon explicit measures. Therefore, the purpose of the present empirical investigation was to set up and implement an indirect measure to see whether negative affective associations in women with dyspareunia are (also) evident at the automatic level (in the sense of fast and unintentional). Such indirect measures have already been successfully used to assess disorder-relevant automatic associations in a range of psychological complaints, including pain (Vancleef, Peters, Gilissen, & de Jong, 2007), specific fears (e.g., Teachman, Gregg, & Woody, 2001), social phobia (e.g., de Jong, 2002), depression (e.g., De Raedt, Schacht, Franck, & De Houwer, 2006), and addiction (e.g., Huijding, de Jong, Wiers, & Verkooijen, 2005).

To test implicit affective associations with sex-related stimuli, we used a modified pictorial Affective Simon Task (AST; De Houwer & Eelen, 1998). The AST is a reaction time paradigm designed to capture the unintentional influence of the affective value of a stimulus on task performance. Participants are instructed to choose as fast as possible between a positive and a negative response on the basis of a non-affective stimulus feature (i.e., relevant stimulus feature) meanwhile ignoring the valence of the presented stimuli (i.e., irrelevant stimulus feature). Various studies have shown that the time to select the correct response is influenced by the match between the valence of the response and the (irrelevant) valence of the stimulus. That is, reaction times (RT) are typically shorter when the valence of the required response matches with the valence of the stimulus, thereby revealing indirectly the valence of the stimulus for the participant (De Houwer et al., 2001; De Houwer & Eelen, 1998). Earlier studies showed that the AST can be successfully applied to assess automatic affective associations in the context of phobic and generally threatening stimuli (de Jong, van den Hout, Rietbroek, & Huijding, 2003).

We preferred the AST as an indirect measure of automatic affective associations. The AST has some distinct advantages above the most widely used Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). Most important,

inherent to its design the IAT is a relative measure and assesses the strength of affective associations of a target relative to a contrast category (e.g., black vs. white, in-group vs. out-group). Unlike the IAT, the AST is a non-relative measure of automatic associations, allowing for a more straightforward assessment of concepts that have no meaningful contrast (such as erotic stimuli). Furthermore, unlike the IAT, the AST can be used to examine associations involving subcomponents of the concept of interest within the same task (e.g., erotic stimuli with or without penetration). Finally, the AST seems more robust against non-associative explanations of the effects than the IAT (e.g., Rothermund & Wentura, 2004). The present AST included erotic pictures showing either explicit penis-in-vagina penetration or explicit heterosexual acts without any form of vaginal penetration (e.g., erotic kissing, cunnilingus, fellatio, and manual stimulation of the vulva). These two categories were created to test whether women with dyspareunia would only hold automatic negative affective associations concerning penetration stimuli (e.g., because penetration might have become associated with recurrent experiences of genital pain) or that sexual stimuli in general activate automatic negative associations in these women.

We investigated the following questions: (1) Do women with complaints of superficial dyspareunia show negative affective associations with sexual stimuli? (2) If so, are these negative associations restricted to penetration stimuli or do they exist for sexual stimuli in general? (3) Do these negative affective associations depend on conscious deliberation or can they also be found at the automatic level?

Method

Participants

The study sample consisted of 35 women suffering from superficial dyspareunia and 35 women without sexual complaints. All participants were premenopausal women aged between 18 and 45 years and being in a steady heterosexual relationship for at least 6 months. The participants were recruited through advertisements, media attention, and professional referral. Eleven symptomatic women and 10 controls were also included in previous studies on dyspareunia (Brauer et al., 2006, 2007). The inclusion criterion for women with dyspareunia was complaints of superficial dyspareunia in minimally 50% of intercourse attempts for at least 6 months. Exclusion criteria for women with dyspareunia were somatic conditions responsible for dyspareunia (e.g., active vulvo-vaginal infections), generalized vulvodynia (unprovoked chronic vulvar burning, itching or irritation in the whole vulvar region); and lifelong vaginismus. Vulvar vestibulitis syndrome (VVS), recently redefined as vestibulodynia (Edwards,

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[2] Note that the constructs measured by indirect measure are not necessarily unconscious constructs. Participants may be unaware what the test measures, but that does not imply that they are also unaware of their evaluations (Fazio & Olson, 2003). Hence, in the present context the term automatic is not equivalent to the term unconscious, but rather means that an indirect measure leaves insufficient time for participants to purposefully control their response.

2004), was not an exclusion criterion since the etiology of VVS is largely unknown (Lotery et al., 2004).

Women in the control group had no sexual complaints for at least one year, were sexually active including intercourse, had their first coital experience more than a year ago, and had partners without severe sexual complaints that could impede intercourse. We excluded women from both groups if any of the following applied: pregnancy or lactation; a diagnosis of a current depressive episode according to DSM-IV-TR (American Psychiatric Association, 2000); and medication that could influence reaction time.

Following a telephone screening, participants underwent subsequent testing at the sexology outpatient clinic of the department of gynecology of a university medical center where they were informed about the study in greater detail and were examined to determine further suitability for the study. Screening consisted of a semi-structured sexual function interview. To check for current depressive episode, a part of the MINI International Neuropsychiatric Interview (MINI) was conducted. The MINI is a semi-structured diagnostic interview regarding the most common psychiatric disorders according to the DSM-IV on Axis 1 (American Psychiatric Association, 2000; Lecrubier et al., 1997; Sheehan et al., 1997). Participants were told that the purpose of the study was to investigate the effects of sexual stimuli on emotions and cognitions by means of computer tasks and questionnaires. Participants received a compensatory fee of €12.50. Travel expenses were also reimbursed. The study protocol was approved by the Medical Ethics Committee of the Leiden University Medical Center.

One woman with dyspareunia was excluded after the screening, because she suffered from deep dyspareunia instead of superficial dyspareunia. In the case of one control participant, completion of the AST was terminated by the experimenter because the woman experienced difficulties with comprehending the task instructions, even after repeated instructions.

Table 1 lists demographic and complaint characteristics. The dyspareunia group (*M* age, 26.4 years, *SD* = 6.0) and control group (*M* age 24.5 years, *SD* = 5.2) were successfully matched on age. Both groups did not differ significantly in educational level. The average duration of the genital pain complaint was 6.0 years (*SD* = 4.3). For 15 (42.9%) of the women with dyspareunia, the pain during intercourse was a lifelong problem.

Measures

Affective Simon Task

For several reasons, pictorial erotic stimuli rather than words were selected. First, the concept of sex may not be readily captured in words, since sex-related words might have a strong negative valence in themselves as they are used as foul language (e.g., to fuck); might refer to medical language which individuals are unfamiliar with (e.g., coitus, cunnilingus); or are multi-interpretable (e.g., pussy). Second, research has demonstrated that pictures more easily activate semantic representations (e.g., De Houwer & Hermans, 1994) and, as such, might yield more robust findings (Huijding & de Jong, 2005). Finally, pictorial representations of sexual acts have been shown to elicit subjective experiences of sexual arousal (e.g., Spiering, Everaerd, Karsdorp, Both, & Brauer, 2006) and preliminary evidence exists that sexual pictures can activate genital responses in a laboratory context (Janssen et al., 2000; Laan & Everaerd, 1995b). As far as we know, for words with a sexual content it has not been investigated whether they elicit genital and subjective sexual arousal in women.

The computerized AST consisted of three phases. It started with a prime phase in order to strengthen the bond between the required response and the subjective valence of the pictorial stimulus, thus bolstering the affective Simon effect (cf. Huijding et al., 2005). During the prime phase, participants were instructed to say "positive" when they were presented with a picture with a positive valence and "negative" when they were presented with a picture with a negative valence. Six positive pictures and six negative pictures were selected from the photographs included in the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). The IAPS numbers of the positive category were 1441, 1750, 2050, 5760, 8496, 8501 and the IAPS numbers of the negative category were 2205, 2750, 9001, 9421, 9440, 9830. All pictures were presented twice in landscape format and twice in portrait format. Hence, the priming phase consisted of 48 trials.

During phases 2 and 3, participants were instructed to respond as fast as possible with saying either "Positive" or "Negative" to stimuli, depending on whether they were presented in a landscape format (longest side horizontal) or a portrait format (longest side vertical). In the second phase, the sex-AST, participants were presented with 12 pictures displaying explicit heterosexual acts. Half of these pictures depicted explicit penis-in-vagina penetration (i.e., penetration stimuli), whereas the other half depicted other heterosexual acts without anything being penetrated into the vagina (i.e., non-penetration stimuli, for instance erotic kissing, cunnilingus, fellatio, and manual stimulation of the vulva). Prior to the experiment, a large selection of erotic pictures had been generated to serve as potential stimuli. These pictures were shots taken from an erotic film, *One Size Fits All*, a so-called women-friendly erotic film directed by Candida Royalle (Laan, Everaerd, van Bellen, & Hanewald, 1994). In a pilot study among sexually functional women (*n* = 35), participants were instructed to categorize these pictures as fast as possible as either depicting "penetration" or "sexual activity without penetration" by means of pressing one of two computer keys. The pictures that revealed shortest reaction times and most

Table 1 Demographic and sexual function characteristics

Characteristics	Dyspareunia (n = 35)		Controls (n = 35)		χ^2 or t-values
	M	SD	M	SD	
Age (in years)	26.4	6.0	24.5	5.2	1.39
Duration relationship (in years)	6.5	4.7	2.9	1.8	4.27*
Married/co-habiting, N (%)	21 (60.0)		10 (28.6)		7.01*
Children, N (%)	5 (14.3)		1 (2.9)		2.92
Education (%)					3.04
Primary school-lower secondary	5 (14.3)		2 (5.7)		
Higher secondary	5 (14.3)		10 (28.6)		
College-university	25 (71.4)		23 (65.7)		
Duration dyspareunia (in years)	6.0	4.3	–		
Onset dyspareunia lifelong, N (%)	15 (42.9)		–		
FSFI	20.5	6.9	32.0	2.5	−9.12*

Note: Range for FSFI, 2–36. Lower scores indicate worse sexual function. FSFI = Female Sexual Function Index

* $p < .01$

correct responses were selected for the current sex-AST (Brauer, ter Kuile, & Laan, 2005). All pictures were presented eight times in landscape format and eight times in portrait format. In total, 192 trials were presented. To control for possible stimulus order effects on the sex-AST, two mirrored fixed random stimulus presentation orders were created. Prior to the sex-AST, participants were presented with 12 practice trials with neutral pictures chosen from the IAPS (numbers: 7004, 7006, 7009, 7010, 7035, 7080) to become familiarized with the procedure.

During the third phase, the control-AST, participants were presented with six positive and six negative pictures, selected from the IAPS (numbers of positive pictures: 1440, 1710, 2222, 2388, 2550, 7580; numbers of negative pictures: 2900, 6610, 9300, 9404, 9800, 9911). All pictures were presented three times in landscape format and three times in portrait format. Hence, the control-AST consisted of 72 trials. This control-AST was mainly included to see whether we could replicate the earlier reported general affective Simon effects (i.e., shorter RTs when picture valence and required response are congruent). If so, this would support the validity of the present experimental set-up (lay-out, instruction, etc.). In addition, adding the control-AST enabled us also to examine whether any between group effects on the sex-AST were specific for the sexual stimuli.

To optimize the sensitivity for finding interference (i.e., affective Simon) effects with respect to sex stimuli, we decided to present the sex-AST always prior to the control-AST (instead of counterbalancing the tasks) as it can be assumed that participants gradually learn to resist the interference of the irrelevant stimulus feature (i.e., the valence of the picture) due to practice (cf. de Jong et al., 2003).

During the second and third phase, response requirements were counterbalanced between participants: half of the participants were instructed to say "positive" upon presentation of a picture in landscape format and "negative" when a picture was presented in portrait format, whereas the

response assignment was reversed for the other half of the participants.

During all three phases, pictures were randomly depicted in five different dimensions. This was done to prevent participants from focusing on one point of the screen while discriminating between portrait and landscape pictures. Fixation on one point may limit the processing of picture content (cf. Huijding & de Jong, 2005). Depending on whether the pictures were presented in a landscape or portrait format, the longest side was horizontally or vertically depicted, respectively (e.g., dimensions for landscape were 360 × 300 pixels, 380 × 320 pixels, 400 × 340 pixels, 420 × 360 pixels, 440 × 380 pixels).

Each phase was preceded by specific instructions on the computer screen. Participants were seated in front of the computer screen at a distance of approximately 40 cm. Participants were instructed to respond as fast and accurately as possible by saying "positive" or "negative." The voice-key recorded reaction times. Inaccurate responses and voice key failures were recorded on a computer by a female research assistant. The next trial was initiated after the experimenter entered a code. Each trial consisted of a fixation cross (500 ms) followed by a stimulus, which remained on the screen until the voice key had registered a response. If no response was registered, the stimulus disappeared automatically after 3,000 ms.

Self-reported Affective Responses to Sexual Stimuli

In order to examine subjective affective responses to erotic stimuli, participants were asked to provide ratings on five questions after each erotic picture that they had seen previously in the sex-AST. As a self-report equivalent of the AST, participants were asked to indicate their general feeling towards each picture on a 100 mm Visual Analogue Scale (VAS), with the left anchor of the VAS-scale being "negative" and the right anchor being "positive." To obtain a more complete impression of how the sexual stimuli were

appraised, participants had to assess the degree to which they were experiencing "sexual arousal," "sexual desire," "fear," and "aversion," when looking at the picture. The items "sexual arousal" and "sexual desire" were selected since women associate positive sexual stimuli typically with these feelings (Brauer et al., 2005). The items "fear" and "aversion" were selected because we expected that these descriptors would be the most relevant negative emotional responses in women with dyspareunia. These affective descriptors were measured by separate VAS-scales, anchored at the left and right by the words *not at all* and *very strong*, respectively. Three measures were derived: *general affective evaluation, positive sexual affect* (calculated as the mean score on sexual arousal and sexual desire), and *negative affect* (calculated as the mean score on fear and aversion).

Questionnaires

Participants completed the Dutch version of the Female Sexual Function Index (FSFI; Rosen et al., 2000; ter Kuile, Brauer, & Laan, 2006). The FSFI is a brief self-report measure of female sexual function, consisting of the following subscales; desire, arousal, lubrication, orgasm, satisfaction, and pain. As an indication for sexual functioning, the total score of the FSFI score was used in this study. Lower scores represent worse sexual function. Based on a Dutch sample consisting of approximately 350 women with and without sexual complaints, the internal consistency and stability of the FSFI were found to be satisfactory-to-good. The FSFI's ability to discriminate between sexually functional and dysfunctional women was excellent as well as the ability to predict the presence or absence of sexual complaints. Finally, the convergent and divergent construct validity was good (ter Kuile et al., 2006).

A *t*-test indicated that the dyspareunia group reported significantly more sexual problems than the control group (see Table 1).

Procedure

Participants were tested individually. After general instructions on the experimental procedure were given and informed consent was obtained, all participants first completed the AST. Next, explicit affective responses to the erotic pictures used in the AST were obtained, and finally, participants were asked to complete the questionnaires. Following the recommendations of Bosson, Swann, and Pennebaker (2000), the AST preceded the self-report measures.

Data Analysis

We had planned to analyze data regarding mean reaction times as well as number of errors. However, because almost no errors

were made during both the sex-AST and the control-AST, error data could not be meaningfully interpreted by means of univariate analyses. Therefore, we decided to only examine reaction time (RT) data. For the RT data, all incorrect responses were excluded. RTs less than 300 ms or greater than 3,000 ms were excluded from analyses (cf. De Houwer, 2003). Mean RTs on both the sex-AST and the control-AST were analyzed using separate univariate analyses (ANOVA). For the sex-AST, a 2 (Group) × 2 (Stimulus Category) × 2 (Required Response) × 2 (Stimulus Presentation Order) ANOVA was conducted. RT data obtained from the control-AST were entered in a 2 (Group) × 2 (Stimulus Valence) × 2 (Required Response) × 2 (Stimulus Presentation Order) ANOVA. Stimulus Valence refers to the pictures with either a positive or negative valence.

With respect to self-reported affective responses to the erotic stimuli used in the sex-AST, three separate 2 (Group) × 2 (Stimulus Category) ANOVAs were performed to analyze group differences. For RT effects and self-report responses, effect sizes (*f*) were calculated as a function of η^2 (see Cohen, 1988, p. 284). For the purpose of interpretation, Cohen considered $|.10| < f < |.25|$ as small, $|.25| < f < |.40|$ as medium and $f > .40|$ as large. To inspect group differences in demographic variables and sexual function (FSFI), independent sample *t*-tests and chi-square tests were used. Pearson's product moment correlations were calculated between implicit and explicit measures.

Results

Preliminary analyses showed no significant differences between women with lifelong dyspareunia and women with acquired dyspareunia on automatic affective sex-related associations and self-reported affective responses to sexual stimuli. There was a striking resemblance in both groups in their automatic, $F(1, 33) < 1$, and self-report responses, $F(1, 33) = 1.75$. For both subgroups, the correlations between RT and self-report indices of the affective evaluation of sexual stimuli were non-significant. Therefore, in further analyses the entire dyspareunia sample was compared to the control sample.

General Affective Simon Effect (Control AST)

RT data were square-root transformed to normalize the positively skewed distribution. Untransformed mean RTs are displayed in Table 2. A 2 (Group) × 2 (Stimulus Valence) × 2 (Required Response) ANOVA with mean RT as the dependent variable yielded a significant main effect of Required Response, $F(1, 68) = 12.12$, $p < .01$, $f = 0.42$, and a significant Stimulus Valence × Required Response interaction,

Table 2 Mean reaction times (in milliseconds) as a function of stimulus type and required response in both the control-AST and the sex-AST

Required response Stimulus category	Dyspareunia (n = 35)				Controls (n = 35)				Combined (n = 70)			
	Positive		Negative		Positive		Negative		Positive		Negative	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
General affective stimuli												
Positive	641	128	703	145	606	128	648	132	623	128	675	141
Negative	694	173	674	145	621	126	635	137	658	154	654	142
Sexual stimuli												
Penetration	651	120	664	123	574	97	609	127	612	115	636	128
Non-penetration	658	133	680	131	582	95	615	124	620	121	648	131
Sex (total)	654	125	672	126	578	94	612	124	616	117	642	128

$F(1, 68) = 17.71$, $p < .01$, $f = 0.51$. As can be seen in Table 2, this interaction effect indicated, as expected, that participants were generally faster when there was a match than when there was a mismatch between the valence of the irrelevant feature (i.e., picture content) and the valence of the required response. There was a marginally significant tendency that this effect was more pronounced in the dyspareunia group, $F(1, 68) = 3.24$, $p = .076$, $f = 0.22$. Subsequent t-tests indicated that participants were significantly faster to positive stimuli when the required response was positive (match) than when the required response was negative (mismatch), $t(69) = -4.91$, $p < .01$. Although a similar pattern seems evident for the stimuli with a negative valence (see Table 2), the influence of response requirement (positive vs. negative) did not approach significance, $t(69) < 1$.

Sex-AST

Preliminary analysis revealed that there was neither a main effect for stimulus presentation order, $F(1, 66) < 1$, nor were there any significant interaction effects, $Fs (1, 66) < 3.30$, $ps > .074$. Therefore, we only report here the analyses using the pooled data. Data were normally distributed. Mean RTs to sexual stimuli are shown in Table 2. A 2 (Group) × 2 (Stimulus Category) × 2 (Required Response) ANOVA yielded a significant main effect for Required Response, $F(1, 68) = 11.86$, $p < .01$, $f = 0.42$, a significant main effect for Stimulus Category, $F(1, 68) = 10.74$, $p < .01$, $f = 0.40$, and a significant main effect for Group $F(1, 68) = 6.31$, $p < .02$, $f = 0.30$. As can be seen in Table 2, the main effect for Required Response signified that participants were generally faster on trials displaying sexual stimuli when the required response was "positive" than when the required response was "negative." Thus, contrary to expectations, symptomatic as well as complaint-free women displayed positive automatic associations with sexual stimuli and the strength of these associations did not differentiate between both groups of women. The significant main effect for Stimulus Category

indicated that participants were generally faster when exposed to penetration stimuli than to non-penetration stimuli. Furthermore, the main effect for Group implied that the dyspareunia group was overall significantly slower in responding than the control group.

Self-Reported Affective Responses to Sexual Stimuli

General Affective Evaluation

A 2 (Group) × 2 (Stimulus Category) ANOVA for the general affective evaluation of the sexual stimuli yielded only a significant main effect for Group, $F(1, 68) = 6.59$, $p < .02$, $f = 0.31$. As can be seen in Table 3, ratings on this self-report equivalent of the sex-AST were significantly more negative in the dyspareunia group than in the control group.

Positive Sexual Affect

A 2 (Group) × 2 (Stimulus Category) ANOVA for ratings of positive sexual affect revealed a significant main effect for Group, $F(1, 68) = 10.90$, $p < .01$, $f = 0.40$, indicating that the dyspareunia group experienced less positive sexual affect (i.e., arousal and desire) when looking at the sexual pictures (see Table 3).

Negative Affect

A 2 (Group) × 2 (Stimulus Category) ANOVA for ratings of negative sexual affect revealed a significant main effect for Group, $F(1, 68) = 12.29$, $p < .01$, $f = 0.43$, as well as a marginally significant Group by Stimulus Category interaction, $F(1, 68) = 3.81$, $p = .06$, $f = 0.24$. Follow-up tests of the Group by Stimulus Category interaction revealed that exposure to both non-penetration stimuli, $F(1, 68) = 6.92$, $p < .05$, $f = 0.32$, and penetration stimuli, $F(1, 68) = 14.68$, $p < .01$, $f = 0.47$, elicited more negative affect in the dyspareunia group than in the control group. The level of

Table 3 Self-reported affective responses to erotic stimuli

| Ratings | Dyspareunia (n = 35) | | | | | | Controls (n = 35) | | | | | |
| | Penetration | | Non-penetration | | Combined | | Penetration | | Non-penetration | | Combined | |
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
General affective evaluation	48.7	21.7	53.9	21.8	51.3	18.5	64.2	22.5	63.0	21.7	63.6	21.5
Positive sexual affect	43.6	23.4	43.0	20.1	43.3	19.6	61.7	21.2	56.1	21.0	58.9	20.0
Negative affect	29.5	23.0	24.6	18.2	27.1	18.7	11.8	12.7	13.9	13.5	12.8	12.6

Note: Range for each descriptor, 0–100. Higher scores on the VAS-scale for a general affective evaluation of sex-related stimuli indicate more positive associations. Higher scores on the VAS-scales for positive sexual affect and negative affect indicate that affect was experienced as more intense

experienced negative affect as elicited by both stimulus categories did not differ among women with dyspareunia, $F(1, 34) = 1.46, f = 0.21$, negative affect tended to be higher for the non-penetration stimuli than for penetration stimuli among complaint-free women, $F(1, 34) = 3.58, p = .07, f = 0.32$.

Relationship Between Reaction Time and Self-report Indices of the Affective Evaluation of Sexual Stimuli

To examine the relationship between automatic and self-report measures, we first calculated sex-AST indices. Mean RTs on trials on which the correct response was positive were subtracted from trials on which the correct response was negative. Following this, a positive AST index indicates positive associations with target stimuli (i.e., sexual stimuli), whereas a negative AST index indicates negative associations (cf. De Houwer, 2003). Pearson product–moment correlations were calculated between sex-AST indices for each of the self-reported affective ratings of the sexual stimuli collapsed across stimulus categories and groups. No significant correlations were found between the AST index and the self-report measures.

Discussion

This study examined whether dysfunctional (automatic) affective associations were involved in superficial dyspareunia. The main findings can be summarized as follows: (1) both symptomatic and complaint-free women displayed shorter reaction times when they had to respond with "positive" to sexual stimuli than when they had to respond with "negative," indicating that both groups displayed relatively positive automatic associations with sexual stimuli; (2) the strength of the positive automatic sex-related associations was similar for groups; (3) at the self-report level symptomatic women were characterized by both weaker positive (i.e., arousal and desire) and stronger negative (i.e., fear and aversion) associations with sex cues than controls.

To check the validity of the present pictorial AST as a measure of automatic affective associations, we added a control-AST to the design containing generally positive and negative pictorial stimuli selected from the IAPS (Lang et al., 2005). Sustaining the validity of the present task and replicating previous research using verbal (e.g., De Houwer & Eelen, 1998; de Jong et al., 2003; Huijding et al., 2005) and pictorial stimuli (De Houwer et al., 2001), results showed a general affective Simon effect. That is, participants were generally faster when there was a match than when there was a mismatch between the valence of the irrelevant feature (i.e., picture content positive or negative) and the valence of the required response ("positive" or "negative"), and there were no significant differences between both groups in this respect. These results clearly demonstrate that the valence of the pictures interfered with responding although picture content had to be ignored. This interference with responding can be interpreted as reflecting automatic (i.e., unintentional) affective associations with the target stimuli (cf. De Houwer & Eelen, 1998). Meanwhile, it should be acknowledged that the general Affective Simon effect appeared restricted to the positive stimuli. Unexpectedly, picture content did not interfere with task performance on trials depicting negative IAPS slides. One explanation could be that the negative stimuli were more complex and diverse than the positive stimuli, reducing their power to elicit bottom up interference effects. Another explanation could be that the selected pictures were not sufficiently negative to elicit automatic negative affective evaluations. Unfortunately, we did not assess self-reported affect for these pictures, so it remains to be seen whether the absence of a straightforward negative appreciation was restricted to the automatic level.

The major aim of the present study was to examine the role of "reflective" and "reflexive" affective associations in women suffering from dyspareunia. The results of the explicit affective ratings of the erotic stimuli were in line with previous research (Brauer et al., 2006, 2007, 2008; Payne et al., 2007) and converge to the conclusion that sexual stimuli activate more ambivalent meanings in women with dyspareunia, with less positive and more negative affect as opposed to sexually

functional women. As earlier research indicated that erotic stimuli may elicit ambivalent emotional states in women (Laan & Everaerd, 1995a, 1995b; Peterson & Janssen, 2007), it is interesting in its own right that particularly the dyspareunia group seems to be characterized by a more pronounced ambivalence in affect concerning sexual stimuli. Explained in terms of the information processing model on sexual arousal, co-occurrence of contrasting or conflicting meanings of sexual stimuli can lower the intensity of an emotional experience in the sense that it may involve a process of weighing of positive and negative meanings. Especially when threat/fear-related nonsexual meanings prevail, sexual arousal may subsequently be inhibited (Janssen et al., 2000).

In contrast to the self-report measures, the sex-AST did not differentiate between women with and without dyspareunia. For both groups of women, responses were faster when the required response was "positive" than when the required response was "negative," indicating that both women with and women without dyspareunia are characterized by positive rather than negative automatic (reflexive) affective associations with sexual stimuli. The strength of the positive automatic associations was similar for stimuli depicting heterosexual acts without any form of penetration, and stimuli depicting explicit vaginal penetration. So, the present results counter the idea that negative automatic affective associations with sexual stimuli are critically involved in women with dyspareunia.

One testable explanation for the absence of relatively negative automatic associations in women suffering from dyspareunia might be related to the ecological validity of the sexual stimuli that were used in this study. The sexual pictures, either with or without explicit reference to vaginal penetration, may not have been sufficiently accurate symbolic representations of the actual domain of concerns. For example, seeing pictures of other people having sex may well elicit different (automatic) affective associations than (the prospect of) having sex oneself. However, the finding that at the self-report level there was a clear differential pattern of affective responses, with symptomatic women reporting more negative affect (i.e., fear and aversion) together with less positive sexual affect (i.e., less arousal and desire), renders this explanation for the absence of differential automatic affect not very convincing. Meanwhile, it remains important to test in future research whether differential automatic affect will emerge in more personalized idiosyncratic sexual contexts.

Another explanation for the absence of overtly negative automatic associations in women with dyspareunia might be that the present sample of symptomatic women was not a representative one with respect to complaint characteristics. A comparison between our study sample of women with dyspareunia and a sample of patients with dyspareunia ($n = 99$) visiting an outpatient clinic for sexology of a university medical hospital showed that there were no significant differences between these two samples regarding demographic variables (age, marital status, duration relationship, children), and sexual (dys)function as assessed by the FSFI, although the average duration of dyspareunia was significantly longer among women participating in the present study.[3] So there are no indications that we relied on an atypical group with relatively minor complaints. Therefore, it seems unlikely that the absence of relatively negative automatic affective associations in the present group of women suffering from dyspareunia can be attributed to our sample being characterized by an atypically low level of symptoms.

A third testable explanation for the absence of overtly negative automatic associations in women with dyspareunia might be that the current version of the sex-AST lacked sufficient sensitivity. Yet, previous work using a structurally very similar AST was successful in differentiating between high and low spider fearful individuals in both student (Huijding & de Jong, 2005) and community samples (Huijding & de Jong, 2006). Moreover, individuals' reaction times during the sex-AST were clearly affected by the task-irrelevant picture content, suggesting its sensitivity as an indirect measure of affect: Participants were systematically faster when the required response was positive than when the required response was negative. Although one may suspect that this finding may merely reflect a phonological advantage of saying positive compared to negative, this seems not very likely. That is, a similar advantage for positive being the required response was absent in case of pictures representing generally negative stimuli. In addition, in none of the previous AST studies in the Netherlands and Belgium using the same verbal response options (e.g., De Houwer & Eelen, 1998, De Houwer et al., 2001; de Jong et al., 2003; Huijding et al., 2005) participants were generally faster when positive was the required response (i.e., irrespective of the valence of the irrelevant stimulus feature). Furthermore, a pilot study specifically testing the potential confounding influence of the phonological characteristics of saying positive versus negative provided no evidence to indicate that the phonological difference between positive and negative played a major role in participants' velocity of responding (de Jong, 2000). All in all, it seems not very likely that a lack of sensitivity played a crucial role in the absence of group differences in automatic affect. At the very least, it cannot explain why symptomatic women tended to show positive rather than negative associations with sexual stimuli.

The finding that women with dyspareunia displayed positive automatic associations with sexual stimuli regardless of their persistent intrusive painful intercourse experiences may be explained by assuming that the deliberate negative associations with sex are acquired at a relatively late age. That is, deliberate negative associations might develop during initial

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[3] Data are available from the corresponding author upon request.

sexual experiences or at intercourse debut in women with lifelong dyspareunia and even later, after a period of pain-free intercourse, in women with acquired dyspareunia. The painful intercourse experiences may result in a relatively negative conscious appraisal of sexual stimuli but may not be sufficiently influential to render deeply ingrained automatic positive associations negative.

The apparent robustness of positive automatic associations is also consistent with emotion theories (e.g., Lang, Bradley, & Cuthbert, 1990), stating that species survival requires that emotionally significant stimuli are detected by automatic processing mechanisms, which immediately activate physiological responses. That is, defensive responses are activated when confronted with stimuli that threaten survival such as snakes and spiders, whereas approach responses are primed by stimuli that promote survival, such as sexual stimuli. In agreement with this view, it has been suggested that there must be a strong link between sexual stimuli and genital responses and that this link is likely to be highly prepared (in a biological sense) and automatic (in a cognitive sense) (Janssen et al., 2000; Laan & Everaerd, 1995a; Laan & Janssen, 2007). Support for a strong link between sexual stimuli and genital responses stems from cumulative research demonstrating that sexual stimuli easily elicit genital responses even under adverse experimental conditions. These findings have been documented in sexually functional women as well as women with dyspareunia (e.g., Brauer et al., 2006, 2007, 2008; Payne et al., 2007). Furthermore, research into sexual response specificity has shown that women respond with an increase in genital arousal to film fragments showing a woman being raped (e.g., Both, Everaerd, & Laan, 2003; Laan, Everaerd, & Evers, 1995) and to sexual stimuli depicting primates mating (Chivers & Bailey, 2005).

The low correlations between the reaction time (i.e., AST) and self-report measures of sex-related affective associations correspond with the predictions based on information processing models that emphasize the discrepancy between deliberate affective associations and automatically activated affective associations (e.g., Fazio & Towles-Schwen, 1999; Strack & Deutch, 2004; Wilson et al., 2000). This is consistent with neurobiological evidence for the presence of separate pathways for initial, lower order and slower, higher order processing of stimulus information (e.g., LeDoux, 1995).

The information processing model of sexual arousal (Janssen et al., 2000; Laan & Janssen, 2007) may also account for the discrepancy between automatically activated and deliberate affective associations regarding sexual stimuli in the dyspareunia group as it proposes that different levels of cognitive processing differentially influence subjective and physiological sexual arousal responses. Integrating our findings in this model, we argue that exposure to sexual stimuli automatically elicits a genital response in women with and without dyspareunia, but that in women with dyspareunia the

sexual stimulus is consciously appraised as relatively negative, thereby impeding genital (i.e., lubrication) as well as subjective sexual arousal. Conversely, sexually functional women appraise sexual stimuli more positively, which may eventually result in the occurrence of full-blown genital and subjective sexual arousal responses.

Apart from the above-mentioned main findings, results showed that irrespective of the required response the dyspareunia group displayed longer reaction times on the sex-AST than the control group. This slowed responding of the dyspareunia group during the sex-AST may reflect a relatively strong attention-grabbing power (cf. Pratto & John, 1991) or relatively strong arousing properties (cf. Schimmack, 2005) of sexual stimuli within the dyspareunia group, possibly because of their threatening nature. Such an explanation would be in line with previous research using an AST showing that both generally threatening stimuli and cues that are specifically related to individual's phobic concerns resulted in longer response latencies than neutral control words, independent of the required response (de Jong et al., 2003). However, since the control-AST always followed the sex-AST, the present design precluded a direct test whether slower responding during the sex-AST was caused by the specific sexual stimulus content or whether women with dyspareunia were generally slower due to other factors. Future studies in which sex-relevant and sex-irrelevant ASTs are presented in a counterbalanced order are necessary to arrive at more solid conclusions in this respect.

Although statistical analysis indicated that there were no reliable differences between women with and without dyspareunia with respect to their automatic affective associations with sex stimuli, exploratory analyses indicated that the Simon effect was only small to medium in the dyspareunia group ($f = .26$) whereas it was large in the control group ($f = .63$). This might indicate that women with dyspareunia tend more towards ambivalent automatic affective associations with sex-related stimuli rather than overtly positive associations. One way to investigate the potential ambivalence of automatic sex-related associations in women with dyspareunia would be to design a unipolar AST (neutral vs. positive; neutral vs. negative) allowing to assess positive and negative affective associations separately (cf. Vancleef et al., 2007).

In addition, it would be important to test the specificity of the present pattern of findings for women suffering from dyspareunia. It would therefore be helpful to include clinical control groups (e.g., women with lifelong vaginismus or hypoactive sexual desire disorder) in future research on this issue.

Finally, this study opens the way for future research of automatic affective sex-related associations in women with dyspareunia (or other sexual dysfunctions) by means of additional indirect measures (e.g., facial EMG, stIAT).

In sum, the present findings suggest that dysfunctional automatic associations are not critically involved in superficial

dyspareunia. Instead, our findings point to the relevance of deliberate (reflective) appraisal of sexual stimuli in the onset and maintenance of superficial dyspareunia. Following this, reappraisal of deliberate affective associations with sexual stimuli seems the most appropriate focus of therapeutic interventions.

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