Author: Brom, Mirte
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Chapter 4

Evidence for Persistence of Sexual Evaluative Learning Effects

Mirte Brom

Ellen Laan

Walter Everaerd

Philip Spinhoven

Baptist Trimbos

Stephanie Both

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Abstract

Research demonstrated that genital arousal and enhanced positive affect towards neutral stimuli due to sexual conditioning did not extinguish during a brief extinction phase. Possible resistance to extinction of conditioned human sexual response has not been studied using extensive extinction trials. Healthy sexually functional men (N= 34) and women (N=32) participated in a differential conditioning experiment, with neutral pictures as conditioned stimuli (CSs) and genital vibrostimulation as unconditioned stimulus (US). Only one CS (the CS+) was followed by the US during the acquisition phase. Men and women rated the CS+ as more positive compared to the CS- during all 24 extinction trials, and demonstrated a slight tendency to approach the CS+ directly after the extinction procedure. Participants rated the CS+ as more sexually arousing than the CS- during 20 extinction trials. No evidence was found for conditioned genital sexual response. The results provide evidence that conditioned sexual likes are relatively persistent, also at the behavioural level.

4.1. Introduction

In the aetiology of sexual dysfunction, such as paraphilia, hypersexuality and related sexual disorders, basic learning processes like classical conditioning are hypothesized to play a pivotal role. In classical conditioning, a neutral stimulus (NS) is repeatedly paired with an unconditioned stimulus (US) (Pavlov, 1927), and eventually the NS is able to trigger the same reaction as the US (Pavlov, 1927; Bindra, 1974). The NS is now called the conditioned stimulus (CS) and the reaction to the CS is called the conditioned response (CR). Research has demonstrated conditioned sexual arousal responses in animals (Pfaus et al., 2012), and recently, some notable studies have demonstrated conditioned sexual arousal responses in humans (for a review see Brom et al., 2014a). Generally, when the CS is repeatedly presented without the US, and the CS no longer predicts the aversive or appetitive outcome (Delamater, 2004), this will result in a loss of conditioned responding (i.e. *extinction*). *Extinction* learning has obvious clinical relevance, since it is thought to be the core mechanism for therapeutic interventions such as exposure therapy (Hermans et al., 2006; Rescorla, 2001; Myers, Carlezon & Davis, 2011). In therapeutic protocols, unwanted emotional responses to specific cues are lessened or inhibited by repeated or prolonged exposure to the cue in absence of the rewarding or aversive event it used to predict. In general, this results in a decrease in the magnitude or frequency of the emotional response.

As a result of classical conditioning, a CS can also acquire the hedonic valence of the US. This form of learning involves the transfer of affective value to an initially neutral stimulus as a result of its contingent presentation with (dis)liked stimuli, and is called evaluative conditioning (De Houwer, Thomas & Baeyens, 2001; Hermans et al., 2002). While in classical conditioning the CS elicits a US expectancy and CR (i.e. signal learning), in evaluative learning it is thought that the CS automatically evokes the representation of the US (Díaz, Ruiz & Baeyens, 2005). Research suggests that although extinction procedures do eliminate the expressions of US expectancy, extinction procedures do not change the expressed valence of a CS, and as a result, exposure treatment is often unsuccessful in reducing acquired subjective (dis-) likes (Baeyens, et al., 1992; de Houwer, et al., 2001). Experimental studies on conditioned sexual response demonstrated that conditioned genital responses and subjective affect do not extinguish (Both et al., 2011; Brom et al., 2014b), suggesting resistance to extinction of appetitive conditioned sexual response. This is highly clinically relevant, because when conditioned valence and possibly genital arousal are relatively resistant to extinction procedures, then a combination of extinction with some other intervention (e.g. counter conditioning) would presumably be more effective than extinction alone in the treatment of paraphilia, hypersexuality and related sexual disorders. In addition, from fear research and research on disgust it is known that affective evaluations of the CS that persist after extinction of US expectancies are associated with the return (renewal) of conditioned responses (Dirikx, et al., 2007; Hermans et al., 2005; Viar-Paxton & Olatunji, 2012). However, despite the fact that it will likely yield important knowledge about mechanisms underlying sexual motivation and related disorders such as hypo- and hypersexuality, there is only limited empirical research on conditioning of sexual arousal, and research on sexual extinction learning in humans is even scarcer. Only few studies have juxtaposed sexual conditioning in men and women in appetitive paradigms, with mixed results (Hoffmann, Janssen & Turner, 2004; Klucken et al., 2009; Brom et al., 2014b), and none of them investigated extinction of conditioned sexual responses systematically in men and women, making use of the same paradigm, using extensive extinction trials.

Evaluative conditioning paradigms differ from traditional classical conditioning paradigms and it is argued that the parametric differences explain why evaluative learning appears to be resistant to extinction (see Vansteenwegen et al., 2006). Genuine sensitivity to extinction can be observed making use of classical conditioning procedures that demonstrate conditioning of autonomic responses, as it is thought that the observed resistance to extinction in evaluative conditioning paradigms is produced by demand artifacts or consistency effects (Vansteenwegen et al., 2006). Therefore, to investigate resistance to extinction of different measures of conditioned sexual response, in the present study a differential (autonomic) conditioning paradigm was applied in sexual functional men and women. Genital vibrotactile stimulation served as US, and two neutral pictures served as CS. It was expected that after repeated pairing of the CS and US, genital blood flow would be higher following the picture that was paired with the vibrotactile stimulation (CS+), compared to following the picture that was not paired with the US (CS-). In addition, it was expected that the CS+ would elicit more positive affective value and higher subjective sexual arousal as compared to the CS-. Resistance to extinction was studied by inclusion of a large series of extinction trials (Vansteenwegen et al., 2006). Based on evaluative conditioning theory (de Houwer, et al., 2001) it was expected that genital responses and sexual arousal ratings would show a loss of conditioned responding, while valence ratings (conditioned positive affect) would show no loss. Since affect ratings may be susceptible to demand characteristics, in addition a task was included to assess implicit approach and avoidance tendencies towards the CSs (Wiers et al., 2010; Cousijn, Goudriaan & Wiers, 2011). It was predicted that repeated associations between the CS+ and the vibrotactile stimulation would result in a stronger approach tendency to this CS+, compared to other stimuli, even after a large number of extinction trials.

4.2. Method

4.2.1. Participants

In total 34 men and 32 women (all sexually active) participated in the research, of which 26 participants were students. Participants were paid (€35,-) or received course credit for their participation. Participants between the age of 18 and 45 were recruited through (online) advertisements. Because of the used stimuli, only participants with a heterosexual orientation were included. Exclusion criteria were: sexual problems, a Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV) diagnosis of an affective or psychotic disorder or abusive drug use, pregnancy or breastfeeding, a medical illness or use of medication that could interfere with sexual response, and sexual fetishes or abnormal sexual preferences. In addition, participants reporting a history of sexual abuse and related subsequent psychological problems were also excluded. Before participation all subjects received written information, including a description of the procedure, the vibrotactile stimulation, and the genital response measurement. Women were not tested during menstruation. Confidentiality, anonymity, and the opportunity to withdraw from the experiment without penalty were assured to all participants. The study was approved by the Ethical Committee of the Medical Center.

4.2.2. Design and conditioning procedure

The experimental design involved differential conditioning with one stimulus (the CS+) being followed by genital vibrostimulation (US) during the acquisition phase, whereas the other stimulus (CS-) was never followed by genital vibrostimulation. Which of the two stimuli served as the CS+ was counterbalanced across participants. During the whole experiment measurements of genital arousal were recorded. During the preconditioning-, and extinction- phases ratings of subjective affect and subjective sexual arousal were collected. For a schematic overview of the procedure see Figure 1. In the preconditioning phase, participants saw four nonreinforced presentations of the CS+ and four presentations of the CS- for 9s each. Subsequently, in the acquisition phase the contingency between CS+ and US was learned: the CS+ and CS- were presented 10 times each and the CS+ was always followed by the US. The extinction phase consisted of 24 unreinforced CS+ presentations and 24 CS- presentations. There were two random orders for each phase; with the restriction of only two successive presentations of each CS. Half of the participants saw the pictures in order 1, the other half in order 2. There was no interval between the preconditioning, acquisition, and extinction phases. During the whole procedure inter-trial intervals (ITIs) were 20, 25, or 30s. The order of the length of the ITI was random, with the restriction of only two successive lengths. The basic design for testing conditioning effects was a 2 (CS+ vs. CS-) x 24 (trial) within subjects design.

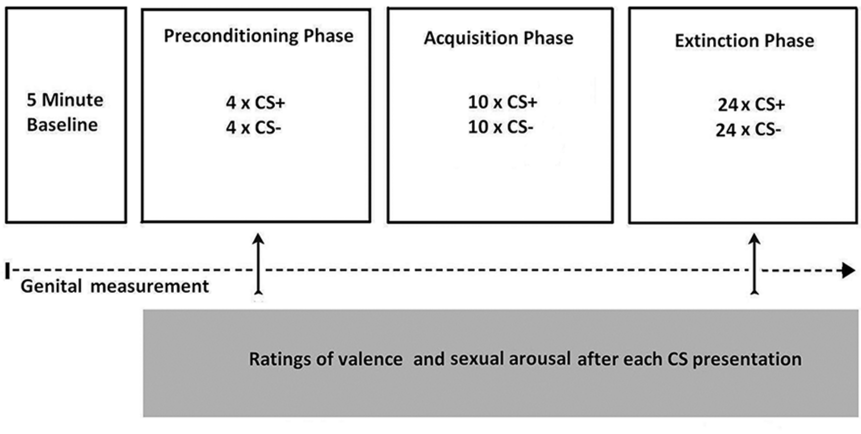

Figure 1. Schematic representation of the conditioning procedure and extinction phase.

4.2.3. Materials, Apparatus, and Recording

Stimulus Materials. Two neutral pictures of pictorial faces as used by Both et al. (2011) and Brom et al. (2014b) served as CS+ and CS-. The pictures differed with regard to details of the drawings, like the nature of the hat, and the glasses the figure was wearing. Male participants were presented with cartoon-like drawings of a female character; women were presented with cartoon-like drawings of a male character. The background and size of the pictures were equal. The CSs were shown in the middle of a computer monitor, approximately 1.5 m in front of the participant. The size of the presented pictures was 14 X 21 cm. During intervals between the pictures, a white screen was presented.

Genital vibrostimulation (US). Genital stimulation was provided only during the acquisition phase, 8s following the start of each CS+ for 2s. For male participants, the vibrotactile genital stimulation was administered by means of a ring-shaped vibrator just below the coronal ridge. For women, a small hands-off vibrator (2 cm diameter) was used (Laan & van Lunsen, 2002). The vibrator was placed on the clitoris using a lycra panty that had an opening for the vaginal plethysmograph. The participants were instructed to place the vibrator in such a way it was *most sexually stimulating*.

Male genital sexual arousal. An indium/gallium-in-rubber penile gauge assessed changes in penile circumference (Bancroft, Jones, & Pullen, 1966; Janssen, Prause, & Geer, 2007). Participants were clearly instructed to place the gauge midway along the penile shaft, making use of an instruction model. Participants were then asked to go over the instructions that were given just before, to assure that they would place the devices correctly. Changes in electrical output caused by expansion of the gauge were recorded by a continuous DC signal. The Indium-Gallium penile gauges were disinfected after each use, according to Sekusept plus disinfection procedure (MedCaT B.V.).

Women's genital arousal. Vaginal photoplethysmography assessed vaginal pulse amplitude (VPA) (Laan, Everaerd & Evers, 1995). The photoplethysmograph is a menstrual tampon-sized device containing an orange-red light source and a photocell (Manufactured by the technical support department, department of Psychology, University of Amsterdam). The light source illuminates the capillary bed of the vaginal wall and the phototransistor responds to the light backscattered by the vaginal wall and the blood circulating within it. When the signal is connected to an alternating current (AC) amplifier, vaginal pulse amplitude is measured, which reflects the phasic changes in vaginal engorgement accompanying each heartbeat, with larger amplitudes reflecting higher levels of vaginal vasocongestion. VPA is a sensitive, specific, and reliable measure of increases in vaginal vasocongestion in response to sexual stimulation (Laan & Everaerd, 1998). The VPA signal was sampled at 100Hz with a Keithley KPCI3107 A/D converter, running on a Windows2000 PC system. Depth of the probe and orientation of the light emitting diode were controlled by a device (a 6- X 2-cm plate) attached to the cable within 5 cm of the light sensor. The photoplethysmograph was disinfected at the medical centre by means of a plasma sterilization procedure between uses. Plasma sterilization is a highly effective method for the complete removal of all organic (and certain in-organic) material. Genital response was measured continuously during resting baseline, preconditioning, acquisition and extinction phases.

Subjective Ratings. Ratings of affective value, sexual arousal and US expectancy were collected during the preconditioning- and extinction phase. Participants were first asked to rate, after each CS presentation, the affective value of the CSs by answering the question "*What kind of feeling does this picture* *evoke in you*?" on a seven-point Likert scale on a keyboard that varied from *very negative* to *very positive*. Then, subjective sexual arousal was rated by answering the question "*How sexually arousing is this picture to you*?" on a seven-point scale that varied from *not sexually arousing at all* to *very sexually arousing*. The questions were presented at the monitor 1 second following the end of picture presentation. The time the question was shown was paced by the participant's response; the time to respond was maximally 11 seconds. When the participant answered the first question, the next question was presented after 15 seconds.

Approach avoidance task (AAT, see Cousijn et al., 2011; E-prime 2.0 Software, Psychology Software Tools, Inc)**.** This task assesses approach and avoidance motivational processes by requiring participants to respond to irrelevant feature of pictures by either pulling a joystick handle toward them or by pushing it away. The amount of time required to execute these actions is the dependent variable. After the extinction phase, participants were presented with the CS+ and CS- pictures from the experiment, as well as neutral pictorial objects and cartoon faces resembling the CSs. The CS+ and CS- were presented 80 times each, 40 times in push- and 40 times in pull-format. Likewise, other test trials consisted of 80 presentations of CS alike pictorial faces and 80 presentations of pictorial objects. The resulting 320 test trials were presented in semi-random order (at most three similar rotations and image categories in a row) and preceded by 15 practice trials with grey rectangles. The latency was recorded between picture onset and lever response. Literature supports the AAT's validity in measuring approach/avoidance motivational processes (Wiers et al., 2011).

The international index of erectile function (IIEF). This is a validated 15-question questionnaire that examines 4 main domains of male sexual function: erectile function (6 questions, range 0-5), orgasmic function (2 questions, range

0-5), sexual desire (2 questions, range 0-5), and intercourse satisfaction (3 questions, range 0-5). Higher scores indicate better sexual function. Psychometric properties of the IIEF are good (Rosen et al., 1997).

The female sexual function index (FSFI). Women's sexual functioning was assessed by the FSFI (Rosen et al., 2000; Ter Kuile, Brauer & Laan, 2006), consisting of six subscales: desire (two items; range 1–5), arousal (four items; range 0–5), lubrication (four items; range 0–5), orgasm (three items; range 0–5), satisfaction (three items; range 0–5), and pain (three items; range 0–5). A higher score indicates better sexual functioning. The FSFI has good internal reliability and is able to differentiate between clinical samples and nondysfunctional controls.

Exit interview. Participants were asked, among others things, about their reactions to the experimental procedure, the use of the genital device, and their evaluation of the genital vibrostimulation. For instance, participants were asked to what extent they liked the vibrostimulation. This could be rated at a 5-point scale ranging from (1) not pleasant at all, to (5) very pleasant. Likewise, participants were asked how sexually aroused they became by the vibration.

4.2.4. Procedure

After participants had given informed consent, they were tested individually by a trained experimenter of the same sex, in a sound-attenuated room. Participants were instructed that the purpose of the experiment was to measure physiological responses to different pictures and to sexual vibrotactile stimuli. They were told that during picture viewing, brief periods of vibrotactile stimulation would be provided. After instructions were given, the experimenter left the room to allow the participant to insert the vaginal probe, or place the penile gauge privately. Further instructions were given through an intercom and through written instructions on the monitor. Then a 5-minute resting period followed, during which a neutral film was played and baseline measurements of genital response were collected during the last 2 minutes. After the baseline period, the preconditioning, acquisition, and extinction phases followed. Immediately after the experimental procedure had finished and after the participant removed the genital devices and was fully dressed again, the AAT was presented in the experimental room. Lastly, after completion of this task, participants completed privately a questionnaire about demographics, sexual orientation and sexual functioning (e.g., the International Index of Erectile Function (IIEF; Rosen et al., 1997; Rosen, 1998); and the Female Sexual Function Index (FSFI; Rosen et al., 2000; Ter Kuile, Brauer & Laan, 2006). Finally, an exit interview questionnaire was administered. Participants were asked about their reactions to the experimental procedure, the use of the genital device, and their evaluation of the vibrotactile stimulus.

4.2.5. Data Reduction, Scoring and Analysis

A software program (VSRRP98) developed by the Technical Support Department of Psychology (University of Amsterdam) was used to reduce the genital data. The software program enables off-line graphical inspection of the data. Artifacts in the channel monitoring penile circumference and VPA can be caused by movements of the lower part of the body, and for VPA by voluntary or involuntary contractions of the pelvic muscles. These artifacts can be readily detected by the eye in that they show an extreme change in the signal. Artifacts in the penile circumference signal were deleted by hand, and for the VPA signal specialized build-in software was used for artifact deletion. After artifact removal, mean penile circumference or mean VPA level during the 2-minute resting baseline period was calculated. Based on previous studies (Both et al., 2011: Brom et al., 2014b) genital responses to the CSs were scored in three latency windows: during 4-8, 9-12 and 13-16 seconds following CS onset, respectively FIR (first interval response), SIR (second interval response) and TIR (third interval response). The timeframe of SIR and TIR were included to analyze genital responding during and following (expected) US delivery. For FIR, SIR and TIR, change scores were calculated for each CS presentation by subtracting mean genital resting baseline from genital measurements following CS presentation. Preconditioning and acquisition phases were both analyzed as a whole, whereas the extinction phase was analyzed in steps of 5, 10, 20 and 24 trials at a time, in order to determine thoroughly when extinction of conditioned responding occurred.

Direct gender comparison of genital responses cannot be made because of the use of different measures to assess genital response. Therefore genital data for men and women was analyzed separately, and effects were tested with repeated measures univariate analysis of variance procedures (General Linear Model in SPSS), with Stimulus and Trial as within-subject factors. Analyses of subjective measures were conducted for men and women combined, with Gender as between subjects factor. The Greenhouse–Geisser correction was applied to adjust for violation of the sphericity assumption in testing repeated measures effects. Preconditioning, acquisition, and extinction phases were analyzed separately. Effect sizes are reported as proportion of partial variance (η_p^2) (Cohen, 1988).

Data from the AAT were corrected for outliers (see Cousijn, Goudriaan & Wiers, 2011). The bias score was calculated by subtracting median approach RT from median avoid RT for each image category. The subtraction resulted in a bias score for CS+ images, CS- images, CSs alike images and neutral images for each participant. A positive bias score indicated a relatively faster approach compared to avoid RTs, whereas a negative score indicated a relatively faster avoid compared to approach RTs for the concerned image category. A positive bias score will be referred to further as an approach-bias and a negative bias score as an avoid-bias. AAT bias scores were analyzed using standard analysis of variance (ANOVA).

With a chosen *p*-value of 0.05, a power of 80% and an effect size of 0.5, a minimal number of 26 subjects was needed for within-subject effects (Cohen, 1988). Since we only explored possible gender differences, it was sufficient to include a minimum of 30 women and 30 men for these within subjects analyses.

Variable	**Men (N= 34)**		**Women (N= 32)**		
	M	**SD**	**M**	**SD**	***p***
Age (years)	23.66	4.44	26.13	7.17	*.09*
Sexual Functioning (IIEF/ FSFI-score)	36.66	6.66	27.28	3.35	
Prior experience vibrostimulation	1.71	0.91	3.38	1.26	*<.01**
Pleasantness US	2.91	1.22	3.00	0.80	*.73*
US perceived as sexually arousing	2.71	1.14	2.59	0.76	*.64*
Declared Sexual Arousal	2.06	0.92	2.16	0.88	*.66*
Strongest genital reaction	22.24	26.14	27.88	23.25	*.36*
Erotic fantasies	2.32	1.04	2.03	1.06	*.26*

Table 1. Descriptive subject variables for men and women. Notes: IIEF= *International Index of Erectile Function* (Rosen et al., 1997; Rosen, 1998); FSFI= *Female Sexual Function Index* (Rosen et al., 2000; Ter Kuile, Brauer & Laan, 2006). Questions from the Exit interview, Scales: Prior experience vibrostimulation: 1 (never) – 5 (very often); Pleasantness US: 1 (not pleasant at all) - 5 (very pleasant); US perceived as sexually arousing: 1 (not sexually arousing at all) – 5 (very sexually arousing); Declared Sexual Arousal (in response to US): 1 (no sexual arousal at all) – 5 (much sexual arousal); Strongest genital reaction in %; Erotic fantasies during the experiment: 1 (not at all) – 5 (very much); * $p < .05$.

4.3. Results

The results for men's and women's genital data are based on 31 men and 30 women. Due to error data from three male participants and one female participant was lost. In addition, an experimental error caused an invalid baseline value for one woman, resulting in outliers on all subsequent measurements in all phases. The results for the subjective ratings are based on 34 men and 32 women. With respect to the Approach and Avoidance Task, due to technical error, data of one female participant were lost. For study sample characteristics, see Table 1.

4.3.1. Genital Sexual Arousal

Preconditioning phase. Analyses were conducted to verify equal levels of penile circumference and VPA in response to the CS+ and CS- during the preconditioning phase. For all latency windows (FIR, SIR and TIR), no difference in penile circumference following presentation of the CS+ and CS- was found, all *p*s > .29. For FIR and TIR no difference in VPA following the CS+ or CS- was found, all *p*s > .32, but for TIR a significant main effect for Stimulus was found, $F(1, 28) = 4.98$, $p < .04$, $\eta_p^2 = .15$, indicating differential responding towards the CS+ and CS- in the preconditioning phase. As can be seen in Figure 3, the CS+ elicited higher VPA as compared to the CS-.

Acquisition phase. Penile circumference and VPA in response to the vibrotactile stimulation during the acquisition phase was determined in order to verify whether the sexual stimulus elicited genital responses. Genital responses in the second and third latency windows (SIR, TIR) were considered as responses to the vibrotactile stimulation.

Men. Figure 2 summarizes penile circumference (SIR) to CS+ and CS- across trials. The analysis of penile circumference in the acquisition phase revealed a main effect of Stimulus, FIR F (1, 30)= 10.74, p< .01, η_p^2 = .26, SIR F(1, 30)= 85.37, p< .01, η_p^2 = .74; TIR F(1, 30)= 8.23, p< .01, η_p^2 = .22, meaning the vibrostimulation resulted in a genital response, as can be seen in Figure 2. In line with former studies (Brom et al. 2014b; Brom et al. *under review*), penile circumference to CS- was larger as compared to CS+. No effects for Trial were observed, all *p*s> .10, and no significant 2 (Stimulus) × 10 (Trial) interaction was found, all *p*s> .38.

Women. In line with previous studies (Both et al, 2011), the 2 (Stimulus) X 10 (Trial) repeated measures ANOVA of VPA FIR during the acquisition phase revealed no significant main effect for Stimulus, p= .21. In line with the hypothesis, on SIR and TIR this analysis did yield a significant main effect for Stimulus, SIR, F(1, 28)= 4.27, p< .05, η_p^2 = .13, TIR, F(1, 29)= 21.87, p< .01, η_p^2 = .43, indicating genital responding. As can be seen in Figure 3, the vibrostimulation resulted in a genital arousal response. On TIR also an interaction for Stimulus X Trial was seen, F(4, 124)= 3.17, p< .02, η_p^2 = .10, indicating differentiation between genital responding to CS+ plus vibrostimulation and CS- over trials.

Extinction phase.

Men. As can be seen in Figure 2, men showed no increase of differential responding towards CS+ and CS- after the acquisition phase. Analysis of penile circumference during the preconditioning phase (Mean precon trial 1-4) and the first extinction trial, yielded no interaction effect for Stimulus X Trial, all *p*s> .19. Analysis of the first extinction trial, yielded no significant main effect for Stimulus, all *p*s> .30, indicating no conditioned responding. Analysis of the first five extinction trials yielded no significant main effect for Stimulus on all time latencies, all ps > .24. In addition, no main effect for Trial was detected, all ps > .54, and subsequently, no interaction effect for Stimulus X Trial, all ps > .64. This indicates that there was no difference in penile responding towards the CS+ and CS-, and the pattern of responding did not change across extinction trials. Subsequent analyses of 10, 20 and 24 extinction trials neither yielded significance for Stimulus, Trial or Stimulus X Trial, all ps > .21

Women. As can be seen in Figure 3, women showed no increase of differential responding towards CS+ and CS- after the acquisition phase. Analysis of VPA during the preconditioning phase (Mean precon trial 1-4) and the first extinction trial, yielded no interaction effect for Stimulus X Trial, FIR $p = .99$, SIR $p = .68$, TIR $p = .24$. Analysis of the first extinction trial revealed no significance for Stimulus on FIR, $p = .75$, and SIR, $p = .78$, but revealed a trend for Stimulus on TIR, $F(1, 29) = 3.36$, $p < .08$, indicating slight differential responding towards the CS+ and CS- on this first extinction trial. However, analysis of the first five extinction trials yielded no significant main effect for Stimulus on all time latencies, all ps > .33, indicating no conditioned responding. In addition, no main effect for Trial was detected, all ps > .69. Not surprisingly, subsequent analyses of 10, 20 and 24 extinction trials neither yielded significance for Stimulus, Trial or Stimulus X Trial, all ps > .14.

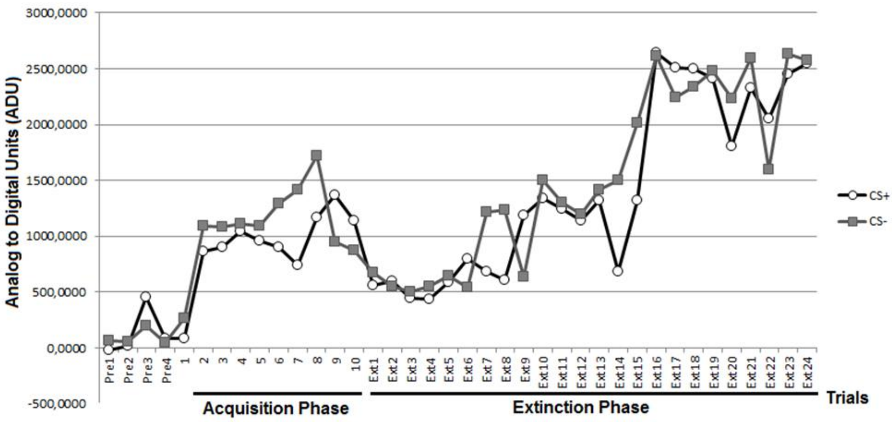

Figure 2. Mean penile circumference change scores during the third interval response window (TIR) following CS+ and CS- during the preconditioning phase, acquisition phase and extinction phase. Note that during the acquisition phase, the response represents responding to the CS+ plus the US. [2]

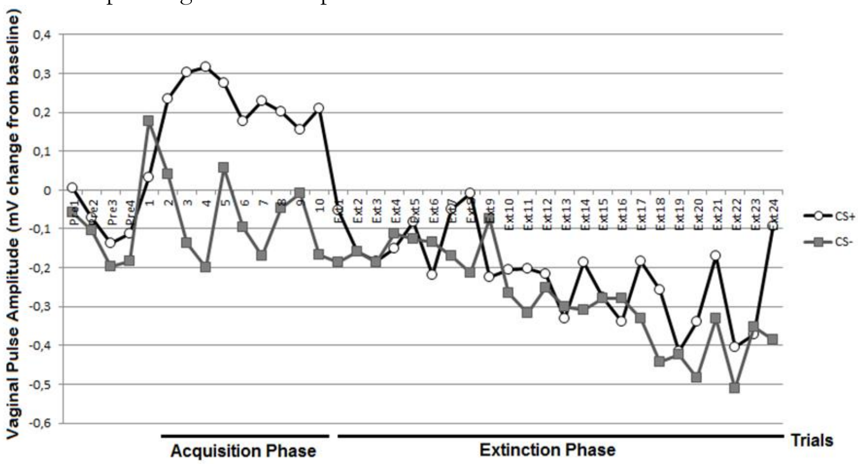

Figure 3. Mean vaginal pulse amplitude (VPA) change scores during the third interval response window (TIR) following CS+ and CS- during the preconditioning phase, acquisition phase and extinction phase. Note that during the acquisition phase, the response represents responding to the CS+ plus the US.

[2] Since not all indium-gallium gauges could be calibrated before data collection, results were calculated in digital output units.

4.3.2. Subjective Measures

Preconditioning phase. The 2 (Stimulus) X 4 (Trial) X 2 (Gender) repeated measures ANOVA was conducted to verify equal levels of subjective responses to the CS+ and CS- during the preconditioning phase. For affective value and subjective sexual arousal, no difference in responding following presentation of the CS+ and CS- was found between men and women, all *p*s > .17.

Extinction Phase.

Subjective Affect. As can be seen in Figure 4, men and women showed an increase of differential responding towards CS+ and CS- after the acquisition phase. Analysis of the affective value ratings during the preconditioning phase (Mean precon trial 1-4) and the first extinction trial, revealed a significant interaction effect for Stimulus X Trial, $F(1, 59)= 28.76$, $p< .01$, $\eta_p^2 = .33$. No differences were seen between men and women, reflected by the non-significant Stimulus X Trial X Gender interaction, $p= .36$. In line with the hypothesis, the analyses of the first five extinction trials yielded a significant main effect for Stimulus, $F(1, 58)= 26.72$, $p< .01$, $\eta_p^2 = .32$, indicating conditioning effect. Men and women showed stronger positive affect towards the CS+ after the acquisition phase. This 2 (Stimulus) X 5 (Trial) X 2 (Gender) repeated measures ANOVA yielded also a significant interaction effect for Stimulus X Trial, $F(3, 187)= 2.80$, $p< .04$, $\eta_p^2 = .05$, indicating extinction effect. No differences in differential responding were seen between men and women, as reflected by the non-significant interaction effects for Stimulus X Gender, $p= .41$, and Stimulus X Trial X Gender, $p= .58$. Analysis of the first 10 extinction trials yielded a main effect for Stimulus, $F(1, 58)= 20.22$, $p< .01$, $\eta_p^2 = .26$, and for Stimulus X Trial, $F(6, 372)= 3.20$, $p< .01$, $\eta_p^2 = .05$. Again, no differences between men and women were seen, Stimulus X Gender, $p= .77$; Stimulus X Trial X Gender, $p= .21$. This indicates that up to 10 extinction trials men and women showed more positive affect towards the CS+. However, as reflected by the significant Stimulus X Trial interaction, this difference in rated subjective affect between CS+ and CS- gradually decreased across extinction trials. Subsequent analysis of the first 20 extinction trials also yielded a main effect for Stimulus, $F(1, 53)= 9.75$, $p< .01$, $\eta_p^2 = .16$, and for Stimulus X Trial, $F(11, 575)= 3.17$, $p< .01$, $\eta_p^2 = .06$. The interaction for Stimulus X Trial X Gender, approached significance, $F(11, 575)= 1.75$, $p= .06$. Analysis of all 24 extinction trials still revealed a main effect for Stimulus, $F(1, 37)= 6.36$, $p< .02$, $\eta_p^2 = .15$, indicating conditioned responding during 24 extinction trials, and for Stimulus X Trial, $F(11, 391)= 1.96$, $p< .04$, $\eta_p^2 = .05$, indicating a reduction of differential responding towards the CS+ and CS-. Again, a trend was seen for the interaction Stimulus X Trial X Gender, $F(11, 391)= 1.62$, $p= .09$. Additional analysis of the first extinction trial, revealed a main effect for Stimulus, $F(1, 61)= 27.77$, $p< .01$, $\eta_p^2 = .31$, with no differences between men and women, $p= .13$, whereas analysis of the last extinction trial did only yield a trend for Stimulus, $p< .07$, with again no differences between men and women, $p= .35$.

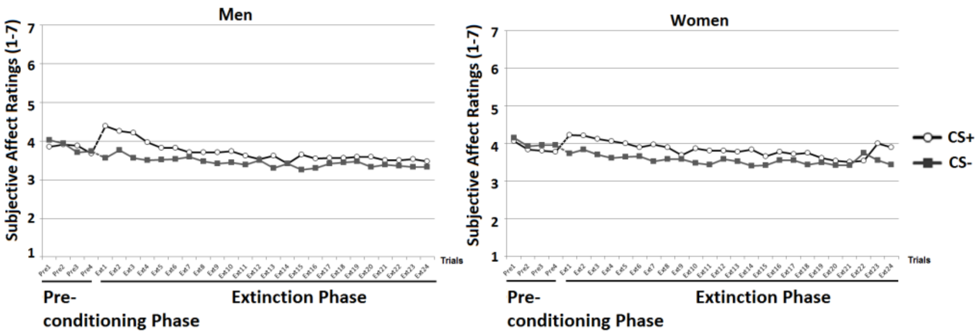

Figure 4. Subjective affect ratings following the CS+ and CS- during the preconditioning phase and extinction phase for men (left) and women (right).

Subjective Sexual Arousal. Figure 5 shows the ratings of subjective sexual arousal across all trials. In line with the expectations, analysis of the first extinction trial, revealed a main effect for Stimulus, $F(1, 64)= 11.32$, $p< .01$, $\eta_p^2 = .15$, with no differences in this conditioned responding between men and women, $p= .49$. Analysis of the ratings of subjective sexual arousal during the preconditioning phase (Mean precon trial 1-4) and the first extinction trial, revealed a main effect for Stimulus, $F(1, 64)= 14.84$, $p< .01$, $\eta_p^2 = .19$, and an interaction effect for Stimulus X Trial, $F(1, 64)= 15.49$, $p< .01$, $\eta_p^2 = .20$. No differences were seen between men and women, reflected by the non-significant Stimulus X Gender and Stimulus X Trial X Gender interactions, both *p*s> .50. In line with the hypothesis, the analyses of the first five extinction trials yielded a significant main effect for Stimulus, $F(1, 61)= 8.32$, $p< .01$, $\eta_p^2 = .12$, indicating conditioning effect. Men and women showed stronger subjective sexual arousal towards the CS+ after the acquisition phase. This 2 (Stimulus) X 5 (Trial) X 2 (Gender) repeated measures ANOVA did not yield a significant interaction effect for Stimulus X Trial, only a trend was seen, $F(3, 175)= 2.48$, $p< .07$, indicating no extinction of conditioned responding. No differences in differential responding were seen between men and women, as reflected by the non-significant interaction effects for Stimulus X Gender, $p = .38$, and Stimulus X Trial X Gender, $p = .57$. Analysis of the first 10 extinction trials also yielded a main effect for Stimulus, $F(1, 60) = 7.83$, $p < .01$, $\eta_p^2 = .12$. No significant interaction effect was found for Stimulus X Trial, $p = .11$, indicating no extinction of conditioned differential responding towards the CS+ and CS-. Again, no differences between men and women were seen, Stimulus X Gender, $p = .62$; Stimulus X Trial X Gender, $p = .18$. This indicates that up to 10 extinction trials men and women declared to find the CS+ more sexually arousing as compared to the CS-. Analysis of the first 20 extinction trials also yielded a main effect for Stimulus, $F(1, 57) = 4.22$, $p < .05$, $\eta_p^2 = .07$. Now also a significant interaction effect for Stimulus X Trial was seen, $F(6, 143) = 2.39$, $p = .02$, $\eta_p^2 = .04$, indicating extinction of conditioned responding. Again, no differences between men and women were seen, all *p*s > .18. Finally, analysis of all 24 extinction trials did not yield a main effect for Stimulus anymore, $p = .15$, nor for Stimulus X Trial, $p = .16$, indicating that over all 24 extinction trials no conditioned responding could be detected. No differences were seen between men and women, all *p*s > .65. Analysis of the last extinction trial did also not yield significance for Stimulus, $p = .11$, indicating no differential responding on this last extinction trail towards the CS+ and the CS-, with no differences therein between men and women, $p = .29$.

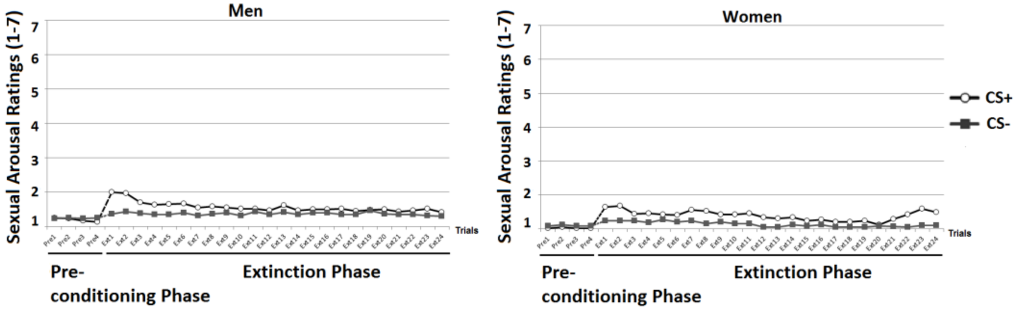

Figure 5. Ratings of subjective sexual arousal following the CS+ and CS- during the preconditioning phase and extinction phase for men (left) and women (right).

4.3.3. Approach Avoidance Tendencies

Differences in AAT bias scores were analysed with mixed ANOVA with Gender as between-subject factor and Image as within-subject factor (CS+, CS-, CS alike and neutral objects). A trend was found for Image, *F*(3, 168)= 2.39, *p*< .08, η_p^2 = .04, suggesting that participants differed in approach and avoidance tendencies towards the different stimuli. No differences therein were seen between men and women, as reflected by the non-significant Image X Gender interaction, *p*=.65.

In additional analysis, CS+ bias scores were compared with the bias scores of CS-, CS alike and Neutral images. Since multiple comparisons are done, tests were conducted using Bonferroni adjusted alpha levels of *p*<.017 (.05/3). The analysis yielded no difference between CS+ bias scores and CS- bias scores, *p*= .32, with no differences therein between men and women, *p*= .78. Likewise comparison between CS+ and CS-alike bias scores neither yielded significance for Stimulus, *p*= .51, with no difference between men and women, *p*= .63. However, the analysis of CS+ and Neutral images yielded a strong trend for Stimulus, F(1, 63)= 5.26, *p*= .02, η_p^2 = .08, indicating that participants were slightly faster in approaching CS+ images as compared to neutral images, see Figure 6.

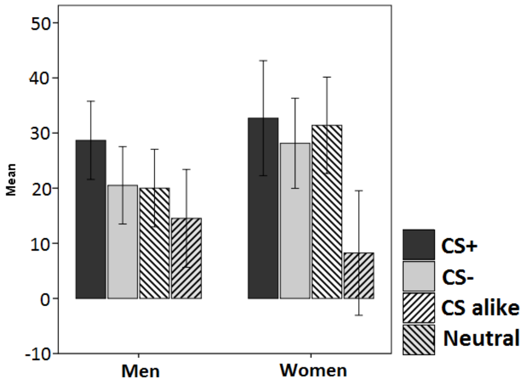

Figure 6. Mean Approach Avoidance Task (AAT) bias score for CS+, CS-, CS alike and neutral images in men and women (ms with standard error bars). A positive score indicates faster reaction times on pull (approach) trials compared to push (avoid) trials.

4.4. Discussion

The present study provides evidence that sexual evaluative learning effects are difficult to modify through the procedure of extinction, at least in an appetitive sexual paradigm, in healthy sexually functional men and women. The results revealed that extinction trials eventually reduced subjective sexual arousal towards the CS+. Importantly, appetitively conditioned subjective affect and approach tendencies towards the CSs, seem to be even more persistent. These findings are consistent with prior research suggesting that acquired likes and dislikes are resistant to extinction (Vansteenwegen et al., 2006; Gawronski, Gast & de Houwer, 2014). The results from the AAT demonstrated that the pairing of the CS+ with the sexual vibrotactile stimulus did still result in slight approach tendencies towards this CS+ in men and women, even after a very extensive extinction phase. Apparently the CS+ retained sexual affective value to elicit approach. It is highly reasonable that the AAT measured learned evaluative sexual likes that survived extinction, as participants 'knew' that the US would not be presented during this task since all genital devices were removed before completion of this task. Therefore, the observed slight approach tendencies towards the CS+ must have been due to its hedonic value rather than its predictive value.

The absence of a conditioning effect for the genital measure does not hamper any conclusions about the persistence of sexual evaluative learning effects. The absent conditioned genital arousal response that was observed in men is in line with former research from our lab (Brom et al., 2014b). It seems that the combination of neutral CSs and a vibrotactile US is insufficient to elicit conditioned genital sexual responding in men. However, surprisingly, women also did not show robust genital conditioned response in the present study. This is remarkable, given that similar parameters to those of previous research were used (Both et al., 2008, Both et al., 2011; Brom et al. 2014b). Although there is no clear explanation for this, it should be mentioned that sexually conditioned responses have generally been found to be small (O'Donohue & Plaud, 1994; Hoffmann, Janssen & Turner, 2004). Nevertheless, future studies may provide further evidence for the hypothesis that sexual evaluative conditioning is indeed distinct from other forms of sexual conditioning by using sexually relevant pictures as CSs instead of neutral pictures, so as to increase the chances of observing genital conditioning effects in men and women. In a previous study (Brom et al., 2014b), making use of the same paradigm but with sexually relevant CSs as the only difference, robust conditioned genital and subjective sexual arousal and subjective value was observed in men. Future studies should investigate how persistent conditioned genital responses are and to what extent and in which period of time they eventually will (or will not) extinguish.

Although this study highlights the potential shortcoming of extinction in reducing learned sexual likes, there are some limitations of this study that must be considered before definitive inferences can be made. First, it is possible that the observed absence of conditioning effect and subsequent extinction effect of the genital measure is due to measurement error rather than a genuine lack of conditioning. For future studies it would be interesting to include a between subjects (unpaired) control group. With such a control group one can determine even more precisely whether and what learning has occurred. For instance, the possibility of sensitization of sexual arousal would translate into increased genital responses across trails, and not in differential responding towards the CS+ and CS- per se (Domjan, 2010; Hoffmann, et al., 2014). Second, the AAT was administered at the end of the experimental conditioning procedure. It is therefore unclear whether the results would have been different when the task was administered before or after acquisition, or after extinction. Third, no subjective measure of US expectancy was included in the present study. Earlier research (Brom et al., 2014b) revealed that different response systems do not always behave in synchrony with each other in a sexual conditioning procedure: US expectancy, subjective sexual arousal and subjective affect may go hand in hand during this process of conditioning in men, whereas in women subjective sexual arousal does not seem to increase affective value, or vice versa. And lastly, and clinically relevant, the present study investigated only newly acquired sexual evaluative learning and relatively short-term effects within one experimental session.

Despite these limitations, former research on conditioned sexual response has not incorporated such extensive extinction manipulations. Findings from the present study and from earlier research (Brom et al., 2014b) suggest that although an extinction procedure may reduce the CS-US contingency, learned sexual evaluations may be difficult to modify through this procedure. Therefore, in the treatment of sexual disorders with a learned component, like hypersexuality or paraphilia, unwanted but persistent subjective sexual evaluations may be better targeted by interventions such as counterconditioning or the deployment of emotion regulation strategies. In counterconditioning, the CS is paired with a stimulus evoking a response that is incompatible with the original unconditioned response, thereby altering the valence of a stimulus (Baeyens, et al., 1992). Although the effects of counterconditioning on evaluative learning has received little attention in the literature, research on appetitive conditioning in the domain of food stimuli has shown that counterconditioning is more effective than extinction alone in changing evaluations of the CS (Van Gught et al., 2010). In addition, research on the deployment of an emotion regulation strategy (i.e. attentional deployment) during sexual conditioning, demonstrated that emotion down-regulation affected extinction of conditioned evaluative sexual learning effects in men, and in women down-regulation resulted in attenuated conditioned approach tendencies towards the CSs (Brom et al., 2015b).

Quite intriguing is the finding that making use of exact the same procedure, but with a painful stimulus as US and erotic pictures as CSs, in a parallel aversive sexual conditioning paradigm, sexual evaluative learning effects were not difficult to modify through the procedure of extinction (Brom et al., 2015a*)*. In that study, next to attenuated female genital and subjective sexual arousal towards the CS+ on the first few extinction trials, men and women showed less positive affect towards the CS+ up to 10 extinction trials. However, for all measures extinction of conditioned responding was seen within 10 extinction trials, and no conditioned behavioural avoidance tendencies were seen towards the CS+ after the extinction phase. This suggests that appetitive and aversive sexual extinction learning seem to encompass distinct processes and are not organized in the same fashion. Research has demonstrated appetitive - aversive interactions in dopamine neurons in the brain reward system: when a neuron is excited by an aversive CS it is inhibited by an appetitive CS or vice versa (Matsumoto & Hikosaka, 2009; Bouton & Peck, 1992; Nasser & McNally, 2012). In addition, recruitment of the relevant motivational system (appetitive vs aversive) is dependent on the US. Painful stimulation (e.g. electric shock) can selectively activate the aversive system, whereas sexual stimulation (e.g. genital vibrostimulation) will activate the appetitive system. However, since erotic pictures were used as CSs in the parallel aversive study (Brom et al., 2015a), these pictures most likely automatically recruited the appetitive motivational system. In addition, the painful stimulation that served as US most likely recruited the aversive motivational system. Since the two motivational systems oppose each other, a CS which excites one motivational system will inhibit the other. In other words, a conditioned excitor of one motivational system is functionally equivalent to a conditioned inhibitor of the other, and prior appetitive sexual learning could have interfered or augmented sexual aversive learning (Nasser & McNally, 2012). In the present study neutral pictures were used as CSs, and as a consequence, only the appetitive motivational system was recruited by the US, and no prior learning interfered with CR acquisition. The question remains if the mechanisms described here would be effective in clinical practice in the treatment of sexual motivation disorders such as female sexual interest/arousal disorder or sexual aversion. Likewise, it will be of interest to investigate counterconditioning in sexual motivation disorders at the other end of the spectrum, such as hypersexuality or paraphilia. Early studies on the 'treatment' of homosexuality or undesired sexual behaviours have applied counterconditioning procedures in order to shape sexual behaviour (see Brom et al., 2014a for a review). Although these uncontrolled (case) studies yielded mixed results, it would be of interest to systematically investigate the effect of counterconditioning on appetitively learned sexual evaluative effects, in healthy participants but eventually also in clinical samples. Like applied in fear research and treatment (Wolpe, 1968), counter conditioning in the treatment of paraphilia for instance, would consist of encouraging patients to visualize or imagine the targeted sexually-arousing stimulus while pairing this stimulus with an aversive stimulus (e.g. an aversive smell, a loud noise or a disgusting (mental) image) until eventually the most sexually arousing image no longer yields sexual response, also at the evaluative level. These possible mechanisms in changing unwanted sexual CRs remain important directions for future research, including the neural mechanisms for appetitive-aversive interactions that are poorly understood, as it will likely yield important knowledge which may help in the development of clinical treatments for maladaptive sexual behaviours, including paraphilias and deviant sexual preferences that manifest perturbed motivation, but also for the more prevalent sexual desire and arousal disorders.

References

Baeyens, F., Eelen, P., van den Bergh, O., & Crombez, G. (1992). The content of learning in human evaluative conditioning: Acquired valence is sensitive to US-revaluation. *Learning and Motivation*, 23, 200–224.

Bancroft, J. H. J., Jones, H. G., & Pullen, B. R. A. (1966). A simple transducer for measuring penile erection with comments on its use in the treatment of sexual disorder. *Behavior Research & Therapy* 4: 239–241.

Bindra, D. (1974). A motivational view of learning, performance, and behavior modification. *Psychological Review* 81: 199–213.

Both S, Brauer M, Laan E (2011) Classical conditioning of sexual response in women: a replication study. *Journal of Sexual Medicine* 8: 3116–3131.

Both S, Laan E, Spiering M, Nilsson T, Oomens, S, et al (2008) Appetitive and aversive classical conditioning of female sexual response. *Journal of Sexual Medicine* 5: 1386–1401.

Bouton, M. E., & Peck, C. A. (1992). Spontaneous recovery in cross-motivational transfer (counterconditioning). *Animal Learning & Behavior* 20; 313-321.

Brom M., Both S, Laan E, Everaerd W, Spinhoven, P. (2014a) The role of conditioning, learning and dopamine in sexual behavior: A narrative review of animal and human studies *Neuroscience & Biobehavioral Reviews* 38: 38–59.

Brom, M., Laan, E., Everaerd, W., Spinhoven, P., & Both, S. (2014b). Extinction and renewal of Conditioned sexual responses. *PloS ONE* 8; e105955.

Brom, M., Laan, E., Everaerd, W., Spinhoven, P., & Both, S. (2015a). Extinction of Aversive Classically Conditioned Human Sexual Response. *Journal of Sexual Medicine* 12, 916–935.

Brom, M., Laan, E., Everaerd, W., Spinhoven, P., Cousijn, J. & Both, S. (2015b). The influence of emotion down-regulation on the expectation of sexual reward. *Behavior Therapy*, 46, 379–394.

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.), New Jersey: Lawrence Erlbaum Associates.

Cousijn J, Goudriaan AE, Wiers RW (2011). Reaching out towards cannabis: approach-bias in heavy cannabis users predicts changes in cannabis use. *Addiction*, 106: 1667–1674.

De Houwer, J., Thomas, S., & Baeyens, F. (2001). Associative learning of likes and dislikes: A review of 25 years of research on human evaluative conditioning. *Psychological Bulletin*, 127, 853–869.

Delamater AR (2004) Experimental extinction in Pavlovian conditioning: behavioural and neuroscience perspectives. *Quarterly Journal of Experimental Psychology: Comparative and Physiological Psychology* 57: 97–132.

Diaz, E., Ruiz, G., & Baeyens, F. (2005). Resistance to extinction of human evaluative conditioning using a between-subjects design. *Cognition & Emotion*, 19, 245–268.

Dirikx, T., Hermans, D., Vansteenwegen, D., Baeyens, F., & Eelen, P. (2007). Reinstatement of conditioned responses in human differential fear conditioning. *Journal of Behavior Therapy and Experimental Psychiatry*, 38, 237–251.

Domjan M. (2010). The principles of learning and behavior (6thed.). Belmont, CA: Wadsworth Cengage Publishing.

Gawronski, B., Gast, A., & De Houwer, J. (2014). Is evaluative conditioning really resistant to extinction? Evidence for changes in evaluative judgments without changes in evaluative representations. *Cognition and Emotion*, DOI: 10.1080/02699931.2014.947919.

Hermans, D., Craske, M. G., Susan Mineka, S., Lovibond. P. F. (2006). Extinction in Human Fear Conditioning. *Biological Psychiatry* 60: 361-368.

Hermans, D., Vansteenwegen, D., Crombez, G., Baeyens, F., & Eelen, P. (2002). Expectancy-learning and evaluative learning in human classical conditioning: Affective priming as an indirect and unobtrusive measure of conditioned stimulus valence. *Behaviour Research and Therapy*, 40, 217–234.

Hermans, D., Dirikx, T., Vansteenwegen, D., Bayens, P., Van den Bergh, O., & Eelen, P. (2005). Reinstatement of fear responses in human aversive conditioning. *Behaviour Research and Therapy*, 43, 533–551.

Hoffmann, H., Goodrich, D., Wilson, M., & Janssen, E. (2014). The role of classical conditioning in sexual compulsivity: a pilot study. *Sex Addict Compulsivity* 2014; 21, 75-91.

Hoffmann, H., Janssen, E., & Turner, S.L. (2004). Classical conditioning of sexual arousal in women and men: effects of varying awareness and biological relevance of the conditioned stimulus. *Archives of Sexual Behavior*; 33: 43–53.

Janssen, E. (Ed). (2007). *The Psychophysiology of Sex*. Bloomington, IN: Indiana University Press.

Janssen E, Prause N, Geer J (2007). The sexual response system. In: Cacioppo JT, Tassinary LG, Berntson, GG (Eds.), Handbook of Psychophysiology, ed. New YorkCambridge University Press.

Klucken, T., Schweckendiek, J., Christian, J., Merz, C.J., Tabbert, K., Walter, B., Kagerer, S., Vaitl, D., Stark, R. (2009). Neural activations of the acquisition of conditioned sexual arousal: effects of contingency awareness and sex. *Journal of Sexual Medicine*; 6, 3071–3085.

Kuile, ter, M.M., Brauer, M., & Laan, E. (2006).The female sexual function index (FSFI) and the Female sexual distress scale (FSDS): Psychometric properties within a Dutch population. *Journal of Sex & Marital Therapy* 32. 289-304.

Laan, E., & Everaerd, W. (1998). Physiological measures of vaginal vasocongestion. *International Journal of Impotence Research*, 10, S107– 110, 124–125.

Laan E, Everaerd W, Evers A, (1995). Assessment of female sexual arousal: response specificity and construct validity. *Psychophysiology* 32: 476–485.

Laan, E., & van Lunsen, R. H. W. (2002). Orgasm latency, duration and quality in women: Validation of a laboratory sexual stimulation technique. Poster presented at 28th Conference of the International Academy of Sex Research, Hamburg, Germany.

Matsumoto, M., & Hikosaka, O. (2009). Two types of dopamine neuron distinctly convey positive and negative motivational signals. *Nature* 459; 837– 841.

Myers KM, Carlezon WA, Davis M (2011). Glutamate receptors in extinction and extinction-based therapies for psychiatric illness. *Neuropsychopharmacology* 36: 274-293.

Nasser, H. M., & McNally, G. P. (2012). Appetitive-Aversive interactions in Pavlovian fear conditioning. *Behavioral Neuroscience* 126; 404-422.

O'Donohue WT, Plaud JJ (1994). The conditioning of human sexual arousal. Arch Sex Behav 23: 321–344.

Pavlov, I. (1927). Conditioned Reflexes. Oxford, UK Oxford Univ. Press.

Pfaus, J. G., Kippin, T. E., Coria-Avila, G. A., Gelez, H., Afonso, V. M., Ismail, N., & Parada, M. (2012). Who, what, where, when (and maybe even why)? How the

experience of sexual reward connects sexual desire, preference, and performance. *Archives of Sexual Behavior* 41; 31-62.
Prause N, Janssen E. (2006). Blood flow: Vaginal photoplethysmography. In: Goldstein I, Meston CM, Davis S, Traish A, eds. Women's sexual function and dysfunction. London: Taylor & Francis Medical Books, 359–367.
Rescorla RA (2001). Retraining of extinguished Pavlovian stimuli. *Journal of Experimental Psychology: Animal Behavior Processes* 27: 115–124.
Rosen, R. C., Riley, A., Wagner, G., Osterloh, I. H., Kirkpatrick, J., Mishra, A. (1997). The international index of erectile function (IIEF): a multidimensional scale for assessment erectile dysfunction of erectile dysfunction. *Urology* 49: 822-830.
Rosen R. (1998). Sexual function assessment in the male: physiological and self-report measures. *International Journal Impotence Research* 10: 59-63.
Rosen, R., Brown, C., Heiman, J., Leiblum, S., Meston, C., Shabsigh, R., Ferguson, D., D'Agostino, R. (2000). The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. . *Journal of Sex & Marital Therapy* 26: 191-208.
Van Gucht, D., Baeyens, F., Vansteenwegen, D., Hermans, D., & Beckers, T. (2010). Counterconditioning reduces cue-induced craving and actual cue-elicited consumption. *Emotion*, 10, 688–695.
Vansteenwegen, D., Francken, G., Vervliet, B., De Clercq, A., & Eelen, P. (2006). Resistance to extinction in evaluative conditioning. *Journal of Experimental Psychology: Animal Behavior Processes* 32: 71–79.
Viar-Paxton, M. A., & Olatunji, B. O. (2012). Context effects on habituation of disgust-relevant stimuli. *Behavior Modification*, 36, 705–722.
Wiers, R.W., Eberl, C., Rinck, M., Becker, E.S., Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science* 22: 490–497.
Wolpe, J. (1968). Psychotherapy by reciprocal inhibition. *Conditional reflex: a Pavlovian journal of research & therapy* 3, 234-240.