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Up-regulating Sexual Arousal and Down-regulating Disgust while Watching Pornography: Effects on Sexual Arousal and Disgust

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ABSTRACT
Sexual response occurs when sexual excitatory factors outweigh inhibitory factors. Problems with sexual arousal may occur when sexual excitement is too low and/or inhibitory influences such as feelings of disgust are too strong. To explore interventions that may help overcome decreased sexual responding, we examined if sexual responding could be amplified by instructions to up-regulate sexual arousal and/or down-regulate disgust. Women with no sexual difficulties (N = 255; μage = 20.55; SD = 2.23) were randomly assigned to a sexual arousal up-regulation, disgust down-regulation, or passive control condition. Participants were instructed to use the assigned regulation strategy while viewing pornography. To prevent floor effects due to low disgust responsivity in a non-clinical sample, half of the participants were presented with a prime that was designed to make the contaminating properties of sex more salient. Instruction to up-regulate sexual arousal successfully enhanced feelings of sexual arousal in the unprimed group, yet the increase in sexual arousal was not paralleled by reductions in feelings of disgust. Instruction to down-regulate disgust successfully decreased disgust; however, this decrease was not paralleled by increases in sexual arousal. Overall, findings indicate that emotion regulation techniques could facilitate affective control in sexual contexts.

Sexual stimuli can elicit sexual excitation, but also negative emotions (Laan & Everaerd, 1995). According to information processing models of sexual arousal (Janssen et al., 2000; Laan & Janssen, 2007) whether or not a sexual stimulus can trigger a full-blown sexual response largely depends on the appraisal of sexual stimuli, determined by an interaction of memory, regulatory, and attentional processes (Spiering et al., 2004). As such, due to social learning, the appraisal of sexual stimuli is under a strong social influence, including social beliefs and group norms. Indeed, people’s attitudes toward sex, including their subjective appreciation of sexual stimuli, can vary widely. Thus, although most people have expectations of pleasure and enjoyment in response to sexual stimuli, others, under the same circumstances, may experience negative emotions, such as fear or disgust. Some people may even report feelings of ambivalence toward sexual stimuli, where a mix of positive emotions and negative emotions occurs simultaneously, and this ambivalence does not exclude the occurrence of subjective sexual arousal (Borg, de Jong, et al., 2014; Peterson & Janssen, 2007). For instance, pornography use may be associated with both pleasure, and a sense of guilt, shame, moral disapproval, or even disgust with one’s behavior (e.g., Fisher et al., 2019; Grubbs & Perry, 2019; Kraus et al., 2020; Marques, 2018; Mosher & MacIlan, 1994).

While the ability to become sexually aroused is a key factor in pleasurable sexual behavior, the mere presence of sexual excitatory stimuli may not be sufficient to ensure that a sexual response will follow. The Dual Control Model proposes that a sexual response involves a balance between sexually excitatory (e.g., sexually arousing stimulus) and inhibitory factors (e.g., contamination threat) that facilitate or hinder sexual functioning (Bancroft et al., 2009; Bancroft & Janssen, 2000). In that sense, a sexual response occurs when sexual excitation outweighs sexual inhibition (Bancroft et al., 2009).

Emotions are potent forces that can influence sexual behavior directly by strengthening or weakening feelings of sexual arousal and sexual desire (Graham, 2010). Indeed, the inability to successfully modulate emotional experiences (i.e., emotion dysregulation) was found to predict risky sexual behavior in women (e.g., failure to use condoms, having sex with someone under the influence of drugs or alcohol; Messman-Moore et al., 2010). Experiencing strong sexual desire is associated with positive emotions and feelings, such as high satisfaction with current sexual relationships and affection (Carvalho & Nobre, 2011). Yet, negative emotions like shame (e.g., related to low self-perceived attractiveness or performance), fear (e.g., of genital pain), performance anxiety, or disgust (e.g., associated with signals of contamination threat) may impede the development of sexual arousal and desire (Bancroft et al., 2009). Relatively, the emotions of fear (Payne et al., 2005), pain (ter Kuile et al., 2010), and disgust (Borg et al., 2010) have been implicated in the etiology of female sexual dysfunctions. Specifically, disgust has been implicated in genito-pelvic pain/penetration disorder, where heightened disgust responsivity appeared to be a defining feature (Borg et al., 2010).

Disgust has evolved as a defensive mechanism, with the main function of protecting the body against contamination,
and thus is associated with avoidance behaviors (Rozin et al., 1995). In that sense, experiencing disgust in response to a stimulus, or appraising a stimulus as disgusting, signals (contamination) threat and prompts behavioral avoidance. Since some body parts and products involved in sexual stimulation are highly susceptible to contamination when on one’s own body, and have high disgust potency when on someone else’s body, it should come as no surprise that organs such as the mouth, penis, vagina and the corresponding bodily fluids can be strong disgust elicitors (Rozin & Fallon, 1987; Rozin et al., 1995). Indeed, brain networks activated by visual sexual stimuli show substantial overlap with brain networks activated by disgust stimuli (Borg, de Jong, et al., 2014, Karama et al., 2011). Experiencing sex-related disgust is associated with the presence of sexual problems in women (van Overveld et al., 2013), and in the absence of sexual arousal, women may respond with disgust to penetration stimuli (Borg, Georgiadis, et al., 2014). Yet, the feelings of disgust and disgust-induced avoidance weaken following induction of sexual arousal in women (Borg & de Jong, 2012). Nonetheless, people show large differences in their tendency to respond with disgust (propensity), and in their appraisal of disgust experiences (sensitivity), including in response to sexual stimuli. This suggests that even though feelings of disgust may contribute to the subjective appreciation of sexual stimuli, there are other possible pathways that can influence sexual response.

According to the model proposed by de Jong et al. (2013), sexual arousal and disgust play mutually opposing roles in the development of sexual responses, such that sexual arousal levels can counteract the effects of disgust and vice versa (de Jong et al., 2013). In this way, depending on trait and state characteristics of an individual, sexual stimuli may be regarded as sexually arousing or disgusting (Bancroft et al., 2009; de Jong et al., 2013). Thus, the balance between elicited feelings of sexual arousal and disgust in response to a sexual stimulus determines the behavioral outcome, be it sexual arousal-induced approach or disgust-induced avoidance (Ariely & Loewenstein, 2006; Borg & de Jong, 2012; Stevenson et al., 2011). Since prolonged exposure to disgust stimuli is the most effective way to reduce experienced disgust, disgust-induced avoidance that inhibits sexual approach could contribute to a vicious cycle of avoidance of sexual stimuli, promoting the development of sexual problems (cf. de Jong et al., 2013). From this perspective, amplification of sexual arousal and/or reduction of disgust in response to sexual stimuli using emotion regulation strategies (i.e., techniques used to influence emotional experience and expression) could prove to be an inexpensive and effective addition to the current treatment protocols directed at tackling female sexual dysfunctions. For that purpose several specific emotion-regulation techniques have been designed, such as up-regulation of positive emotions (e.g., Both et al., 2011), and down-regulation of negative emotions (e.g., Gallo et al., 2012) (for a comprehensive overview of the emotion-regulation techniques, see e.g., Suri et al., 2013). While up-regulation strategies focus on maximizing emotional experiences by directly directing to those experiences and enhancing emotional expression, down-regulation strategies aim to weaken emotional experiences by employing a myriad of different techniques, including reappraisal. Reappraisal changes the trajectory of emotional experience by cognitively altering the meanings that are activated in response to emotion-eliciting situation. Research has shown that these strategies may have differential effects on overall well-being (Livingstone & Srivastava, 2012), are effective in altering the emotional experience and expression (e.g., Gross & John, 2003), and are associated with distinct patterns of neural activity (Ochsner et al., 2004). Consequently, it has been suggested that up-regulation of positive emotions and reappraisal of negative emotions can be regarded as useful tools in the management and treatment of various affective disorders, in which emotion dysregulation plays a role (Gilbert et al., 2013).

Among such disorders are sexual dysfunctions (e.g., female sexual interest/arousal disorder; FSIAD; DePesa & Cassisi, 2017). Although emotion regulation may be an effective strategy in achieving emotional control during sexual behavior (e.g., Gillespie et al., 2012; Tull et al., 2012), so far no study has explored whether down-regulation of disgust using reappraisal can result in a simultaneous decrease in feelings of disgust, and increase in sexual arousal in response to sexual stimuli. Moreover, only one study to date has tested whether employing a sexual arousal up-regulation strategy can effectively enhance feelings of general arousal in response to still visual sexual stimuli and decrease feelings of disgust in response to these stimuli (van Overveld & Borg, 2015). In line with the predictions derived from the model proposed by de Jong et al. (2013), the brief emotion regulation training facilitated the enhancement of state general arousal in response to still sexual stimuli. However, against the predictions derived from this model, this increase in state arousal was not paralleled by the predicted decrease in state disgust (van Overveld & Borg, 2015). Yet, the level of experienced disgust in response to the sexual stimuli was generally very low, which might have undermined the sensitivity of the design to find a further reduction in disgust as a result of the arousal up-regulation manipulation. Perhaps, due to self-selection bias inherent in sex research studies (Catania et al., 1986; Strassberg & Lowe, 1995), individuals volunteering to take part in van Overveld and Borg’s (2015) study were generally more easily aroused, which might have inhibited the emergence of feelings of disgust. In line with such explanation for the generally low level of disgust in this earlier study, there was a negative relationship between the propensity for experiencing general arousal and state disgust measured in response to the sexual stimuli.

We aimed to test the robustness of the earlier findings of van Overveld and Borg (2015), with regard to the effectiveness of up-regulation of sexual arousal on amplifying sexual response by increasing feelings of sexual arousal, in a sample of women with no sexual difficulties. To further examine whether up-regulation of sexual arousal can decrease feelings of disgust in response to a sexual stimulus in women with no sexual difficulties, we used an experimental manipulation designed to increase the potency of sexual stimuli to elicit disgust by priming participants with the contaminating features of sex. Following from the perspective that the priming manipulation could inhibit the development of sexual arousal in the control group, this would leave more room for the sexual arousal up-regulation instruction to influence sexual arousal (i.e., increase) as well as disgust (i.e, decrease). Moreover, we aimed to further
test the predictions following from de Jong et al.’s (2013) model, by investigating whether down-regulation of disgust through reappraisal can reduce the level of experienced disgust. Lastly, we also tested whether disgust down-regulation can amplify sexual response in women with no sexual difficulties by increasing feelings of sexual arousal. Priming manipulation was expected to facilitate development of disgust in the control group, thus increasing the chance of disgust down-regulation instruction to influence sexual arousal and disgust. In that sense, the priming manipulation was hypothesized to magnify the effects of disgust down-regulation instruction on both disgust and arousal.

**Method**

**Participants**

A sample of 363 heterosexual women was recruited at two Dutch universities and through social media (e.g., Facebook). Table 1 shows a summary of sample characteristics. Recruited participants were randomly assigned to one of six groups based on the type of priming (Contamination prime vs. No prime) and emotion regulation instruction (Sexual arousal up-regulation vs. Disgust down-regulation vs. Control) that participants received. An a-priori power analysis conducted using the G*Power program (Faul et al., 2007) with power set at 0.80 and an alpha level at 0.05, two-tailed, indicated that the number of participants per group needed to detect a small effect size ($d = 0.20$; Cohen, 1992) in a full factorial 2 (Prime: Yes vs. No) x 2 (Instruction: Sexual arousal up-regulation vs. Control; Disgust down-regulation vs. Control) between-subjects analysis of variance (ANOVA) was 52, resulting in the targeted total sample size of 312 participants. Following recruitment and random group assignment, 108 participants were excluded from the initial sample of 363 participants because of noncompliance with the study instructions, or completion of the experiment in an unrealistically short or long time. Thus, the total sample size selected for the statistical analyses down to 255 participants. Power analysis indicated that for this sample size the power to detect small effects ($d = 0.20$) was 0.71. However, power to detect modest effects ($d = 0.30$) was still high at 0.97. Figure 1 shows a schematic representation of the random assignment procedure, including the number of participants per group after the exclusion of ineligible participants. University students received course credits in return for their participation, while women recruited through social media did not receive any compensation. The study was approved by, and conducted in line with the regulations of the local Dutch Ethical Committee of Psychology (Code number: 16232-S-NE).

**Measures**

**Demographic Questionnaire**

A short demographic questionnaire was used to assess age, relationship status, frequency of sexual behavior (i.e., heavy petting, oral sex, anal penetration, vaginal penetration), and contraception use.

**The Sexual Excitation/Sexual Inhibition Scales – Short Form (SES/SIS-SF)**

The SES/SIS-SF (Carpenter et al., 2011) were included to index the individual propensities for sexual excitation and sexual inhibition. These self-report scales consist of 14 items rated on a 4-point Likert-type scale, ranging from 1 (= Strongly Agree) to 4 (= Strongly Disagree). The Sexual Excitation Scale (SES) includes themes describing sexual arousal originating in social interactions, visual stimuli, fantasies, and non-sexual situations. The two Sexual Inhibition Scales (SIS1 and SIS2) include themes of distraction, focus on sexual performance, and past problems with arousal (SIS1) as well as themes of risk of getting caught during sex or contracting a sexually transmitted infection (SIS2). While SES had a satisfactory internal

<table>
<thead>
<tr>
<th>Table 1. Sample characteristics.</th>
<th>M (SD)</th>
<th>range</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>20.55 (2.23)</td>
<td>18.00 – 30.00</td>
<td>255</td>
</tr>
<tr>
<td>SES/SIS-SF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td>14.06 (2.80)</td>
<td>6.00 – 24.00</td>
<td>255</td>
</tr>
<tr>
<td>SIS1</td>
<td>10.89 (1.87)</td>
<td>5.00 – 15.00</td>
<td>255</td>
</tr>
<tr>
<td>SIS2</td>
<td>8.80 (2.06)</td>
<td>4.00 – 14.00</td>
<td>255</td>
</tr>
<tr>
<td>DPSS-R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propensity</td>
<td>16.04 (3.73)</td>
<td>6.00 – 29.00</td>
<td>255</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>12.40 (3.81)</td>
<td>6.00 – 24.00</td>
<td>255</td>
</tr>
<tr>
<td>Relationship status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N (%)</td>
<td>n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stable relationship with intimate sexual contact</td>
<td>46.27</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>Stable relationship without intimate sexual contact</td>
<td>1.96</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Single without intimate sexual contact</td>
<td>29.03</td>
<td>74</td>
<td></td>
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<tr>
<td>Single with intimate sexual contact (stable partner)</td>
<td>11.37</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Single with intimate sexual contact (changing partners)</td>
<td>11.37</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Contraceptive use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hormonal</td>
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<td>130</td>
<td></td>
</tr>
<tr>
<td>Non-hormonal</td>
<td>19.61</td>
<td>50</td>
<td></td>
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<tr>
<td>Combination of hormonal and non-hormonal</td>
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<td>29</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>18.04</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>BSSC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied with own sexual function</td>
<td>72.55</td>
<td>185</td>
<td></td>
</tr>
</tbody>
</table>

SES/SIS-SF = The Sexual Excitation/Sexual Inhibition Scales – Short Form; SES = Sexual Excitation Scale; SIS1 = Sexual Inhibition Scale 1; SIS2 = Sexual Inhibition Scale 2; DPSS-R = Disgust Propensity and Sensitivity Scale Revised; BSSC = The Brief Sexual Symptom Checklist.
consistency in the current sample (α = .73), the SIS1 (α = .54) and SIS2 (α = .52) had low internal consistency. The internal consistency of the SIS1 and SIS2 scales improved after removal of items 6 and 9 (SIS1 α = .58; SIS2 α = .64), which had the lowest correlation with other items of their respective scales. After the removal of these items the internal consistency of SIS subscales was comparable to that reported by other researchers (e.g., SIS1 α = .60 and SIS2 α = .70; cf. Velten et al., 2018).

**Disgust Propensity and Sensitivity Scale Revised (DPSS-R)**

The DPSS-R (van Overveld et al., 2010) was used to index the individual disgust trait propensity (i.e., the frequency of experiencing disgust) and sensitivity (i.e., the subjective appraisal of the experience of disgust). This 12-item self-report questionnaire measures disgust propensity with items such as “I avoid disgusting things” and disgust sensitivity with items such as “It scares me when I feel nauseous”. The 5-point response scale ranges from 1 (= Never) to 5 (= Always). Internal consistency in the current sample was established as satisfactory for the propensity (α = .75), and the sensitivity (α = .71) subscales.

**The Brief Sexual Symptom Checklist (BSSC)**

The BSSC (Hatzichristou et al., 2010) is a 4-item self-report checklist that assesses the presence of sexual symptoms with binary (i.e., yes or no) questions, such as “Are you satisfied with your sexual functioning?”.

**Subjective Self-reports**

**Visual Analogue Scale (VAS)**

To assess the effects of priming and emotion regulation instruction on experienced state disgust and state sexual arousal, participants were asked to indicate on a scale from 0 (= Not at all) to 100 (= Very much) the intensity of the experienced emotions of anger, stress, inspiration, happiness, disgust, fear, sexual arousal, excitation, and amusement both before and after the manipulation. Of the emotions included in the VASs, only sexual arousal and disgust were of importance in the current study, while the other emotions were included to mask the variables of interest.

**Materials**

**Contamination Prime**

In order to elicit sufficient levels of sexual disgust in women with no sexual difficulties, half of the recruited participants read an information text describing the contagion, incidence, and consequences of contracting sexually transmitted infections before viewing the pornographic video material. The other half of the sample served as a control group and did not read any textual information. Statistics reported in the information text were fabricated in order to elicit a more lasting effect on participants. The contamination prime can be found in Appendix A.

**Emotion Regulation Instructions**

Prior to viewing the video material participants allocated to the arousal up-regulation instruction groups (primed up-regulation and not-primed up-regulation) received an instruction to maximize their sexual arousal by focusing internally on the self-relevance of the erotic scenes (i.e., to identify themselves with the actress in the pornographic video material). This arousal up-regulation instruction was developed based on the sexual arousal up-regulation instruction used by van Overveld and Borg (2015). Meanwhile, participants allocated to the disgust down-regulation instruction groups (primed down-regulation and not primed down-regulation) received an instruction to reappraise the experienced disgust by focusing externally on alternative meanings for depicted actions and potential situational contexts (i.e., think that the depicted actions occur in a context of stable romantic relationship). This type of reappraisal strategy has been positively endorsed by women in other research (Rupp & Wallen, 2008). Lastly, participants allocated to the control groups (primed control and not primed control) were instructed to simply watch the
video material. The emotion regulation instructions can be found in Appendix B.

**Video Material**

The video material included a 5-minute-35-second-long excerpt from a pornographic film (Collins & Myne, 2016) depicting a White heterosexual couple during various sexual activities (kissing, cunnilingus, anilingus, fellatio, penile-vaginal intercourse). This type of stimulus was chosen specifically, because women report a preference to watch a couple in a stable relationship engage in sexual activity rather than multiple partners across various contexts (Rupp & Wallen, 2008). To promote disgust responsivity, the video material contained close-ups of stimuli with relatively high contamination potency, such as genitals and bodily fluids (i.e., saliva, vaginal fluids, sperm; Rozin et al., 1995).

**Procedure**

The current study was advertised as an experiment on interactions between emotions and sexual stimuli. The recruitment material specified that the research was intended for heterosexual women, due to the heterosexual nature of stimuli used. In order to ensure that participants’ emotional ratings were not influenced by experimenter demand, no mention of sexual arousal or disgust was included. Interested participants were directed to a Qualtrics® online survey (https://www.qualtrics.com) link. Upon accessing the link participants were informed that during the study they would be asked about their past sexual behavior and that they would rate the intensity of their emotions in response to explicit pornographic materials. If participants were interested in taking part in the study, they were invited to sign the informed consent form and were asked to find a private room where they could watch pornographic video material without any distractions.

Upon giving informed consent participants were randomly allocated to one of the six groups via the Qualtrics® software. Subsequently, participants were asked to provide the baseline ratings of the intensity of their emotions using the VASs. Following this, participants in the primed groups read the contamination prime, after which they proceeded to read their group-specific emotion regulation instructions. Participants in the non-primed groups read only their group-specific emotion regulation instructions. After the instructions, all participants were asked if they had read the prime and instruction text. Participants then watched the pornographic movie, after which they were asked to complete the VASs once again to rate the intensity of their emotions. Upon completing the VASs, participants were asked to complete the SES/SIS-SF, the DPSS-R and the BSSC. At the end of the experiment, participants were also asked to indicate if the answers they provided throughout the experiment were honest.

Lastly, participants were debriefed about the nature of the study, including the description of the intended goal of contamination priming (with information that the data presented in the STI prime were fabricated), variables of interest, and research questions. In order to prevent potential future participants from learning about the manipulations used, participants were asked to refrain from speaking to anyone about the contents of the study after their participation in the study.

**Data Reduction and Analysis**

The present study was designed to test the effects of two different emotion regulation interventions. First, we wanted to test whether a reduction of disgust could be achieved via disgust down-regulation, and if so, whether this effect was paralleled by an increase in arousal. Second, we wanted to test whether an increase in sexual arousal was possible via sexual arousal up-regulation, and if so, whether this effect was then paralleled by a reduction in disgust. To that effect mean change scores from baseline were computed for the VAS sexual arousal ratings and the VAS disgust ratings by subtracting pretest responses from the posttest responses. This resulted in one data point for sexual arousal ratings and one data point for disgust ratings. A 2 (Prime: Yes vs. No) x 2 (Instruction: Disgust down-regulation vs. Control) between-subjects analysis of variance (ANOVA) was used to evaluate whether sexual arousal up-regulation instruction increased sexual arousal and decreased disgust responses from pre- to post-test, and whether these effects were amplified by the contamination prime. A similar 2 (Prime: Yes vs. No) x 2 (Instruction: Disgust down-regulation vs. Control) between-subjects ANOVA was used to evaluate whether disgust down-regulation instruction decreased disgust and increased sexual arousal responses, and whether these effects were amplified by the contamination prime. In each of the analyses the main effect of the intercept was used to evaluate whether sexual arousal or disgust significantly increased or decreased from pre- to posttest. To evaluate whether emotion regulation instructions had an effect on the sexual arousal and disgust change scores, the main effect of Instruction was investigated. To further check whether priming manipulation had decreased sexual arousal and increased disgust, the main effect of Prime was evaluated. To evaluate whether the priming manipulation increased the sensitivity of the current design to detect the effects of emotion regulation instructions on sexual arousal and disgust, a Prime x Instruction interaction effect was investigated. Statistically significant Instruction x Prime interaction effects were followed up using independent samples t-tests by comparing the effects of emotion-regulation instructions with the effects of control instruction on target emotions in the absence and the presence of a prime. In order to test if the priming manipulation had an effect on the subjective appreciation of the video material, the disgust change and sexual arousal change from pre- to posttest in the primed control group and the unprimed group were compared using independent samples t-tests. Effect sizes were reported as Cohen’s $d$, where $d = 0.2$ denotes a small effect size, $d = 0.5$ a medium effect size, and $d = 0.8$ a large effect size.

**Results**

**Priming Manipulation Check**

Independent samples t-tests revealed that primed and unprimed control groups did not differ significantly with regard to disgust change from pre- to posttest, $t(85) = 1.68, p = .097$, nor in terms of sexual arousal change from pre- to posttest, $t(85) = 0.42, p = .679$. These results indicate that the priming manipulation did not lead to an increase in disgust (nor to a decrease in arousal) while watching the video material.

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**References**


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Sample Characteristics

Table 1 shows a summary of the sample characteristics, including questionnaire scores. All mean questionnaire scores in the current sample were within the normal range (cf. Carpenter et al., 2011; van Overveld et al., 2010).

Sexual Arousal Up-regulation Effects

Effects on Sexual Arousal

Table 2 shows mean sexual arousal ratings at baseline and mean sexual arousal change scores with corresponding SDs broken down by Prime and Instruction. A significant main effect of the intercept indicated a general increase in sexual arousal from pre- to posttest, $F(1,171) = 200.28$, $p < .001$, $d = 2.17$. Sexual arousal up-regulation instruction did not generally increase sexual arousal significantly compared with control instruction, as indicated by the lack of a significant main effect of Instruction, $F(1,171) = 3.13$, $p = .079$. Furthermore, there was no significant main effect of Prime, indicating that the priming manipulation had not generally decreased sexual arousal from pre- to posttest, $F(1,171) = 1.99$, $p = .160$. Yet, the priming manipulation influenced the effects of sexual arousal up-regulation and control instructions on sexual arousal change from pre- to posttest, as indicated by a significant Prime x Instruction interaction effect on the sexual arousal change scores, $F(1,171) = 4.16$, $p = .043$, $d = 0.29$. Follow-up analyses using independent samples $t$-tests revealed that sexual arousal change scores were significantly higher after sexual arousal up-regulation instruction than after control instruction, but only in the unprimed participants, $t(86) = 2.78$, $p = .007$, $d = 0.60$, not in the primed participants, $t(85) = 0.19$, $p = .853$.

Effects on Disgust

Table 2 shows mean disgust ratings at baseline and mean disgust change scores with corresponding SDs broken down by Prime and Instruction. A significant main effect of the intercept indicated a general increase in disgust from pre- to posttest, $F(1,171) = 188.38$, $p < .001$, $d = 2.10$. Yet, there was no significant main effect of Instruction, indicating that sexual arousal up-regulation instruction did not generally facilitate a significant decrease in disgust compared with control instruction, $F(1,171) = 0.45$, $p = .502$. There was no significant main effect of Prime, indicating that priming manipulation did not generally increase disgust from pre- to posttest, $F(1,171) = 1.73$, $p = .190$. Moreover, priming manipulation had not influenced the difference in disgust change between sexual arousal up-regulation and control instruction groups, as indicated by a non-significant Prime x Instruction interaction effect, $F(1,171) = 1.30$, $p = .256$.

Disgust Down-regulation Effects

Effects on Disgust

Table 3 shows mean disgust ratings at baseline and mean disgust change scores with corresponding SDs broken down by Prime and Instruction. Analysis revealed a significant main effect of the intercept, indicating a general increase in disgust from pre- to posttest, $F(1,164) = 147.61$, $p < .001$, $d = 1.90$. Disgust down-regulation instruction attenuated this increase in disgust compared with control instruction, as indicated by a statistical trend for the main effect of Instruction, $F(1,164) = 3.80$, $p = .053$, $d = 0.31$. Yet, unexpectedly, the priming manipulation was also found to

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**Table 2.** Means and standard deviations of sexual arousal and disgust at pretest, and the pre- to posttest change scores for the sexual arousal up-regulation and control groups as a function of the presence/absence of a contamination prime.

<table>
<thead>
<tr>
<th>Prime</th>
<th>Contamination prime Instruction</th>
<th>No prime Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arousal up-regulation Control</td>
<td>Arousal up-regulation Control</td>
</tr>
<tr>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Pretest sexual arousal</td>
<td>14.15 (18.50)</td>
<td>12.90 (15.63)</td>
</tr>
<tr>
<td>Pretest disgust</td>
<td>3.89 (8.54)</td>
<td>4.20 (5.50)</td>
</tr>
<tr>
<td>Δ Sexual arousal</td>
<td>25.28 (25.78)</td>
<td>39.27 (23.71)</td>
</tr>
<tr>
<td>Δ Disgust</td>
<td>28.68 (28.53)</td>
<td>29.46 (28.46)</td>
</tr>
</tbody>
</table>

Δ denotes change score from pre- to posttest.

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**Table 3.** Means and standard deviations of sexual arousal and disgust at pretest, and the pre- to posttest change scores for the disgust down-regulation and control groups as a function of the presence/absence of a contamination prime.

<table>
<thead>
<tr>
<th>Prime</th>
<th>Contamination prime Instruction</th>
<th>No prime Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disgust down-regulation Control</td>
<td>Disgust down-regulation Control</td>
</tr>
<tr>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Pretest sexual arousal</td>
<td>18.90 (17.96)</td>
<td>15.15 (15.09)</td>
</tr>
<tr>
<td>Pretest disgust</td>
<td>2.77 (3.98)</td>
<td>3.22 (5.32)</td>
</tr>
<tr>
<td>Δ Sexual arousal</td>
<td>34.56 (28.34)</td>
<td>30.27 (25.30)</td>
</tr>
<tr>
<td>Δ Disgust</td>
<td>18.36 (27.78)</td>
<td>27.78 (31.12)</td>
</tr>
</tbody>
</table>

Δ denotes change score from pre- to posttest.
significantly decrease (instead of increase) disgust, as indicated by the significant main effect of Prime, $F(1,164) = 5.14$, $p = .025$, $d = .35$. However, there was no significant Prime x Instruction interaction effect, indicating that these effects were independent from one another, $F(1,164) = 0.02$, $p = .891$. Thus, priming manipulation had no effect on the difference in disgust change between disgust down-regulation and control instructions.

**Effects on Sexual Arousal**

Table 3 shows mean sexual arousal ratings at baseline and mean sexual arousal change scores with corresponding SDs broken down by Prime and Instruction. There was a general increase in sexual arousal from pre- to posttest, as indicated by a significant main effect of the intercept, $F(1,164) = 181.17$, $p < .001$, $d = 2.10$. There was no significant main effect of Instruction, indicating that the disgust down-regulation instruction did not significantly increase sexual arousal compared with control instruction, $F(1,164) = 3.20$, $p = .076$, although there was a trend in the predicted direction. There was also no significant main effect of Prime, indicating that the priming manipulation did not decrease sexual arousal from pre- to posttest, $F(1,164) = 0.50$, $p = .480$. Lastly, there was no significant Prime x Instruction interaction effect, indicating that the priming manipulation had no influence on the difference in sexual arousal change from pre- to posttest between disgust down-regulation and control instructions, $F(1,164) = 0.01$, $p = .908$.

**Discussion**

The current study examined the effects of two emotion regulation strategies on sexual arousal and disgust experienced during pornographic video material in a sample of women with no sexual difficulties. Half of the sample was primed with the contaminating features of sex prior to viewing the video material, whereas the other half was not primed. Sexual arousal up-regulation instruction was found to be effective in increasing feelings of sexual arousal compared with control instruction, but only in the unprimed group. Nonetheless, sexual arousal up-regulation instruction had no effect on disgust change from pre- to posttest. Compared with the control instruction, disgust down-regulation instruction decreased disgust from pre- to posttest, yet had no significant effect on sexual arousal change, although there was a trend in the predicted direction.

**Sexual Arousal Up-regulation Effects**

The results of the current study corroborate and extend previous findings, which showed that brief training in up-regulation of experienced emotions can increase feelings of sexual arousal during sexual stimuli (van Overveld & Borg, 2015). In the current study sexual arousal up-regulation instruction amplified feelings of sexual arousal during erotic video material. However, the effect of up-regulation instruction on sexual arousal was observed only among women in the unprimed group, suggesting that highlighting contaminating features of sex may diminish the effects of sexual arousal up-regulation training on experienced sexual arousal. In terms of the Dual Control Model of sexual response (Bancroft et al., 2009; Bancroft & Janssen, 2000) and de Jong et al.’s (2013) model, the null effect observed in the primed group could be explained by inhibitory effects of disgust resulting from the primed exposure to the ambiguous sexual stimulus, outweighing the excitatory effects of the sexual arousal up-regulation instruction. Yet, the absence of a concurrent rise in disgust questions whether the effect of the prime was driven by heightened disgust as would follow from the model of de Jong et al. (2013).

In contrast to our expectations, the data also more generally revealed that sexual arousal up-regulation instruction had no effect on disgust experienced during the sexual stimulus, and this effect did not vary as a function of priming. This finding corroborated previous evidence obtained by van Overveld and Borg (2013), where an increase in sexual arousal was not associated with decreased disgust to sexual stimuli. It was also in line with other studies showing that sexual arousal did not reduce domain-specific disgust, such as sexual or pathogen disgust (Fleischman et al., 2015; Lee et al., 2014; Zsok et al., 2017). However, this finding also contradicted a body of earlier studies in which sexually aroused participants rated sexual stimuli as less disgusting compared with participants who were not sexually aroused (Ariely & Loewenstein, 2006; Borg & de Jong, 2012; Stevenson et al., 2011). Interestingly, in van Overveld and Borg’s (2015) study, students reported low levels of disgust and high levels of positive emotions in response to still sexual stimuli. In explaining their findings, the authors hypothesized that this might be due to some level of desensitization to disgust that students are likely to experience. Yet, in the current study, which also largely relied on a student sample, increases in sexual arousal in response to the sexual stimulus were paralleled by increases in disgust of similar magnitude. Thus, unlike participants in van Overveld and Borg’s (2015) study, participants in the current study experienced considerable levels of disgust. Nonetheless, no effect of sexual arousal up-regulation on disgust was found, which may indicate that sexual arousal up-regulation is not an effective tool for decreasing disgust experienced during exposure to (ambiguous) sexual stimuli.

**Disgust Down-regulation Effects**

With respect to the effects of disgust down-regulation instruction on disgust experienced during sexual stimuli, the current findings showed some evidence for a modest effectiveness of disgust down-regulation through reappraisal on experienced disgust. To our knowledge this is the first evidence for the effectiveness of reappraisal on disgust experienced in a sexual context. Our finding corroborates other research showing that emotion regulation through reappraisal can effectively decrease feelings of disgust in non-sexual contexts, as compared to control instructions (e.g., Gross, 1998), and even as compared to other down-regulation techniques, such as suppression (e.g., Olatunji et al., 2017).

Based on the model proposed by de Jong et al. (2013), it was also hypothesized that when confronted with a sexual stimulus, disgust down-regulation instruction would result in increased sexual arousal. However, although there was a trend in the predicted direction, the impact of disgust down-regulation on
increasing sexual arousal did not reach the conventional level of significance, perhaps due to the limited power of the current study to reliably detect differences of small effect-size. Future studies with larger samples and stronger manipulations (for a review of emotion regulation techniques, see Suri et al., 2013) would be helpful to arrive at more final conclusions with regard to the impact of down regulating disgust on individuals’ sexual arousal in response to ambivalent sexual stimuli.

**Strengths, Limitations, and Future Directions**

The current study was, to the best of our knowledge, the first to test whether specific emotion regulation techniques aimed at up-regulation of sexual arousal and down-regulation of disgust can respectively increase and decrease the target emotions during sexual stimuli. Our findings corroborated previous findings obtained by van Overveld and Borg (2015), by showing replicability of the sexual arousal up-regulation instruction effect on experienced sexual arousal, and extended them with a more potent audiovisual stimulus, compared to pictorial stimuli used by van Overveld and Borg (2015). However, we also extended these previous results by providing preliminary evidence for the effectiveness of reappraisal on decreasing disgust during sexual stimuli. Emotion regulation techniques aimed at sexual arousal up-regulation or disgust down-regulation can show some effectiveness in increasing control over these target emotions. In clinical contexts these techniques could be used in patients presenting with sexual problems where sexual arousal and/or disgust management in sexual contexts is an issue. Future studies should further explore the use of up-regulation of sexual arousal and down-regulation of disgust in patients with the above-mentioned sexual problems to investigate the clinical utility of these emotion regulation techniques.

The current study also had several limitations. In this study design, for both active intervention groups, the same nonintervention control group was used as a reference condition. Even though this approach had the advantage that the reference for both interventions was similar, it may have come at the cost of an overrepresentation, and thereby an overreliance, on this particular group of participants. Thus, from a purely methodological stance it might have been better to have included two separate (independent) control groups to prevent the influence of incidental features of the current control group in defining differences between the control condition, and each of the active conditions. In a similar vein, despite the efforts of the research team to increase the representativeness of the study sample, the majority of participants in the current study were young college students. Moreover, due to the exclusion of a large number of participants, the power to detect small effects was decreased in the current study, though the power to detect a modest effect remained high.

Although the study was advertised as research aimed at heterosexual women, we did not verify participants’ sexual orientation. In addition, no information was collected on the ethnicity of participants. In spite of the fact that the ethnicity in the Northern part of the Netherlands is quite homogenous, it cannot be ruled out that some participants differed in ethnicity from the actress in the video, which might have affected their response to the materials (e.g., because they had difficulty in fully identifying themselves with the actress presented in the stimuli). Even though the sexual arousal up-regulation instruction used in the current study was based on the instruction successfully applied in the van Overveld and Borg (2015) study, due to its unspecified wording, this instruction could have potentially encouraged participants to up-regulate not only sexual arousal, but also other emotions that might have been experienced in response to the sexual stimulus. Relatedly, no measure of implementation intention or level of self-reported compliance with emotion-regulation instructions was used. Thus, it might have been that participants had trouble regulating their emotions according to the instructions given, but information about this was not collected. Against our expectations, priming participants with the contamination features of sex was found to significantly decrease, rather than increase, disgust, independent from the effects of reappraisal vs. control instructions. Thus, instead of increasing the sensitivity of the current design to detect the effects of disgust down-regulation, it seems that the priming manipulation had an opposite effect on the experienced disgust to the one intended. Furthermore, following the priming manipulation, emotional experiences were not measured immediately; thus, it was not possible to test the direct effect of the prime per se. In addition, the emotional effects of the video may not have been restricted to sexual arousal and disgust, and it may therefore be relevant in future research to also take other emotions (e.g., shame) into account. Finally, the study was presented online. Although this may have contributed to its ecological validity, cost-effectiveness, and it allowed for achieving higher power to detect an effect by increasing sample size, it also limited the experimental control over participants’ behavior. Despite the fact that participants were instructed to complete the experiment in a private, quiet room, with no distractions present, the actual conditions in which participants completed the experiment are unknown. Nevertheless, participants were asked to indicate whether or not they had read the priming and instruction materials in full, and if their answers in the experiment were honest. To gain confidence in the current findings the experiment could be replicated under laboratory conditions, with an addition of measures of implementation intentions, and/or self-reports of compliance.

**Conclusions**

Instruction to up-regulate sexual arousal showed its effectiveness in increasing control over sexual arousal although it did not reduce disgust. In parallel, the instruction to down-regulate disgust was modestly effective in increasing control over disgust, but did not result in a statistically significant increase in sexual arousal. The current pattern of findings provided no straightforward support for the proposed reciprocal inhibitory influence of sexual arousal and disgust. However, the findings do indicate that emotion regulation techniques aimed at up-regulation of positive and down-regulation of negative emotions could be used separately or in conjunction as valuable tools for the treatment of sexual problems where sexual arousal and/or disgust management are a clear issue.
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Data Availability Statement
Research data and material for this project were made available on DataVerseNL platform under the following hyperlink: https://doi.org/10.34894/BRX1L2.

References


### Appendix A. Contamination prime

A study found that it takes only 10 seconds of kissing to transfer 80 million bacteria through saliva (Kort et al., 2014). This is the same as if you would lick the bottom of your shoes after taking a walk through the city. This is just a kiss. You are of course aware that more engaging sexual encounters, like intercourse, can increase the risk of various sexually transmitted diseases – some bacterial and some viral. Some people call them sexually transmitted diseases or STDs, and some prefer the word sexually transmitted infections (STIs) because people may carry the virus and may potentially infect other partners even if they do not show physical signs of disease. Many individuals do not present any symptoms at all. They feel fine and do not notice any physical changes, yet even without symptoms, these infections can cause long-term health problems.

STIs can be of many shapes and forms: herpes and human papillomavirus (HPV), which has no cure, human immunodeficiency virus (HIV), hepatitis A, B, C, chlamydia, thrush infection of the mouth, syphilis, and gonorrhea. Some STIs are sent in semen, pre-cum, vaginal fluids and blood. Others can be passed just through genital skin-to-skin contact. If left untreated, STIs can lead to serious and painful health consequences. For example, chlamydia can cause pelvic inflammatory disease (PID) and infertility; HPV can cause cancer and other fertility issues. Moreover, they can cause a variety of symptoms including painful urination, bumps, and sores full of pus around the vagina, itching around the genital area, which could be explained by crabs or simply...
a rash and drips, which result in thick genital discharge. Many other symptoms can mean you have an infection. Some people who get an STI show no symptoms at all, but still pass it on to someone else. Some are curable, and others are not.

Another critical aspect is that a surprising number of people either have had an STI or currently have an STI. Over 110 million people are suffering from an STD in the USA alone, as well as an estimated 400 million people worldwide. Statistically one out of four people will have an STI. Which means at least one of your closest friends, probably the person sitting next to you in the library, and most likely one of the persons you have had sex with so far, would be one of those people infected. This is quite something when you reflect on it (Academic Edge, 2010).

Appendix B. Sexual arousal up-regulation instruction

In the following film, you will see a heterosexual couple performing sexual acts. After the movie, we will ask you several questions. During the movie, we would like you to regulate your emotions in a specific direction. Endorse and show your feelings as much as you can. If you find it helpful to enhance your sexual arousal, you can also imagine yourself being part of the sexual acts. Let your fantasies run wild and be inspired by the shown content. Any emotion you feel during the movie, try to feel it more strongly. Try to do this during the entire film clip.

Disgust down-regulation instruction

The couple you are about to watch is performing explicit sexual behavior. They are well known in the pornographic film industry for their long and faithful relationship. In other words, they are only filming scenes exclusively as a couple. They are strong promoters of regular health checks. Moreover, they consider their work as mainly educational and aim to provide examples of how to “spice up” sex life, especially directed at couples in long-term relationships.

Control condition instruction

In the following film, you will see a heterosexual couple performing sexual acts. Afterward, we will ask you several questions about the movie. For now, watch and let your emotions roll.