



# Does Sexual Arousal Have Pain Relieving Properties in Women?

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### **Abstract**

The present study aims to build on the findings obtained by Lakhsassi et al. (2022) by investigating if sexual arousal, without the presence of physical stimulation, can reduce the perception of pain in women when disgust is accounted for. Three hypotheses were created for this, 1) The sexual arousal conditions would decrease pain intensity and increase the time participants kept their hands in the water better than the neutral condition. 2) The Female-Friendly Sexual Arousal condition would have a more significant effect than the Sexual Arousal or Neutral condition at reducing pain intensity and increasing the time participants kept their hand in water. 3) The Female-Friendly Sexual Arousal condition would evoke fewer feelings of disgust than the Sexual Arousal condition. To test these hypotheses, a study was conducted with 174 female participants who were randomly allocated to three different conditions: Female-Friendly Sexual Arousal (FFSA), Sexual Arousal (SA) and, Neutral (N). The painful stimulus was delivered through the use of a cold pressor while participants were watching their assigned stimulus video (pornographic videos or train ride). Visual Analogue Scales were used to assess the participants perceived pain as well as their levels of sexual arousal and disgust. The results from the study offered support for hypothesis three as the FFSA condition evoked less feelings of disgust than the SA condition. Hypotheses one and two were not supported by the data as there was no significant difference between conditions when it came to reducing pain intensity and increasing the time participants kept their hand in the water.

*Key words:* Sexual Arousal, Perception of Pain, Cold Pressor Task, Women, Disgust

### **Does Sexual Arousal Have Pain Relieving Properties in Women?**

The topic of the pain-relieving effects of sexual arousal on women has been greatly understudied in the field of psychology. Although there is already a substantial amount of evidence in regards to how sexual stimulation dulls the response to pain-inducing stimuli, the same cannot be said in regards to sexual arousal in the absence of physical stimulation or climaxing (Lakhsassi et al, 2022). To better understand the topic, sexual arousal will be defined as the interaction between physiological, psychological and behavioral mechanisms which occur in response to sexual intercourse or when faced with sexually arousing stimulus (Janssen et al., 2000). Sexual arousal causes the body to undergo physiological changes such as increased heartrate or hormone release and psychological changes such as feelings of pleasure and sexual desire.

#### **Sexual Stimulation and Pain**

Research has shown that there is a relationship between sexual stimulation and the perception of pain. Studies conducted on women by Komisaruk and Whipple have provided some examples of this relationship. One of their studies focused on investigating the pain threshold increase that occurred when women were exposed to vaginal stimulation. For this study they used finger compression to each finger of left hand at 5 second intervals as the painful stimulus, and their results showed that pain tolerance and pain detection thresholds both increased when vaginal self-stimulation occurred via a facial vibrator which was modified by using a pressure transducer specifically designed for creating feelings of pressure or pleasure. This effect was even more prominent when the participants' self-stimulation was carried out to achieve climax (Komisaruk & Whipple, 1984; Whipple & Komisaruk, 1985). Furthermore, their research also concluded that vaginal stimulation has analgesic properties as it decreased the participants' withdrawal response when exposed to a painful stimulus (Komisaruk & Whipple, 1986).

One possible explanation for the pain-relieving properties of sexual stimulation can be attributed to the neurotransmitters released during sexual arousal, specifically endorphins and oxytocin (Khajehei and Behroozpour, 2018). Endorphins can be seen as endogenous opioids generated by the body and are thought to be involved in the regulation of sexual functions in humans. A small increase in beta-endorphins generates feelings of wellbeing, while a larger increase can be linked to feelings of euphoria and in having analgesic properties. Similarly, an increase in endogenous oxytocin in the body due to sexual stimuli is linked to higher levels of endorphins found in blood plasma, which act as natural pain relievers. The release of these natural pain killers has been shown to reduce feelings of pain in women who suffer from dyspareunia (Rosenbaum, 2010). Furthermore, oxytocin and other neurotransmitters and neuromodulators such as norepinephrine, GABA, and enkephalins are also released by the body during vaginocervical stimulation (VCS), which act as a potent pain-relieving mechanism (Komisaruk & Sansone, 2003). It has been shown that VCS works as a pain inhibitor as well as a motor inhibitor (in animal studies with rats, it inhibits the leg withdrawal response when the foot is pinched) (Komisaruk & Larsson, 1971). This inhibition is present in response to painful stimuli but not harmless stimuli, thus demonstrating that it has analgesic properties rather than anesthetic properties. Additionally, the pain-relieving effects of VCS in women were moderated by how pleasurable the stimulation was perceived to be; higher pleasure led to higher analgesic effects.

### **Sexual Arousal and Pain**

Thus far, the focus of this field has mainly consisted of research dealing with the pain-relieving effects of sexual stimulation. Notwithstanding there is a limited amount of research that deals with sexual arousal without any physical stimulation and explores its relationship with the perception of pain. Meagher et al. (2001) conducted research which demonstrated this relationship by using a Cold Pressor Test to deliver the painful stimulus and erotic pictures as

the sexual stimulus. Looking at the sexual stimulus led to the pain intensity threshold in men to increase, thus demonstrating the analgesic properties that sexual arousal can have. However, viewing the erotic pictures did not produce this analgesic effect on women.

Nonetheless, not all the evidence supports these findings. Research was conducted by King and Alexander (2000) and focused on the relationship between pain sensitivity and sexual behaviors. Pain sensitivity was measured through the use of a Cold Pressor Task (CPT) and sexual behavior, which consisted of sexual motivation and subjective measurements of sexual arousal, was evoked with the use of a 5-minute long sexually arousing audio narrating sexual activities carried out by two consenting heterosexual adults. Participants were instructed to listen to the audio stimulus using headphones and subsequently complete a rating scale measuring the subjective sexual arousal and enjoyment resulting from the audio. After completing the rating scale, participants carried out the CPT by placing their dominant hand into the cold water and the researchers measured their pain threshold (when the participant reported they first perceived pain) as well as their pain tolerance (when the participant removed their hand from the water). Results showed that, when exposed to the painful stimulus, women experienced an increase in pain sensitivity, meaning that their pain threshold was lowered. On the other hand, men did not show such a reaction. The gender difference found in this study could be attributed to the difference in responsiveness to the sexual stimulus provided, with women being less sexually stimulated by the auditory stimulus than men and thus not experiencing the pain-relieving effects of sexual arousal. Additionally to auditory stimuli, picture-based sexual stimuli have been shown to be less effective in generating feelings of sexual arousal in women, so in order to achieve the analgesic properties of sexual arousal it might be advisable to focus on sexual stimuli in the form of pornographic videos as these have been shown to be more effective at inducing a state of sexual arousal (Chivers et al., 2010).

### **The Effect of Disgust**

The effect of disgust on sexual arousal and its subsequent interaction with its analgesic properties was explored through a series of studies by Lakhsassi et al. (2022) where their main aim was to examine if sexual arousal without physical stimulation could reduce the subjective perception of pain when exposed to a painful stimulus in women. The first study in this series used a CPT to elicit the painful stimulus to the participants while they watched their assigned film. There were four possible conditions: Sexual Arousal (pornographic video), Generalized Arousal (exciting video), Distraction and Neutral. A visual analogue scale was used to measure the subjective perception of pain experienced by the participants. Results showed no significant effect between sexual arousal and the perception of pain reported by participants. This lack of effect was attributed to the pornographic video chosen possibly eliciting feelings of disgust in some of the participants. Thus, the second study of the series (unpublished manuscript), which used the same research set-up, aimed to research how disgust affects pain tolerance and pain intensity and was used to confirm that the original pornographic video used indeed generate feelings of disgust (Lakhsassi, 2021). Based on these findings, it was proposed that the feeling of disgust might have worked against the pain-relieving qualities that were expected to impact sexual arousal.

Disgust is an adaptive evolutionary response which serves to protect humans against pathogens as it induces an avoidance or escape reaction towards disgusting stimuli (Curtis et al., 2011). This avoidance reaction helps humans stay safe by reducing the chances of getting contaminated by possible pathogens in the environment. Stimuli present during sexual activities are inherently predisposed to evoke feelings of disgust if presented in a different context (e.g. saliva, bodily secretions, genitals). Nevertheless, people still show approach behaviors to these types of situations and it has thus been suggested that an increase in sexual arousal might result in a momentary decrease in disgust-based avoidance (Hinzmann et al.,

2020). However, in order for sexual approach behaviors to happen the excitatory factors present need to reach the threshold where they outweigh the inhibitory factors (Pawlowska et al. 2021). If this threshold is not met then an inhibitory response will be seen in regards to sexual arousal. This concept was studied by Andrews III et al. (2015) and it consisted of participants in the experimental condition being primed with disgusting images prior to viewing sexually explicit images. Their results showed that, when compared to the neutral condition (where participants were primed with neutral images), the participants in the experimental condition experienced lower feelings of sexual arousal. Moreover, this effect was shown to be greater in women than in men. In this study, the presence of disgust-evoking primes meant that the aversive properties of disgust were more readily available for the participants and thus they were less likely to experience strong feelings of sexual arousal.

Likewise, when sexual arousal up-regulation was used in women watching a pornographic film, results demonstrated that women who had been primed by gaining awareness of the contaminating features of sexual intercourse showed a lower feeling of sexual arousal while watching the film than women who had not been primed with the disgust evoking information. This suggests that even though sexual arousal up-regulation can increase the feelings of sexual arousal, the awareness of disgust diminishes these effects (Pawlowska et al. 2021).

### **Present Study and Hypotheses**

This study aims to build upon the findings obtained by Lakhsassi et al. (2022) and thus investigates whether sexual arousal, without physical stimulation, can reduce the perception of pain in women when disgust is considered. To achieve this, three conditions were assigned; Sexual Arousal (using the pornographic stimulus used in previous studies by Lakhsassi et al. (2022)), Female-Friendly Sexual Arousal (pornographic stimulus which does not cause feelings of disgust (Coslar, 2022)), and Neutral (stimulus depicting a train ride).



The research question “Can sexual arousal reduce the subjective perception of pain in women if disgust is accounted for?” was formulated, and from there, three hypotheses were created for this study. 1) It was hypothesized that the sexual arousal conditions, regardless of which sexually arousing video is shown, will decrease the intensity of pain and increase the time participants keep their hand in the water more than the neutral condition. 2) The second hypothesis predicts that the Female-Friendly Sexual Arousal condition will have a more significant effect on reducing the intensity of pain and increasing the time participants keep their hand in water than the Sexual Arousal or Neutral condition. 3) The final hypothesis aims to offer support to the results obtained by Lakhsassi (2021) showing that the Female-Friendly Sexual Arousal condition will evoke fewer feelings of disgust than the Sexual Arousal condition.

## **Method**

### **Participants**

Using G\*Power the sample size necessary for the study to have a statistical power of 0.80 when using the effect size of 0.25 was calculated to consist of 159 participants. The recruited sample size was increased in order to ensure that the study would not be compromised in case of participant drop outs.

A purposive sample of 174 female participants was recruited from the first-year psychology SONA Participant Pool at the University of Groningen. The participants took part in this study in exchange for course credits for the course “A Practical Introduction to Research Methods” (course code: PSBE1-28). The recruitment criteria for the study required participants to be over 18 years of age, right-handed, identify as mostly heterosexual (e.g. have a sexual preference for men), have no sexual dysfunctions (e.g. pain during intercourse, vaginismus, problems with sexual arousal), have no medical conditions which cause pain (e.g. chronic

pain), have no strong aversion to viewing pornographic content and to have no cold-water training (e.g. frequent ice water bathing). The study was carried out in English.

A participant was excluded from the statistical analyses due to their participation being affected by a technical error with the equipment (water pump was not functioning) used ( $n = 1$ ). Taking this into consideration, the sample used for the statistical analyses consisted of 173 female students. Based on the final number of participants who were used for the statistical analyses a power of 0.84 was attained to test the hypotheses. Furthermore, this study was submitted and approved by the Ethical Committee of Psychology (ECP approval code: PSY-2122-S-0422).

## **Materials**

***Video Stimuli.*** 3 different videos with a maximum duration of 6 minutes each were used to carry out the study. Each video was chosen to induce a different emotional state; (a) a sexually explicit video of a heterosexual couple to induce sexual arousal, (b) a female friendly sexually explicit video of a heterosexual couple to prompt sexual arousal while controlling for disgust and (c) a video depicting a train ride through the countryside to stimulate a neutral emotional state.

***Cold Pressor Task.*** This task was used to deliver the painful stimulus to the participants (Mitchell, 2004) and thus assesses how long the participants can keep their hand submerged in the water. The set-up of the Cold pressor task (CPT) consisted of a cooler container (Height: 22cm, Width: 36cm, Length: 39cm) which was fully filled with water in order for the participants to easily submerge their hands in it. Ice cubes were used to cool down the water and the temperature at the start of each experiment was kept at 2 degrees Celsius. The temperature of 2 degrees Celsius was used as it has previously been used to successfully deliver a painful stimulus in studies using a CPT (Wang et al., 2019). An aquarium pump was placed at the bottom of the CPT with the nozzle secured with tape to the edge to facilitate water flow

while the participants carried out the experiment. Thermometers were used to measure that the CPT was at target temperature. The laboratory was also equipped with an ice machine and a refrigerator so that the researchers were able to have a constant influx of ice in between participants and so that ice can be stored to be used in the following experiment day.

***Programmed Buttons.*** A camera providing a live-stream was used to visualize the participants hand going in and out of the CPT. Researchers pressed one button when the participants hand was fully submerged in the water to mark the starting time and the other button was pressed once the participants hand was fully out of the CPT. The second button finalizes the trial time and stops the video stimuli being shown to the participant. There was no need for researchers to press the stop button if the participant lasted 4 minutes with their hand in the CPT as the program would automatically stop in these cases.

***E-prime.*** The E-prime software was used to carry out the experiment. The software provided participants with all the instructions they needed for the study, played the assigned video stimulus depending on the condition the participant had been allocated to and recorded the data collected. The software also allowed for researchers to conduct a manipulation check in the FFSA condition with the use of the question “Did you successfully manage to think about a sexual memory or fantasy?” and providing the answer options of “Yes, I managed to have some erotic thoughts within this minute” or “No, I did not manage to have any erotic thoughts whatsoever” which could be selected by the participant using the computer mouse. Furthermore, the E-prime software was used to measure the participants pain intensity, arousal and disgust through the use of Visual Analogue Scales. These scales were used to ask participants the following 3 questions; “How intense was the pain you felt?”, “How sexually aroused did you feel during the experiment?” and “How disgusted did you feel during the experiment?”. These questions were asked after the CPT was finalized and participants could rate their answers from 0 (not at all) to 10 (very strongly).

## **Design and Procedure**

A between-group one-way analysis of variance (ANOVA) experimental design was used in which participants were randomly allocated into one of the three conditions provided; Sexual Arousal (SA), Female-Friendly Sexual Arousal (FFSA) and Neutral (N). Prior to starting the experiment participants were asked to read an information form (Appendix A) which explained the study to them. Once this form was read, and if they agree with the information provided, they had to sign the consent (Appendix B) form before they were able to participate in the study.

While the participants read and signed the forms provided, the researcher was tasked with controlling the water temperature in both the CPT and the Tepid Tub (TT) (Height: 13cm, Width: 28cm, Length: 39cm). Depending on the participants assigned condition the CPT had to be at a temperature of 1.88 (for the SA and N condition) or 1.81(FFSA condition) degrees Celsius. The temperatures were set this way to allow the researcher to have enough time to explain the experiment to the participants and answer any remaining questions before the start of the study. The temperature had to be lower for the FFSA condition given that said condition included a 2-minute thinking exercise before the start of the CPT. The temperature when starting the study required the CPT to be at 2 degrees Celsius for the SA and N conditions and at 1.94 degrees Celsius for the FFSA condition. The temperature on the TT was set to fall between 29-30 degrees Celsius. In order to control the water temperature, the researcher counted with ice cubes, tepid water and gloves (used to remove any remaining ice before starting the experiment to not affect the set temperature). Furthermore, an aquarium pump was used to keep the water in the CPT circulating during the study. The process of setting the CPT and the TT was not seen by the participants as it was carried out behind a wall divider while they were reading and signing the forms provided.

Once the participants indicated they were ready to begin they were asked to remove any jewelry they had on their left hand so that it would not get wet or distract them during the experiment. After this, the researcher provided a tour of the research set-up. The participants were taken into an adjacent room where the researcher introduced them to their colleague and showed them the live-stream from the camera (used to see when the participant places their hand in and out of the water) mentioned in the information form. This was done to reassure the participants that the researchers could only view their hand and that their responses during the study would remain confidential. Once this was completed, the researcher invited the participant back to the study room and into the experiment area.

Before explaining the experiment in detail, the researcher guided the participant to the TT and instructed them to place their left hand in the water for 1 minute in order to standardize their hand temperature (Wang et al., 2019). During this time, the researcher moved the secondary thermometer that was in the TT into the CPT and also turned on the aquarium pump. The pump was used to keep the water circulating throughout the study so that it had a consistent temperature while the participants hand was in the CPT. Once 1 minute had passed, the researcher gave the participant a paper towel to dry their hands and instructed them to take a seat on the chair in the experimental area. The chair was placed facing a TV screen (Height: 52cm, Length: 90cm) and had the CPT on the left and the computer mouse on the right. A picture of the research set-up can be seen in Appendix C. The participants were then given a detailed explanation of what to do during the experiment (researcher showed where the instructions would appear on the screen and where the participants hand should lie in the CPT). Prior to leaving the room, the researcher ensured that the participant had no additional questions, requested them to roll up their sleeves, instructed them to use the headphones provided and explained that to begin the experiment the participant had to press continue. Furthermore, before leaving the researcher also ensured that the CPT was at the required

temperature (if the temperature had to be changed the researcher would do this by either cooling or warming up the water before leaving). When exiting the room, the researcher turned off the lights and the participants were left in a dimly lit room to carry out the experiment. Full script used by researchers can be seen in appendix D.

When the experiment began the participants in the FFSA condition were asked to follow a thinking exercise where they were asked to close their eyes and fantasize about a past sexual experience that was enjoyable and pleasurable for 2 minutes in order to prime them for the movie they were going to watch. After the two minutes a manipulation check was carried out and participants were asked “did you successfully manage to think about a sexual memory or fantasy?” and they could answer “Yes” or “No”. Apart from this thinking exercise the experiment was carried out in the same way for every condition. Once the participants pressed continue to begin, their assigned movie began to play. After 1 minute 41 seconds a Visual Analogue Scale (VAS) appeared at the bottom of the screen asking participants “how sexually aroused do you feel?” followed by the second VAS which asked “How disgusted do you feel?”. These VAS were used as a manipulation check. After answering the questions, at the 2-minute mark, participants received an instruction requesting them to place their hand in the water (start the CPT) and leave it in for as long as they could tolerate. When this instruction appeared the researchers in the other room were required to look at the live-stream and press the start button of the temperature program once the participant's hand was fully in the CPT. Once participants could no longer tolerate the cold water, they removed their hand and the researcher pressed the stop button in the temperature program. When the button was pressed, the assigned film stopped and the participants dried their hands with the paper towel provided. After this the participants were required to answer 3 VAS (one after the other) which asked them “How intense was the pain you felt?”, “How sexually aroused did you feel during the experiment?”

and “How disgusted did you feel during the experiment?”. The participants could hold their hand in the CPT for a maximum of 4 minutes before the film automatically stopped.

Lastly, the program offered participants to help themselves to hand lotion (placed on a table behind them as seen on Appendix C, Figure C2) if needed and instructed them to head to the adjacent room and let the researchers know they were done with the experiment. Throughout the experiment the E-prime software was used as a tool to provide the participants with all the necessary instructions, the VAS used and play their assigned film. This software also recorded the participants data for the researchers to subsequently analyze. Data collection was carried out from the 25<sup>th</sup> of November 2022 until the 2<sup>nd</sup> of March 2023.

## **Results**

### **Preliminary Analyses**

The final data set used for this study consisted of 173 female students. Both the Sexual Arousal and the Neutral condition was composed of 58 participants each and the Female-Friendly Sexual Arousal condition had 57 participants. There were 10 incomplete response items when it came to the VAS asking about the disgust and sexual arousal the participants felt prior to starting the CPT. There were 6 responses missing for the question on disgust and 4 responses missing for the question on sexual arousal. Asking participants how the experiment went at the end of the study provided information on the missing values, which occurred due to participants either not seeing the question or not answering fast enough before the question moved on. A Missing Value Analysis was conducted to check if the values missing were missing at random in between conditions. The result of this analysis showed that the estimated marginal mean was not significantly different ( $\chi^2 = 18.92, df = 14, p = 0.17$ ) thus meaning that the data was missing at random (Table 1). There were 18 outliers found in the data through the SPSS software. The manipulation checks and the main analysis were ran twice, once using the whole sample as well and another using the sample with the outliers removed. The

significance of the results found was not affected by the exclusion of outliers and thus it was decided to use and report on the analyses carried out with the complete data set (no outliers were excluded). All statistical analyses were conducted using the IBM SPSS Statistics 26 software and all significance testing used an alpha level of 0.05.

**Table 1**

*Estimates Marginal Means Table for Missing Value Analysis*

DifferenceCPTMIN	SeatPie	DisgustPie	Pain	SeatPost	DisgustPost
1,19926	30,4037	20,9784	72,50	27,97	20,36

\*. Little's MCAR test: Chi-Square = 18,918, DF = 14, Sig. = ,168

Prior to carrying out the data analyses, namely the between-group one-way ANOVAs, two assumption checks were carried out for the variables of pain intensity and time participant kept hands in water; Normality and Homogeneity of Variances. The assumption of Normality was explored using distribution plots (by observing if the data followed a bell shape) and Q-Q plots (by observing if the residuals followed a linear pattern) (see appendix E for the plots). This assumption was violated but, taking the Central Limit Theorem into consideration, the sample obtained from the population was large enough for its means to be normally distributed and thus the assumption violation does not affect the latter analyses (Zhang et al., 2022). On the other hand, the assumption of Homogeneity of Variances was checked using the Levene's test and was found to be violated as the p-value in the tests was lower than 0.05. Using ANOVAs with roughly equal sample sizes to analyze the data means that the homogeneity of variances assumption does not need to be met.

## **Manipulation Checks**

### *Sexual Arousal*



Sexual arousal was measured twice via a VAS (from 0 to 100); once before the participants started the CPT and after they finished the CPT. Sexual arousal prior to the CPT was rated the highest for the FFSA condition ( $M = 46.23$ ,  $SD = 2.38$ ), followed by the SA condition ( $M = 40.35$ ,  $SD = 2.44$ ), and the least sexual arousal was found in the N condition ( $M = 4.59$ ,  $SD = 2.35$ ). A between-group one-way ANOVA ( $F(2, 166) = 90.63$ ,  $p < .001$ ,  $MSE = 29128.50$ ,  $\eta_p^2 = 0.52$ ) was found to be significant thus offering support for the desired state of sexual arousal was successfully induced (Table 2). The manipulation check for sexual arousal after the CPT showed that sexual arousal was rated the highest in the FFSA condition ( $M = 45.95$ ,  $SD = 2.55$ ), followed by the SA condition ( $M = 36.19$ ,  $SD = 2.53$ ) and was found to be lowest in the N condition ( $M = 2.07$ ,  $SD = 2.53$ ). The ANOVA for sexual arousal post CPT was also significant ( $F(2, 170) = 82.56$ ,  $p < .001$ ,  $MSE = 30625.16$ ,  $\eta_p^2 = 0.49$ ), once again showing that our manipulation was successful in producing the desired state of sexual arousal in the participants (Table 3). These results show that in both manipulation checks (pre and post CPT), the FFSA condition induce the most sexual arousal, followed closely by the SA condition and, as expected, the N condition did not generate any notable arousal.

**Table 2***ANOVA Table for Sexual Arousal Prior to the CPT*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	58256,989 <sup>a</sup>	2	29128,495	90,627	<,001	,522	181,253	1,000
Intercept	155922,649	1	155922,649	485,117	<,001	,745	485,117	1,000
Condition	58256,989	2	29128,495	90,627	<,001	,522	181,253	1,000
Error	53354,419	166	321,412					
Total	264312,000	169						
Corrected Total	111611,408	168						

<sup>a</sup> R. Squared = ,522 (Adjusted R. Squared = ,516)

<sup>b</sup> Computed using alpha = ,05

**Table 3***ANOVA Table for Sexual Arousal After the CPT*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	61250,312 <sup>a</sup>	2	30625,156	82,559	<,001	,493	165,117	1,000
Intercept	136288,862	1	136288,862	367,405	<,001	,684	367,405	1,000
Condition	61250,312	2	30625,156	82,559	<,001	,493	165,117	1,000
Error	63061,480	170	370,950					
Total	259608,000	173						
Corrected Total	124311,792	172						

<sup>a</sup>. R Squared = ,493 (Adjusted R Squared = ,487)

<sup>b</sup>. Computed using alpha = ,05

### **Disgust**

The manipulation check for disgust was carried out in the same way as the one for sexual arousal, one prior to the CPT and one after its completion. The first manipulation check for disgust was rated the highest in the SA condition ( $M = 35.82$ ,  $SD = 2.52$ ), followed by the FFSA condition ( $M = 23.07$ ,  $SD = 2.52$ ) and the least disgust was found in the N condition ( $M = 3.42$ ,  $SD = 2.47$ ). Once again, a between-group one-way ANOVA was carried out (Table 4) to evaluate the success of the manipulation eliciting feelings of disgust in participants ( $F(2, 164) = 42.84$ ,  $p < .001$ ,  $MSE = 14947.65$ ,  $\eta_p^2 = 0.34$ ) and, given that results were significant, the manipulation was successful. For the VAS after the CPT, results showed the highest ratings of disgust in the SA condition ( $M = 34.02$ ,  $SD = 2.88$ ), followed by the FFSA condition ( $M = 24.70$ ,  $SD = 2.91$ ) and the least disgust was found in the N condition ( $M = 2.43$ ,  $SD = 2.88$ ) for the N condition. The ANOVA (Table 5) for the manipulation check after the CPT provided support for the manipulation successfully eliciting feelings of disgust in participants ( $F(2, 170) = 31.66$ ,  $p < .001$ ,  $MSE = 15268.32$ ,  $\eta_p^2 = 0.27$ ). Results of the manipulation check for disgust show that, both pre and post CPT, the SA condition resulted in the highest level of disgust, followed by the FFSA condition and finally by the N condition thus providing support for the

third hypothesis dealing with the FFSA condition evoking less feelings of disgust than the SA condition.

**Table 4***ANOVA Table for Disgust Prior to the CPT*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	29895,304 <sup>a</sup>	2	14947,652	42,841	<,001	,343	85,681	1,000
Intercept	72026,728	1	72026,728	206,432	<,001	,557	206,432	1,000
Condition	29895,304	2	14947,652	42,841	<,001	,343	85,681	1,000
Error	57221,786	164	348,913					
Total	157730,000	167						
Corrected Total	87117,090	166						

<sup>a</sup>. R Squared = ,343 (Adjusted R Squared = ,335)

<sup>b</sup>. Computed using alpha = ,05

**Table 5***ANOVA Table for Disgust After the CPT*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	30536,644 <sup>a</sup>	2	15268,322	31,656	<,001	,271	63,311	1,000
Intercept	71873,328	1	71873,328	149,015	<,001	,467	149,015	1,000
Condition	30536,644	2	15268,322	31,656	<,001	,271	63,311	1,000
Error	81995,137	170	482,324					
Total	184234,000	173						
Corrected Total	112531,780	172						

<sup>a</sup>. R Squared = ,271 (Adjusted R Squared = ,263)

<sup>b</sup>. Computed using alpha = ,05

### **Main Analyses: One-Way ANOVAs on the Effect of Sexual Arousal on Pain Intensity and on Time Participants Kept their Hand in the Water**

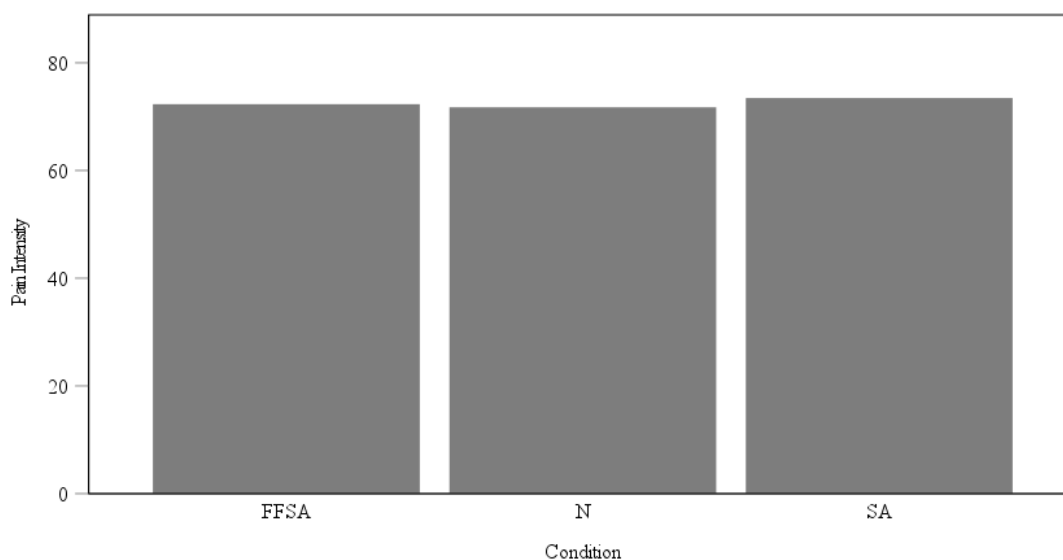
In order to test whether sexual arousal can reduce pain intensity and increase the time participants keep their hand in the water two between-groups one-way ANOVAs were carried out; one analyzing pain intensity (participants subjective responses) and one on the time participants lasted in the CPT.

#### ***Effect of Sexual Arousal on Pain Intensity***

Results for pain intensity showed that participants in the SA condition reported the highest levels of pain intensity ( $M = 73.45$ ,  $SD = 1.92$ ), followed by participants in the FFSA condition ( $M = 72.316$ ,  $SD = 1.94$ ) and participants in the N condition reported the least amount of pain intensity ( $M = 71.72$ ,  $SD = 1.92$ ) during the CPT task (Figure 1). The ANOVA for this variable ( $F(2, 170) = 0.21$ ,  $p = 0.81$ ,  $MSE = 44.50$ ,  $\eta_p^2 = 0.002$ ) did not provide a significant result meaning that there were no significant difference between the three conditions when it comes to their effect on pain intensity, resulting in the hypotheses previously mentioned not being supported (Table 6).

**Figure 1**

*Graph on the Differences in Pain Intensity Across Conditions*



**Table 6**

*ANOVA Table for Pain Intensity*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	89,002 <sup>a</sup>	2	44,501	,208	,812	,002	,416	,082
Intercept	909171,500	1	909171,500	4251,475	<,001	,962	4251,475	1,000
Condition	89,002	2	44,501	,208	,812	,002	,416	,082
Error	36354,247	170	213,849					
Total	945702,000	173						
Corrected Total	36443,249	172						

<sup>a</sup>. R Squared = ,002 (Adjusted R Squared = -,009)

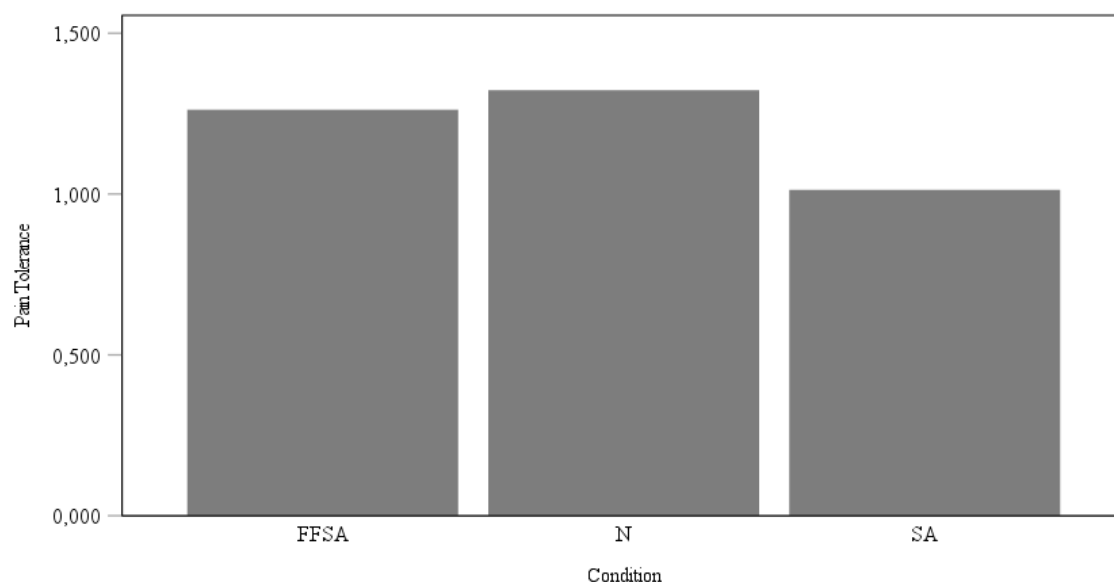
<sup>b</sup>. Computed using alpha = ,05

***Effect of Sexual Arousal on Time Participants Kept Their Hand in the Water***

Results showed that, from the three possible conditions, participants in the N condition kept their hand in the water for the longest time ( $M = 1.32$ ,  $SD = 0.14$ ), followed by the participants in the FFSA condition ( $M = 1.26$ ,  $SD = 0.14$ ) and participants in the SA condition kept their hand in the water the least amount of time ( $M = 1.01$ ,  $SD = 0.14$ ) (Figure 2). The ANOVA ( $F(2, 170) = 1.49$ ,  $p = 0.23$ ,  $MSE = 1.57$ ,  $\eta_p^2 = 0.02$ ) did not provide evidence for our hypothesis as there were no significant differences between the three conditions and their influence on how long participants kept their hand in the water (Table 7).

**Figure 2**

*Graph on the Differences in Time Participants Hands were in the Water Across Conditions*

**Table 7**

*ANOVA Table for Time Participants Hands were in the Water*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	3,129 <sup>a</sup>	2	1,565	1,490	,228	,017	2,980	,315
Intercept	248,946	1	248,946	237,101	<,001	,582	237,101	1,000
Condition	3,129	2	1,565	1,490	,228	,017	2,980	,315
Error	178,492	170	1,050					
Total	430,433	173						
Corrected Total	181,622	172						

<sup>a</sup>. R Squared = ,017 (Adjusted R Squared = ,006)

<sup>b</sup>. Computed using alpha = ,05

### **Exploratory Analyses**

As part of the exploratory analyses, four different regressions were conducted. The regressions analyzed the relationship between disgust and sexual arousal on pain intensity and on the time participants kept their hands submerged in the water both before the CPT and after the CPT in order to find out if these variables could predict the participants perception of pain throughout the study.

#### ***Sexual Arousal and Disgust on Pain Intensity***

A regression analysis was conducted for the dependent variable pain intensity with disgust and sexual arousal prior to the CPT as the independent variables. This analysis showed that disgust and sexual arousal prior to the CPT were not good predictors for the variation in pain intensity (disgust had a beta coefficient of 0.03 with a significance of 0.62 and sexual arousal had a beta coefficient of 0.03 with a significance of 0.59). Furthermore, the regression model does not significantly predict pain intensity as the p-value found was higher than 0.05 ( $F(2, 161) = 0.38, p = 0.68$ ) and the  $R^2$  value was 0.005 meaning that only 0.5% of the total variation in pain intensity was explained by the regression. In a similar manner, the results from the regression analysis of disgust and sexual arousal post CPT did not find these variables to be significant predictors of the variation found in pain intensity (disgust had a beta coefficient of 0.05 with a significance of 0.29 and sexual arousal had a beta coefficient of -0.001 with a significance of 0.99) given the results not being significant at a p-value level of 0.05 ( $F(2, 170) = 0.58, p = 0.56$ ) and the  $R^2$  value found being 0.007 meaning only 0.7% of the variation in pain intensity was explained by the conducted regression.

#### ***Sexual Arousal and Disgust on Time Participants Kept their Hands in the Water***

Analyzing the time participants kept their hands submerged in water and how good disgust and sexual arousal are as predictors, it was found that disgust and sexual arousal prior to the CPT were not a good predictor for the time participants kept their hands in the water

(disgust had a beta coefficient of -0.002 with a significance of 0.56 and sexual arousal had a beta coefficient of -0.001 with a significance of 0.72) nor good at explaining the variation found in the data. This can be seen through the results obtained through the regression analysis showing ( $F(2, 161) = 0.33, p = 0.72$ ) with an  $R^2$  of 0.004, showing that only 0.4% of the total variation in the time participants kept their hand in water was explained by the regression. Once again, the same conclusions can be reached when analyzing disgust and sexual arousal after the CPT given that said variables were not found to be good predictors (disgust had a beta coefficient of -0.001 with a significance of 0.42 and sexual arousal had a beta coefficient of -0.002 with a significance of 0.71) and the results obtained for the regression analysis showed no significant results ( $F(2, 170) = 0.47, p = 0.62$ ) with an  $R^2$  of 0.006, the regression can only explain 0.6% of the total variation in time participants kept their hand in the water.

### **Discussion**

The present study aimed to answer if sexual arousal can reduce the subjective perception of pain in women if disgust is accounted for. Three hypotheses were created to help answer the question at hand; it was hypothesized that 1) the sexual arousal conditions (SA and FFSA) would decrease pain intensity and increase the time of hand in water more than the neutral condition, 2) that the FFSA condition would be better at reducing pain intensity and increasing the time participants kept their hands in the water than the other two conditions (SA and N) and finally, 3) this hypothesis aimed to provide support to the findings obtained in the unpublished pilot by Lakhsassi (2021) in which the FFSA condition evoked fewer feelings of disgust in participants than the SA condition.

Contrary to what was predicted in the first two hypotheses, the main statistical analysis evaluating the effect of the three conditions on pain intensity and time participants kept their hands in the water did not provide any evidence in favor of the sexual arousal conditions decreasing pain tolerance and increasing time participants kept their hand in the water nor

evidence supporting the FFSA condition being better than the other two conditions at decreasing pain tolerance and increasing the time participants kept their hand in the water. The results obtained from both ANOVAs did not provide any significant results meaning that there were no significant differences between the three conditions when it came to their effects on pain intensity and time of hand in water. Nonetheless, the manipulation checks provided support for the validity of the study design given that the target states were elicited with participants reporting feelings of sexual arousal when exposed to the pornographic videos while not reporting sexual arousal when watching the neutral film. The same can be said about the manipulation check for disgust which showed that as expected, disgust was scarcely present when participants watched the neutral film. The third hypothesis was supported by the results obtained with the manipulation check for disgust which showed that the FFSA condition generated fewer feelings of disgust than the SA condition both pre and post CPT. It can be seen that even though disgust was accounted for and that sexual arousal was elicited in the participants there were still no significant analgesic properties found.

### **Sexual Arousal and its Effect on Pain**

A possible explanation for why the current study did not find significant results could be found when exploring the CPT used to deliver the painful stimulus and on the lack of physical stimulation during the study. Examples of previous research where significant analgesic properties were found when sexual arousal was prompted can be seen in the studies conducted by Whipple and Komisaruk (1984, 1985, 1986). These studies differed from the current study as they did not rely on a CPT to elicit the painful stimulus but instead used finger compressions as the painful stimulus. Even though the CPT used in the current study was effective in delivering a painful stimulus, it is possible that the temperature of 2 degrees Celsius was too cold/shocking for participants and could have thus surpassed the participants threshold for experiencing the analgesic properties that can arise from sexual arousal.



Another difference between the current study and previous work by Whipple and Komisaruk is the lack of physical stimulation. In their studies, participants in the sexually arousing conditions used physical self-stimulation, with conditions either having this self-stimulation carried out until climax was achieved or with the sole purpose of enhancing the sexual arousal but without climax being achieved. Given that these studies were able to find analgesic properties it could be that there is a need for physical stimulation to be present in order for the analgesic properties to be obtained.

Furthermore, the influence of disgust and how it affects the pain-relieving properties of sexual arousal was also considered during this study. It was hypothesized that sexual arousal caused by the porn conditions would result in both pain tolerance and the time participants kept their hand in water being higher. However, results did not concur with this hypothesis and a possible explanation for it can be that both porn conditions elicited too much disgust and thus the analgesic effects of sexual arousal were undermined. Disgust might have triggered negative feelings in participants which, as shown by literature, tend to result in lower pain thresholds as these negative feelings can act as a defense mechanism against being exposed to possible noxious stimuli (Meagher et al., 2001). Even though the manipulation check for disgust showed that the Female Friendly Sexual Arousal condition elicited fewer feelings of disgust than the Sexual Arousal condition, the level of disgust seems to anyhow have been high enough to elicit aversive feelings. The manipulation check for disgust in the Neutral condition was much lower than the one in the Female Friendly sexual Arousal condition and this lack of feelings of disgust in the Neutral condition could offer an explanation as to why this condition showed the least amount of pain intensity ( $M = 71.72$ ,  $SD = 1.92$ ) and the longest time of participants keeping their hand in the water ( $M = 1.32$ ,  $SD = 0.14$ ).

### **Limitations**

The present study contains some limitations, namely it could have contained experimenter error, lack of ecological validity, subjective measures of sexual arousal and a selection bias. The experimenter error could have been present due to the use of the programmed buttons which had to be manually pressed to signal when the participants hands went in and out of the CPT. Even though the researchers payed close attention to the livestream and pressed the buttons as accurately as possible human error might still be present. To fix this limitation in future studies the buttons should be programmed to automatically record when the participants hand is introduced and removed from the CPT. This automation would remove any influence the researcher's timing could introduce into the recording of data.

The limitation of ecological validity was introduced due to the setting of the study. Participants had to view their assigned video in the laboratory room which was set-up to allow privacy and provide a comfortable environment (soft lighting used, blanket provided, comfortable chair, plant decorations). Regardless of the comfort provided by set-up it is still an unusual environment for participants to get/feel aroused. Knowing that they are watching pornographic material in study setting might have hindered our participants ability to achieve a complete state of sexual arousal.

Staying on the topic of sexual arousal, the decision to measure sexual arousal using self-reported VAS introduced subjectivity into the results. Previous research suggests that the level of agreement between self-reported sexual arousal and physiological measures of sexual arousal is low in women (Chivers et al., 2010). This possible inaccuracy when reporting sexual arousal could mean that the participants reported a higher level of sexual arousal than what they were really experiencing thus affecting the accuracy of our conclusions. In order to deal with this limitation, future research should aim to use objective measures of sexual arousal such as using skin conductance devices or a vaginal photoplethysmograph (measures vaginal blood flow).

The final limitation of this study occurred due to the sample used. The sample consisted only on female first-year psychology students from the university of Groningen and was recruited through convenience sampling. This convenience sampling might not be representative of the broader population (e.g. non-students) and could thus make it harder to generalize the results without further research being conducted.

### **Conclusion**

To conclude, the study carried out managed to successfully induce the desired state of sexual arousal in participants watching the sexually arousing stimuli as shown by the manipulation checks but nevertheless, there were no significant results found when conducting the main analysis which investigated how the different conditions affected the participants pain intensity and the time they kept their hands in the water. We could not offer evidence in favor of the research question dealing with if sexual arousal without physical stimulation can reduce the subjective perception of pain in women when disgust is accounted for. The use of the CPT as well as the lack of physical stimulation when sexually aroused were explored as possible reasons for the lack of significance in the results obtained. Further research should be conducted in this area to explore if sexual arousal without physical stimulation can indeed generate analgesic properties in women.

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**Appendix A**  
**INFORMATION ABOUT THE RESEARCH**

Version for participants

**“Pain & Porn”**

PSY-2122-S-0422

**Dear Participant:** Welcome, and thank you for your interest in participating in our research! In this study, we are interested in finding out how sexual arousal might influence the experience of pain. We are inviting healthy female (18+) volunteers who identify as mostly heterosexual to participate in our experiment.

Our study will be conducted by 1 Ph.D. candidate (Lara Lakhsassi) and 5 Psychology Master students (Veronike Bunte, Betty-Charlotte Kay, Valeria Osorio Remy, Leonie van Jaarsveld, and Merith Baan) from the University of Groningen, supervised by dr. Charmaine Borg and Prof. Peter de Jong. The research is evaluated by the Ethical Committee of Psychology at the University of Groningen.

**Do I have to participate in this research?**

Participation in the research is voluntary. However, your consent is needed. Therefore, please read this information carefully. Ask all the questions you might have, for example because you do not understand something. Only afterwards you decide if you want to participate. If you decide not to participate, you do not need to explain why, and there will be no negative consequences for you. You have this right at all times, including after you have consented to participate in the research.

**What do we ask of you during the research?**

Before we begin the experiment, you will be asked for your written consent to voluntarily participate. Next, we will explain the experimental procedure to you step by step.

During the experiment, you will be left alone in the room and instructed by the screen to think about a specific memory. Following this, you will watch one of three film clips (Porn Clip A, Porn Clip B, or a film of a train riding along the tracks); the assigned film clip will be randomized. During the movie, you will be asked to rate different emotions you might feel using a visual analogue scale; please respond to these as quickly as possible. Afterwards, you will receive an instruction for when to place your hand in the cold pressor (i.e., ice cold water); once you begin, you are asked to leave your hand in for as long as you can tolerate. There will be a camera facing the cold pressor that will allow the researcher to see and time the duration between when the hand was first placed in the water and when it was removed. To guarantee privacy, the camera will show NOTHING else besides the hand in the cold pressor, and will NOT record any material. Once the movie clip has ended, you will be asked to rate your level of pain on a scale, as well as rate different emotions you might have felt while watching the movie clip on a scale.

The experiment as a whole will last up to ~20 minutes (including set-up and instructions). Once you are finished, you can exit the room and let the researcher know.

During the experiment, you may experience slight physical or personal discomfort due to the cold water or due to the nature/content of the movie clip. We would like to remind you that you are free to withdraw your participation without ANY consequences at any stage during the trial.

Once the experiment has been completed you will receive your SONA credits as compensation (or money for the paid participant pool)!

### **How will we treat your data?**

The data collected will be processed for academic and educational purposes only. It will be collected electronically during a psychology laboratory setting at the University of Groningen by the researchers involved in the study. All participants will be assigned a participation code to ensure confidentiality, and the assignment to the three trial groups will be random.

### **What else do you need to know?**

You may always ask questions about the research: now, during the research, and after the end of the research. You can do so by speaking with one of the researchers present, or by emailing ([c.borg@rug.nl](mailto:c.borg@rug.nl))

Do you have questions/concerns about your rights as a research participant or about the conduct of the research? You may also contact the Ethics Committee of the Faculty of Behavioural and Social Sciences of the University of Groningen: [ec-bss@rug.nl](mailto:ec-bss@rug.nl).

Do you have questions or concerns regarding the handling of your personal data? You may also contact the University of Groningen Data Protection Officer: [privacy@rug.nl](mailto:privacy@rug.nl).

*As a research participant, you have the right to a copy of this research information.*



**Appendix B****INFORMED CONSENT****“PORN AND PAIN”**

PSY-2122-S-0422

- I have read the information about the research. I have had enough opportunity to ask questions about it.
- I understand what the research is about, what is being asked of me, which consequences participation can have, how my data will be handled, and what my rights as a participant are.
- I understand that participation in the research is voluntary. I myself choose to participate. I can stop participating at any moment. If I stop, I do not need to explain why. Stopping will have no negative consequences for me.
- I confirm that I meet the eligibility requirements.

I confirm that (please leave blank if you do not agree):

- I am 18 years old or above
- I identify as mostly heterosexual (i.e., sexual preference for men)
- I do not have a sexual dysfunction (e.g., vaginismus, pain during sex, problems achieving sexual arousal or orgasm)
- I do not have medical problems involving pain (e.g., chronic pain)
- I do not have a strong aversion to pornography
- I do not participate in cold water training exercises (e.g., regular ice water bathing)
- I am right-handed

- Below I indicate what I am consenting to.

Consent to participate in the research:

- Yes, I consent to participate.
- No, I do not consent to participate

Consent to processing my personal data:

- Yes, I consent to the processing of my personal data as mentioned in the research information. I know that until 10-02-2023 I can ask to have my data withdrawn and erased. I can also ask for this if I decide to stop participating in the research.
- No, I do not consent to the processing of my personal data.

Participant's full name:	Participant's signature:	Date:

Full name of researcher present:	Researcher's signature:	Date:

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The researcher declares that the participant has received extensive information about the research.

*You have the right to a copy of this consent form.*

**Appendix C**  
**Research set-up**

**Figure C1**

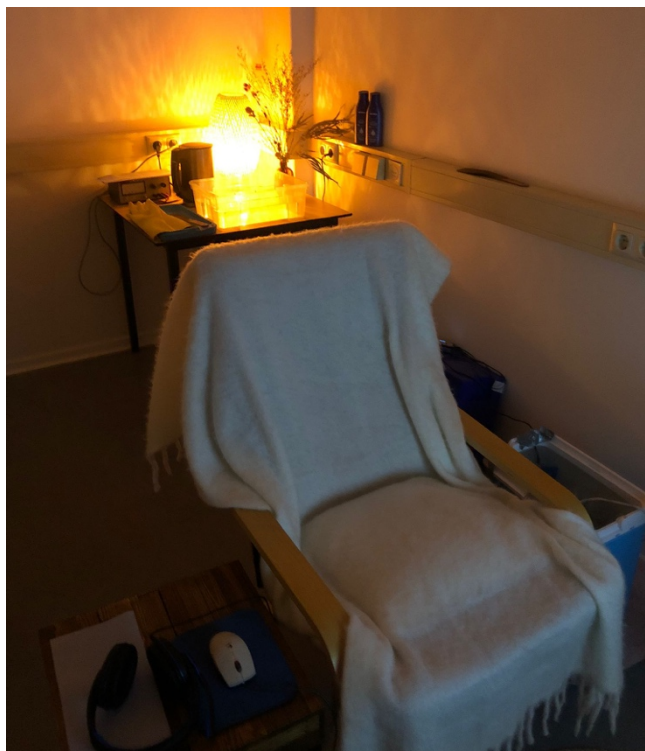
*Reenactment of Participant and Room Layout*

*During the Experiment*



**Figure C2**

*Front view of Experiment Room Set-up*



**Figure C3**

*Tepid Tub and Lighting Layout*



## Appendix D

### Researchers Script

#### **Participant Enters...**

Welcome, thanks for coming to our study. 😊 [be friendly!]

My name is \_\_\_\_\_. You can place your jacket/bag on this chair if you like, and you can have a seat right over here.

- I'd like to first confirm that you are **18 or above the age of 18?**
- Great, and may I have your SONA/PPP number to confirm the booking?
- Lastly, I'd like to ask you to please **sanitize** your hands before we begin.

Perfect, thank you.

Alright, so here you have the information form which will tell you a about what you can expect from this experiment.

- Please read through it very carefully, and let me know if you have any questions.
- You can then read the consent form over here and sign it if you agree with the terms and would still like to participate in the study.
- OK? Let me know when you're ready! 😊

[Use this time to check on both water baths]

Use T.2 for Tepid Tub, and leave T.1 in the CPT closest to participant.

#### **Collect information & consent forms...**

All set? Thank you!

- OK, so before we begin, are you wearing a watch or any jewellery on your hands? []
  - Please **remove your watch** and your **jewellery**; and you can place them over here. This is to make sure nothing gets wet during the experiment.
  - I'd also like to ask that you leave your cell phone out here; can you please make sure it is on silent mode? Thank you.

#### **Give them a tour...**

- Before we begin, I'd like to give you a tour of our research set-up.
  - My colleague and I will be sitting in this room over here (follow me).
    - This is \_\_\_\_\_.
    - As you've read in the information form, we have a camera facing the cold pressor (as you can see on the screen). This camera is a live-feed only, so it does not record anything, it will only show your hand and nothing else.
    - This is all we see on our side, everything else remains private on your side.
- You can follow me back to the experiment room [*enter 'living room'*].
- So this is where you will be during the experiment.

- Before I explain the procedure, I'd like to have you start by placing your left hand in this water for 1 minute. **Just give me one moment before you begin...**
  - 1. **Use Spatula**
  - 2. **NOTE the Tub temperature before they start** → tell partner.
  - 3. **Start timer**
    - OK, go ahead! - This is just to standardize the hand temperature.
  - 1. ***While you wait, start the aquarium pump to check you're @ target. Then turn back off.***
  - 2. ***Place thermometer back into the CPT.***
    - Ok, you can dry your hands,
    - and you can have a seat on this chair.
- **Please make sure NOT to touch the water at any point** before you see the instruction ON THE SCREEN to place your hand in the water. All clear?
  - OK, so you have been assigned to view the [PORN or Train ride] film.
- **I will now explain the experimental step by step.**
    - You will be sitting in this room on your own to ensure privacy.
    - Once I leave the room, please follow the instructions on the screen.
      - You may or may not be asked to follow a thinking exercise. If so, you will receive instructions for this on the screen.
    - Next, your assigned film will begin to play. Please focus all your attention on the movie.
    - After a few minutes, you will have two questions that pop up on the screen about your emotions. For example, you'll be asked to rate on a scale your level of sexual arousal and level of disgust, no matter which film you are watching.
    - **\*\*\*The questions will appear on a scale like this one, where you will be asked to rate your answer from not at all (on the left) to very much (on the right).**
      - You have a few seconds to hover the mouse over the scale like this, but once you click, the question will move on, and you can no longer change your answer. This is meant to be quick as to not distract you from the film too much. So, please make sure you click where you intend to, and try to answer before it disappears.
      - **OK, so you can try it out now and answer the question on the screen. [don't press continue yet].\*\*\***
    - Now the question doesn't disappear right now, but if the movie is playing, it will disappear after you click and move onto the next question or instruction.
    - All scales & instructions during the movie will show here, at the bottom of the screen.
    - Once you've answered both questions, you will see an instruction on the screen to place your hand in the water and leave it in for as long as you can tolerate.
      - **As soon as you see this instruction**, please submerge your hand fully in the water up until your wrist [*show visually; location*], all in one go; so not in and out with your fingers, just put your whole hand in in one go. Then rest your arm comfortably over the armrest and continue watching the film.
      - Also, please make sure that your hand goes in in *this area here* [*show*

*location]*

- Once you can no longer tolerate it, remove your hand, dry it with this paper towel, and answer the remaining questions on the screen.
- This is the camera that I mentioned earlier; it's for us to see when you put your hand in and when you remove it.
- That's it! Is everything clear? No questions? [answer Q's / summarize if need be]
- Perfect.
  - So you can roll up your sleeve and rest your arms comfortably on the arm rests so you can easily reach the mouse and the water.
  - Please wear the headphones over here.
  - I will turn off the lights, and once I leave the room, you can press 'continue' to begin the experiment.

## Checklist before leaving:

- Aquarium pump is turned on.
- CPT is at target temperature with 2 thermometers in place.
  - No ice cubes/coolers in the CPT
- Lamp is turned on.
- Turn off room light before you leave.

**Post Experiment**

Thanks so much!

- Did everything go alright? [take notes if anything unusual]
- And just for our notes, have you ever participated in a similar version of this study?
- Great, well thank you, and have a nice day! 😊

~~~~~  
Check on ice maker every 2h

Appendix E

Normality Assumption

Figure E1

*Distribution Plot of Disgust Scores Prior to the CPT*

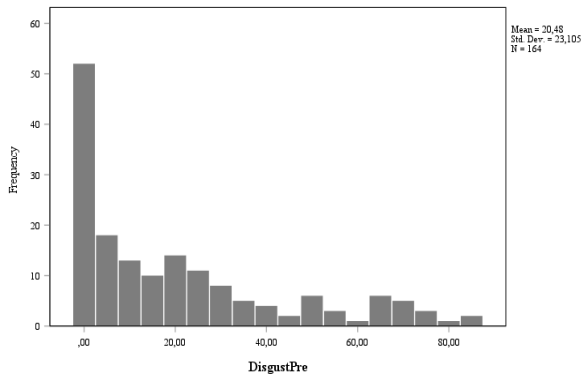


Figure E2

*Distribution Plot of Sexual Arousal Scores Prior to the CPT*

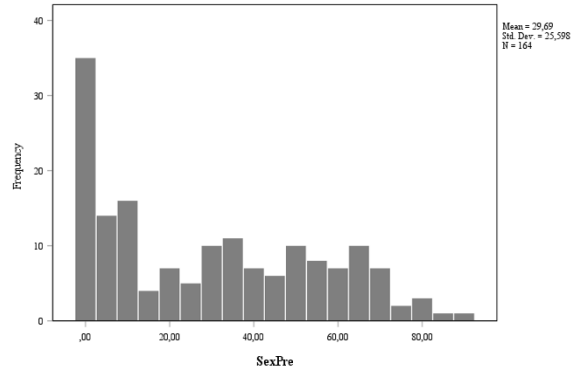


Figure E3

*Distribution Plot of Disgust Scores After the CPT*

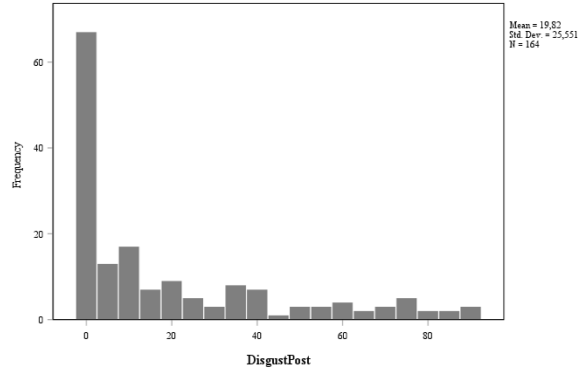


Figure E4

*Distribution Plot of Sexual Arousal Scores After the CPT*

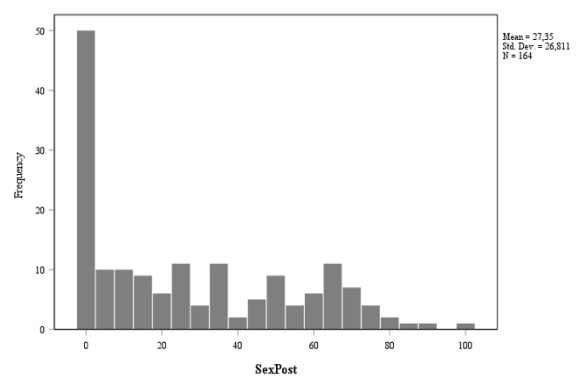


Figure E5

*Distribution Plot of Pain Intensity Scores*

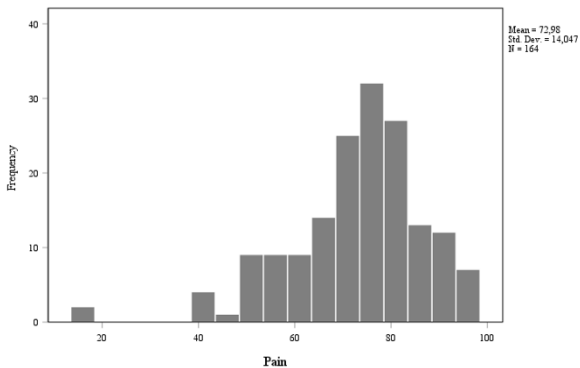


Figure E6

*Distribution Plot of Time Hand Kept in Water Scores*

