Stopped cold: Motor-response inhibition reduces the capacity of sexually-explicit stimuli to elicit subjective and physiological sexual arousal

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Abstract

The motivational incentive of sexual stimuli can be a salient force in determining the focus of thought and behaviour. Here we show that the simple act of *not* pressing a key during the perception of sexual content reduces its motivational incentive and subsequent capacity to elicit sexual arousal. Undergraduate participants (N=116) completed a Go/No-go task that required them to inhibit responses to either sexual or non-sexual images. Later they watched sexually explicit videos and reported moment-to-moment changes in self-reported sexual arousal, while thermography was used to record changes in genital physiological arousal. Participants who previously inhibited sexual images experienced lower levels of both self-reported and physiological arousal than those who inhibited non-sexual images. These results extend prior research to suggest that a by-product of motor-response inhibition is a negative alteration of stimulus-value representations for associated items— the kind of value that drives even the most biologically-fundamental forms of motivated behaviour.

Keywords: *response inhibition, stimulus value, sexual arousal, thermography, genital arousal*

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The motivational incentive of a sexual stimulus can be a salient force in determining the focus of thought and behaviour. Indeed, the success of the multi-billion pornography industry can be traced to the fact that people are strongly motivated to expend time, money and/or behavioural effort to view sexually-explicit materials and thereby experience the arousal and accompanying sexual rewards (e.g., Both et al, 2010; Gillath & Collins, 2016; Imhoff & Schmidt, 2014; Janssen et al., 2000; Spiering et al., 2004). And while our understanding of the determinants of human sexual behaviour have been critically informed by studies showing the influence of sexually-relevant perceptual information, such as that conveyed by a potential mate's voice (e.g., Cussigh et al., 2020; Feinberg et al., 2005), face (Cornwell et al., 2006; Rosetti et al., 2019), body (Rodway et al., & 2019; Tovée et al., 1998), and actions (Chivers et al., 2007; Morris et al., 2013), it has become clear that there are also important, yet less obvious, cognitive determinants of sexual attraction, arousal and behaviour (Speiring and Everaerd, 2007; Everaerd et al., 2006; Frijda, 2005; Toates, 2009). Here we build on recent evidence that inhibition—a type of cognitive-control mechanism critically involved in stopping or overriding cognitive/response-related processes—can influence our attraction to others and our willingness to expend effort to further interact with them (Driscoll et al., 2018; Ferrey et al., 2012). We show that the simple act of either pressing a button or withholding a motor-response during the perception of sexual content can significantly impact its subsequent capacity to elicit sexual arousal. Our findings suggest that the modulation of the sexual potency of stimuli by motor-response inhibition impacts both self-reported and physiological sexual arousal.

Affective devaluation by inhibition

Beyond clear evidence that inhibitory mechanisms are critically involved both in ignoring distracting information and stopping unwanted actions (for recent reviews see Chelazzi et al., 2019; Duque et al., 2017; Gaspelin & Luck, 2018; Noonan et al., 2018), extensive research now demonstrates that simply ignoring or withholding motor-responses from an unfamiliar face or whole-body image also negatively impacts subsequent social-emotional evaluations of those people, including relatively lower ratings of their trustworthiness (Doallo et al., 2012; Driscoll, Clancy & Fenske, 2020; Fenske et al., 2005; Frischen et al., 2012; Goolsby et al., 2009; Kiss et al., 2008; Raymond et al., 2005), likeability (Martiny-Huenger et al., 2014), and attractiveness (Ferrey et al., 2012; Driscoll et al., 2018). These findings have led to the hypothesis—supported by converging cognitive-behavioural (e.g., Frischen et al., 2012), computational modeling (Fragopanagos et al., 2009), neuroimaging (De Vito et al., 2017; Doallo et al., 2012; Kiss et al., 2008) and psychophysiological (Clancy et al., 2019) evidence— that inhibition elicits negative affect or otherwise alters the coding of stimulus-value for associated items (for reviews see Fenske & Raymond, 2006; Raymond, 2009; Gollwitzer et al., 2014). This may be important in the domain of sexual behaviour because arousal depends on assessments of sexual relevance and value (Barlow, 1986; Hardy, 1964; Timmers & Chivers, 2012).

Indeed, existing findings make clear that inhibition-related changes in stimulus value can affect early stages of sexual response. Prior inhibition associated with images of previously-unfamiliar people, for example, negatively biases evaluative choices away from those individuals (Fenske et al., 2005), and reduces perceived attractiveness of and behavioural-approach toward images of preferred-sex individuals (Ferrey et al., 2012; Driscoll et al., 2018), while increasing behavioural avoidance of images of non-preferred individuals (Driscoll et al., 2018). In contrast to this growing evidence regarding these early stages of sexual behaviour—liking, attraction and

behavioural approach—surprisingly little is known about whether the sexual consequences of response inhibition also extend to the biologically-significant later stages, including subjective feelings of sexual arousal and physiological sexual response (e.g., genital vasocongestion).

Current Study

To test whether the social-emotional consequences of response inhibition extend to impact participant subjective and physiological sexual arousal, we assessed arousal levels using self-report measures and genital thermography as participants watched sexually-explicit videos that had either been associated with response inhibition (Prior-inhibition-of-sexual-content group) or not (No-prior-inhibition-of-sexual-content group) in a previous Go/No-go response-inhibition task. To anticipate our results, participants that had previously inhibited sexual content reported less intense feelings of sexual arousal when watching the sexually-explicit videos than the No-prior-inhibition-of-sexual-content group. Prior inhibition of sexual content also reduced the capacity of the sexually-explicit videos to elicit physiological arousal, reflected by smaller increases in genital temperature for the Prior-inhibition-of-sexual-content group than for the No-prior-inhibition-of-sexual-content group.

Methods

All aspects of this research were approved by the University of Guelph Research Ethics Board (protocol #16-12-299). Each session lasted between 60-75 minutes.

Participants

A total of 116 undergraduate students from the University of Guelph completed the experiment in exchange for course credit or \$15 (see Table 1 for demographic information). Nine additional participants were recruited but were unable to complete the experiment due to technical issues. Cognitive-behavioural performance and self-reported feelings of sexual and genital arousal were recorded for all participants. Thermographic imaging was used to obtain

recordings of genital temperature throughout the experiment from a subset of 37 participants (19 female, 18 male). One of these thermography participants reported relatively high levels of anxiety at multiple points in the experiment (7.2 and 7.0 on a 0-9 scale), and while they chose to complete the experiment rather than leave, their data were excluded from analysis because of the known impact of anxiety on sexual arousal (e.g., Bradford & Meston, 2006).

G*Power (Faul et al., 2007) was used to confirm the appropriateness of our resulting sample sizes. These calculations indicated that 70 participants would be required to detect the same-sized effect of response inhibition on subjective states involving sexually-appealing stimuli as that ($d_z = .40$) reported by Driscoll et al. (2018) with a power of .95 at an alpha of .05, and that 14 participants would be required to detect same-sized differences in thermographic genital arousal due to the sexual salience of video content as that ($f = .79$) reported by Kukkonen, Binik, Amsel, & Carrie (2010). Our final samples ($n = 114$ for detecting differences between our experimental groups in subjective sexual arousal, including $n = 35$ for also assessing differences in genital arousal) were substantially larger than those determined by our formal calculations, as the existence and size of an effect of response inhibition on the capacity of sexual stimuli to elicit arousal is not yet known.

All participants completed a pre-experiment telephone screening to verify suitability for inclusion according to the following criteria: previous experience with and current willingness to view sexually explicit materials, pre-menopausal for females, no history of sexual arousal difficulties or sexual dysfunction, and no current medication that could impair sexual arousal. Female participants were tested during the follicular phase of their menstrual cycle to control for possible effects of cycle phase on sexual arousal. Assessment of sexual orientation using a modified Kinsey scale (Kinsey, Pomeroy & Martin, 1948) revealed that the majority of

participants were exclusively or predominantly attracted to opposite-sex individuals (see Table 1). All had normal or corrected to normal vision.

Table 1. Demographic information, sexual orientation, pre-experiment subjective states, and self-reported level of attention during video-viewing task for participants in the two experimental groups. Average values for each group are accompanied by standard deviations in parentheses. P-values are reported for independent-samples t-test comparisons, which revealed no significant differences between the groups on any of these factors.

	<i>Prior inhibition of sexual content</i>	<i>No prior inhibition of sexual content</i>	<i>p</i>
Demographics			
<i>Average age in years:</i>	19.8 (2.5)	19.5 (1.6)	0.3
<i>Gender (% Female / Male / Other):</i>	49.2 / 50.8 / 0	49.1 / 50.9 / 0	
Sexual orientation	<i>% of group</i>	<i>% of group</i>	
<i>Attracted to opposite sex only - 0</i>	73.2	65.5	
<i>1</i>	19.6	29.3	
<i>2</i>	3.6	1.7	
<i>Attracted equally to both sexes - 3</i>	0.0	0.0	
<i>4</i>	0.0	0.0	
<i>5</i>	1.8	0.0	
<i>Attracted to same sex only - 6</i>	1.8	3.4	
<i>Average (out of 6):</i>	0.5 (1.2)	0.5 (1.1)	0.7
Pre-experiment subjective states	<i>out of 9</i>	<i>out of 9</i>	
<i>Feelings of sexual arousal</i>	1.4 (1.8)	1.2 (1.6)	0.7
<i>Feelings of genital arousal</i>	1.2 (1.6)	0.9 (1.5)	0.2
<i>Feeling relaxed</i>	6.4 (1.9)	6.3 (2.1)	0.8
<i>Feeling anxious</i>	2.6 (2.1)	2.8 (2.0)	0.5
<i>Feeling bored</i>	3.4 (2.3)	3.9 (2.3)	0.3
Cognitive-behavioural performance	<i>% correct</i>	<i>% correct</i>	
<i>Go-trial accuracy</i>	96.7 (5.1)	94.9 (6.4)	0.1
<i>No-go-trial accuracy</i>	98.2 (2.5)	98.5 (0.9)	0.3
Participant engagement	<i>out of 9</i>	<i>out of 9</i>	
<i>Attention to videos</i>	7.7 (1.3)	7.9 (1.1)	0.4

Stimuli

Two sexually-explicit video clips similar to those used in prior investigations of subjective and genital sexual arousal (e.g., Kukkonen et al., 2010) were used as stimuli. Each 10-minute video depicted a different adult female-male couple engaging in a variety of consensual sexual activities, including manual and oral genital stimulation and penile-vaginal intercourse. The Go/No task utilized 120 static images from each video (240 total) that were obtained from carefully-chosen timepoints to ensure that the set of screenshots from each video were matched in terms of the different types of sexual activities, camera angles, and level of focus on the faces and other body parts of the female and male actors. In addition to these sexually-explicit screenshots, a scrambled version of each stimulus was created by dividing each image into a 48 x 32 grid of equally sized boxes and randomly varying the locations of the boxes within the grid. These scrambled images served as a set of non-sexual stimuli that could be used along with the sexually-explicit intact set in the Go/No-go task (see Figure 1). The two static-image sets differed in the presence versus absence of sexual content, but they were otherwise matched in terms of low-level visual information (e.g., brightness, contrast, coloration). A separate set of photographs of sexually-attractive individuals in swimsuits (6 female; 6 male) were used to create 12 intact images and 12 scrambled images for use as stimuli for Go/No-go practice trials. The video clips and static images were presented in full 32-bit colour at a resolution of 96 pixels per inch; each subtended approximately $27.8^\circ \times 17.4^\circ$ visual angle at a viewing distance of 70 cm.

Apparatus

Stimulus presentation and response collection. Stimulus presentation and response collection were controlled by a custom-made Psychopy2 (Peirce et al., 2019) script running on an Intel-based desktop computer connected to a monitor. The Self-report-only participants were

fully clothed and sat in a standard office chair in front of a 61cm LCD monitor on a standard-height desk; they provided their responses using a standard keyboard and mouse. The Thermography participants were undressed from the waist down and sat on a medical examination table in front of a 61cm wall-mounted LCD monitor; they provided their responses using a handheld USB number-pad.

Figure 1: Example of the stimulus sequence of events in the Go/No-go response-inhibition task and Video-viewing arousal-assessment task. Static screenshots from two sexually explicit videos were used stimuli in the Go/No-go task. In this example, intact versions of the screenshots are Go stimuli that require a speeded key-press response, and scrambled versions of the screenshots are No-go stimuli that require the response to be withheld. Participants in the Prior-inhibition-of-sexual-content group had the sexually-explicit intact images appear on No-go trials. Participants in the No-prior-inhibition-of-sexual-content group had the non-sexual scrambled images appear on No-go trials. All participants subsequently rated their moment-to-moment changes in feelings of sexual arousal (sliding scale: -10 = totally turned off, +10 = totally turned on) during ten minutes of watching the sexually explicit videos. Participants were able to choose and switch between the two sexually-explicit videos whenever they wanted.

Thermal imaging. Recordings of genital temperature were obtained from the thermography participants following well-established protocols (see e.g., Kukkonen et al., 2010)

with a Lumasense MC320 thermal-imaging camera (0.06°C sensitivity at 60Hz sampling rate) and LumaSpec RT Viewer software (LumaSense Technologies, Santa Clara, California, USA). The camera was mounted in front of at a height of 109 cm and a distance of approximately 50 cm from the participant. Participants were left alone in the testing room for the duration of the experiment and any communication with the experimenter was conducted using an intercom system. Participants undressed from the waist down and sat back on the examination table with their legs apart to provide the camera with a clear view of their genital region. The angle of the camera was adjusted slightly for each participant to further ensure clear, detailed measurements from key genital regions of interest (left labia majorum for females, penile shaft for males). Control regions of interest included the upper right thigh to verify the specificity of temperature change during sexual arousal to the genital region and the exam-table stirrup to account for any temperature drift recording or changes in environmental temperature. Accordingly, temperature values from genital regions of interest were first corrected for any room temperature differences at each timepoint by subtracting the average change in the control region of interest before being analyzed further.

Design and Procedure

The experiment included two main tasks: a Go/No-go response-inhibition task and a Video-viewing arousal-assessment task. The main measure of interest for all participants was the continuous self-reports of subjective feelings of sexual arousal during the Video-viewing task, as well as any moment-to-moment changes in genital temperature in the Thermography participants. However, we were also interested in the overall change in levels of sexual arousal as a result of viewing the explicit videos, so all participants were asked to use a sliding scale (from 0 = ‘not at all’ to 9 = ‘very’) to indicate their feelings of subjective sexual arousal (How sexually aroused do you feel right now?) and genital arousal (How much genital arousal do you

feel right now?) before and after the Video-viewing task. Asking a question specifically about self-perceived genital response allowed us to examine the perception of physical sexual arousal in all participants and determine how it corresponded to the measured physical response in thermography participants. We were specifically interested in any differences across these measures for participants that had previously inhibited sexual content in the Go/No task compared with those for participants that had not previously inhibited sexual content.

Subjective-state confound checks. To ensure that any differences observed between our experimental groups were not due to pre-existing differences in participants' incoming level of sexual arousal, or differences in key factors that can significantly affect sexual arousal, such as anxiety (e.g., Bradford & Meston, 2006) and boredom (e.g., Watt & Ewing, 1996), we asked participants a series of questions before the experiment about their current subjective states. Specifically, participants were to indicate their response on a 10-point scale (from 0 = 'not at all' to 9 = 'very') to the questions "How anxious do you feel right now?", "How relaxed do you feel right now?", and "How bored do you feel right now?". Differences in level of attention to sexual cues can also significantly impact sexual arousal (for review, see de Jong, 2009), so at the end of the video-viewing task we asked participants "How much attention did you pay to the video?" using the same sliding scale. Each of these subjective-state probes were presented at display center until response. The Self-report-only participants adjusted the slider on the scale with a computer mouse. The Thermography participants used the '-' and '+' keys on the number-pad to adjust the slider to select lower or higher points on the scale, respectively.

Go/No-go task. The Go/No-go trials required participants to press a designated 'Go' key with the index finger of their dominant hand as quickly as possible following the appearance of the Go signal and to otherwise refrain from responding. For the 'Prior-inhibition-of-sexual-content' group, participants withheld their response (No-go) from each intact sexually-explicit

image, and made a motor-response (Go) to each scrambled non-sexual image. For the ‘No-prior-inhibition-of-sexual-content’ group, participants withheld their response (No-go) from each scrambled non-sexual image, and made a motor-response (Go) to each intact sexually-explicit image. The group to which each participant was assigned was randomly determined. Each Go/No-go image was presented for 500 ms and was preceded by a 500 ms fixation display. Responses were recorded throughout a 750 ms window following stimulus onset. Each of the 16 blocks of 30 Go/No-go trials contained 15 intact images and 15 scrambled images that were randomly intermixed. Intact and scrambled images were randomly assigned to the different blocks for each participant, with the constraint that each block only contained images from one of the two videos (8 blocks per video). The blocks with images from the different videos were presented in alternating order. Whether the first block contained images from one video or the other was counterbalanced across participants. Participants began the Go/No-go task with a block of 8 practice trials before proceeding to the main experimental trials. All practice-trial images were non-explicit intact and scrambled images of attractive individuals in swimsuits. For the Self-report-only participants, this allowed the experimenter to be in the testing room throughout the practice block to ensure they understood the task instructions. These participants were left alone at the end of practice and throughout the rest of the experiment. The Thermography participants completed the entire experiment alone in a private testing room, using a standard intercom to communicate with the female experimenter, who was in a separate adjoining room.

Video-viewing task. The Video-viewing task gave participants the opportunity to choose between two different viewing options—either of the two sexually-explicit videos— and they were encouraged to switch from one video to the other whenever they wanted via keypress. Our decision to allow participants to choose between different sexually-explicit videos was intended

to enhance participant engagement and corresponding level of sexual arousal elicited during the video-viewing task. Participants used a mouse (Self-report-only participants) or keypresses (Thermography participants) to adjust a slider on a scale to reflect any moment-to-moment changes in their subjective feelings of sexual arousal (from -10 = totally turned off, 0 = neutral, to +10 = totally turned on). The scale remained visible at the bottom of the display throughout the viewing task. The task began with a 10-second preview period during which both videos played simultaneously in side-by-side windows, each centered 34.8° to the left or right of the display center. At the end of the preview, both videos disappeared until the participant indicated which video they would like to continue watching by pressing the designated 'left' or 'right' key. This made the corresponding window reappear and continue playing in its original location. Upon pressing a key to switch to the other video, the switched-from video would disappear as the switched-to video appeared. The play times of the videos were synchronized such that both—whether each was currently visible or not—progressed at the same pace throughout the 10-minute viewing.

Results

Participants that had previously inhibited sexual content in the Go/No task reported lower subjective feelings of sexual and genital arousal (see Figure 2) and experienced less physiological genital arousal (see Figure 3) from watching the explicit videos than participants that had not previously inhibited sexual content.

Subjective feelings of sexual arousal

Pre/post arousal change. A technical issue led to the loss of the subjective-state probe data for five of the Thermography participants, including pre- and post-video ratings of subjective and genital arousal. For the remaining 109 participants, the effect of response inhibition on the capacity of the sexually-explicit videos to elicit subjective arousal was evident

in the arousal-change scores that were calculated for each participant by subtracting pre-video self-reported arousal levels from post-video levels (Figure 2). Submitting these scores to a 2 (Prior inhibition: Sexual content, Non-sexual content) x (Self-report measure: Subjective-sexual arousal, Genital arousal) mixed-factors ANOVA revealed a significant main effect of Prior inhibition, $F(1,107) = 6.24, p = .014, \eta_p^2 = .055$. And while feelings of genital arousal were reported to be higher, overall, than feelings of sexual arousal, $F(1,107) = 13.17, p < .001, \eta_p^2 = .11$, the magnitude of the effect of Prior inhibition was comparable across the different measures, $F(1,107) = .83, p = .36, \eta_p^2 = .008$.

Figure 2: Increase in self-reported feelings of sexual arousal and genital arousal (rating scale: 0 = ‘not at all feeling aroused’ to 9 = ‘very aroused’) following the video-viewing task relative to pre-task levels for the No-prior-inhibition-of-sexual-content group and the Prior-inhibition-of-sexual-content group. Error bars represent standard errors of the means.

Continuous subjective-arousal change scores. The effect of response inhibition on the capacity of the sexually-explicit videos to elicit subjective arousal was also evident in the continuous arousal measure (see Figure 3). Continuous change scores were calculated for each participant by subtracting their initial baseline level of subjective arousal—the average of their

sliding-scale ratings in the first minute of video viewing—from the average for each of the next nine minutes of video viewing. Submitting these scores to a 2 (Prior inhibition: Sexual content, Non-sexual content) x 9 (Time: minutes 2 thru 10) mixed-factors ANOVA revealed a significant main effect of Prior inhibition, $F(1,112) = 5.45$, $p = .021$, $\eta_p^2 = .046$. Moreover, although subjective arousal significantly increased over time watching the explicit videos, $F(8,896) = 10.93$, $p < .001$, $\eta_p^2 = .089$, the extent to which it increased over time was significantly less for participants that had previously inhibited sexual content relative those who inhibited nonsexual content in the Go/No task, $F(8,896) = 2.20$, $p = .026$, $\eta_p^2 = .019$.

Figure 3: Average change from baseline in self-reported feelings of sexual arousal (rating scale: -10 = totally turned off to +10 = totally turned on) for each minute of sexually-explicit video watching for the No-prior-inhibition-of-sexual-content group and the Prior-inhibition-of-sexual-content group. Baseline subjective arousal ratings were obtained during the initial 60 seconds of video viewing. Error bars represent standard errors of the means.

Physiological sexual arousal

Associating sexual content with response inhibition also reduced its subsequent capacity to elicit physiological sexual arousal (see Figure 4). Genital-temperature change scores were

calculated for each participant by subtracting their initial baseline genital temperature—the average in the first minute of video viewing—from the average temperature in each of the next nine minutes of video viewing. Submitting these scores to a 2 (Prior inhibition: Sexual content, Non-sexual content) x 9 (Time: minutes 2 thru 10) mixed-factors ANOVA revealed significant a main effect of Prior inhibition, $F(1,33) = 8.00, p = .008, \eta_p^2 = .195$. The consistency of this effect throughout the video viewing task was evident in the fact that, although genital temperature did increase, overall, across time, $F(8,264) = 3.19, p = .002, \eta_p^2 = .088$, the magnitude of the effect of Prior inhibition on genital temperature did not significantly change across time, $F(8,264) = 1.12, p = .310, \eta_p^2 = .035$.

Figure 4: Average change from baseline in genital temperature (degrees Celsius) for each minute of sexually-explicit video watching for the No-prior-inhibition-of-sexual-content group and the Prior-inhibition-of-sexual-content group. Baseline temperature was obtained during the initial 60 seconds of video viewing. Error bars represent standard errors of the means.

Potential-confound checks

Taken together, the subjective and physiological results provide converging support for the hypothesis that response inhibition negatively alters the value of associated stimuli and

thereby reduces the capacity of sexually-explicit stimuli to elicit arousal. The validity of our evidence, however, depends on the extent to which our experimental groups differ only in their prior experience during the Go/No-go task of inhibiting either sexual content or non-sexual content. Thus, to rule out potential confounds, we directly compared the two groups on key variables that might otherwise lead to differences in sexual arousal (see Table 1). These comparisons revealed no significant pre-existing differences between the Prior-inhibition-of-sexual-content group and the No-prior-inhibition-of-sexual-content group in self-reported feelings of sexually-arousal $t(107) = -.34, p = .74$, genital-arousal, $t(107) = -1.25, p = .17$, being relaxed, $t(107) = -.32, p = .75$, anxious $t(107) = .68, p = .50$, or bored, $t(107) = -.98, p = .33$. There were also no significant differences between the groups in performance during the Go/No-go task—both for Go-trial accuracy, $t(112) = -1.63, p = .11$, and No-go trial accuracy, $t(112) = 0.99, p = .32$ —or in levels of attention allocated to the explicit videos during the video-viewing task, $t(107) = .81, p = .42$. Taken together, the results of these comparisons suggest that the observed between-group differences across multiple measures of arousal were not due to other obvious confounds.

Impact on arousal for women and men

Research into human sexual response is dominated by efforts to find and characterize possible differences between women and men in their patterns of desire, arousal and behaviour (e.g., Buss & Schmitt, 1993; Chivers, Rieger, Latty & Bailey, 2004; Rupp, & Wallen, 2008). Accordingly, it is standard practice in studies of sexual arousal to compare the results of women and men. We therefore reanalyzed our continuous self-report and genital thermography data including self-reported gender (Female, Male) as a factor in the mixed-factors ANOVAs. This revealed that the average effect of previously inhibiting sexual content on subsequent subjective and physiological arousal was nominally smaller for female participants than for male

participants (subjective arousal: $M_{\text{female}} = 0.92$ vs. $M_{\text{male}} = 1.00$; physiological arousal: $M_{\text{female}} = 0.23$ vs. $M_{\text{male}} = 0.60$); however, this apparent interaction between Prior inhibition and Gender was not significant for either the subjective ratings, $F(1,110) = 0.01, p = .924, \eta_p^2 = .009$, or change in genital temperature, $F(1,31) = 1.55, p = .223, \eta_p^2 = .047$. With this in mind, it is important to note that our experimental hypotheses did not focus on potential differences between women and men, nor did we design our experiment to test for these differences. Caution is therefore needed when interpreting these results, given the relatively small numbers of female and male participants in each of our experimental conditions (as low as $n = 28$ per cell for subjective arousal and $n = 8$ per cell for thermography).

Discussion

Understanding the factors that contribute to the motivational incentive of sexual stimuli is important because they can be such a salient force in driving human thought and behaviour (e.g., Sescousse, Li, & Dreher, 2015; Young, 2008). Our investigation into the role of motor-response inhibition as one of these factors builds on existing research showing that simply ignoring or withholding a motor-response from an unfamiliar face or whole-body image negatively impacts subsequent social-emotional evaluations of those people, including those that represent early stages of sexual behaviour (Driscoll et al., 2018; Ferrey et al., 2012). Our current results extend this prior work by showing that motor-response inhibition can also affect the capacity of sexually-relevant stimuli to trigger later stages of sexual behaviour, including subjective and physiological arousal. From a theoretical perspective, this finding is important because it suggests that the stimulus-value representations that are altered by neurocognitive inhibition include those that drive even the most biologically-fundamental forms of motivated behaviour.

Our novel finding that motor-response inhibition can alter the motivational salience and arousal capacity of sexual stimuli builds on prior work establishing the critical role of inhibitory

mechanisms for governing sexual response. Indeed, leading accounts of sexual behaviour focus heavily on the importance of inhibitory mechanisms for stopping sexual excitement and resisting behavioural urges when not appropriate (e.g., Bancroft, 1999; Bancroft & Janssen, 2000; Georgiadis, Kringelbach & Pfaus, 2012; Toates, 2009). The possibility that inhibition of sexual processes may be linked to motor-response inhibition, *per se*, is supported by evidence that hypersexual individuals who struggle to control their sexual behaviour also show deficits in their ability to withhold non-sexual motor responses in standard response-inhibition tasks (Miner, Raymond, Mueller, Lloyd & Lim, 2009; Seok & Sohn, 2020). Note, however, that while researchers question whether there is a general form of inhibition or specific inhibitory mechanisms for downregulating different aspects of sexual response (e.g., Rodriguez-Nieto, G., Emmerling, F., Dewitte, M., Sack, A.T., & Schumann, T., 2019; Rodriguez-Nieto, G., Sack, A.T., Dewitte, M., Emmerling, F., Schumann, T., 2019), the proposed role of inhibition in accounts of sexual behaviour is all about gain control—actively reducing the strength of the corresponding neural, cognitive, and motivational signals. In contrast, research into the affective consequences of inhibition shows that is more going on than just gain control. Rather than a momentary suppression or ‘neutralization’ of an item’s *a priori* affective salience, inhibition appears to instead produce a longer-lasting negative alteration of stimulus value (Doallo et al., 2012; Fragopanagos et al., 2009; Veling, Holland, & van Knippenberg, 2008; Wessel, O’Doherty, Berkebile, Linderman, & Aron, 2014) to make associated stimuli increasingly aversive, even if the stimulus was already relatively aversive to begin with (Chen, Veling, Dijksterhuis, & Holland, 2018; Driscoll et al., 2018; Frischen et al., 2012). Combined with this growing evidence of that inhibition causes stimulus devaluation, our current results make clear

the need to update theoretical accounts of sexual behaviour to accommodate the multi-faceted consequences of neurocognitive inhibition in the sexual domain.

The evidence that motor-response inhibition can reduce the capacity of sexually-relevant stimuli to be perceived as attractive (Driscoll et al., 2018; Ferrey et al., 2012), to elicit behavioural approach (Driscoll et al., 2018) and to elicit subjective and physiological sexual arousal suggests that computer-based tasks involving the inhibition of specific types of sexual content may lead to a reduction in motivational incentive of that type of stimulus. This is promising for the development of interventions aimed at reducing the subjective appeal and motivational incentive of stimuli that trigger maladaptive behavior, such as the problematic use of pornography for the sexually compulsive (Cooper, Delmonico & Burg, 2000). Indeed, finding ways to overcome the incentive salience of problematic stimuli has been implicated as being of great therapeutic concern for addressing sexual dysfunction (Toates, 2009). It should be noted, however, that although we found significant differences in both subjective and physiological sexual response when sexual content was associated with motor-response inhibition, the stimuli did still elicit a sexual response in participants. Ultimately, it can be argued that the motivational goal of sexual activity is sexual gratification, and that any significant increase sexual arousal, despite some stimulus-linked devaluation, could elicit enough interest to continue towards that goal (Smid & Wever, 2019).

Keeping in mind the complexity of human sexual experiences, these initial results showing that motor-response inhibition can reduce the capacity of sexual stimuli to elicit both subjective and physiological sexual response do provide a promising avenue for future research. Such investigations focusing on problematic sexual behavior would align well with recent research on the utility of inhibition-based tasks for devaluing motivationally-relevant stimuli to address disorders of self-control in overeating (e.g., Veling, Lawrence, Chen, van

Koningsbruggen & Holland, 2017), problem gambling (Stevens et al., 2015), and alcohol and drug abuse (e.g., Houben, Nederkoorn, Wiers, & Jansen, 2011; Scholten, Granic, Chen, Veling, & Luijten, 2019). Thus, our findings that inhibition can impact later stages of sexual response converge with other recent discoveries to support the possibility that the affective consequences of inhibition may be effectively utilized in a variety of clinical applications.

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