Attentional Processing of Visual Sexual Stimuli and the Concordia Sexual Image Dataset

Julie G. Shilhan

A Thesis

In the Department

of

Psychology

Presented in Partial Fulfillment of the Requirements

For the Degree of

Doctor of Philosophy (Psychology) at

Concordia University

Montreal, Quebec, Canada

August 2017

CONCORDIA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

This is to certify that the thesis prepared

By: Julie G. Shilhan

Entitled: Attentional Processing of Visual Sexual Stimuli and Concordia Sexual Image Dataset

and submitted in partial fulfillment of the requirements for the degree of

Doctor Of Philosophy (Psychology)

complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the final examining committee:

_____ Chair
Dr. Ian Ferguson

_____ External Examiner
Dr. Joanne-Lucine Rouleau

_____ External to Program
Dr. David Howes

_____ Examiner
Dr. Mark Ellenbogen

_____ Thesis Co-Supervisor
Dr. James Pfaus

_____ Thesis Co-Supervisor
Dr. Aaron Johnson

Approved by _____
Dr. Karen Li, Graduate Program Director

August 28, 2017 _____
Dr. André Roy Dean
Faculty of Arts and Sciences

ABSTRACT

Attentional Processing of Visual Sexual Stimuli and the Concordia Sexual Image Dataset

Julie Shilhan, PhD.

Concordia University, 2017

Historically, research concerning human sexual response and sexual excitement has focused largely on examining subjective arousal or the physiological end points of arousal (e.g., erection or genital vasocongestion: Brotto & Gorzalka, 2002; Laan, van Driel, & van Lunsen, 2008; Laan, van Lunsen, & Everaerd, 2001). However, some researchers have begun to delineate the cognitive mechanisms implicated in human sexual response, and how these mechanisms are influenced by individual differences (Spiering & Everaerd, 2007; Spiering, Everaerd, & Laan, 2004). Accordingly, the studies presented within this dissertation were designed to further elucidate the cognitive contributions of attention and stimulus evaluation on the processing of Visual Sexual Stimuli (VSS), while also expanding the availability of VSS by creating an erotic image database. The modified Stroop paradigm (both word and pictorial) was used to examine attentional responses to VSS. Findings from these studies highlight the importance of attentional factors in the assessment of VSS, and how these factors are influenced by participants' gender and self-reported sexual desire. Further, results from the pictorial Stroop study suggest that men's and women's attentional systems may have adapted to be attuned differently in the processing of VSS. Heterosexual males automatic and controlled attentional biases were category specific (i.e., consistent with their sexual preference), whereas women's were nonspecific. The general lack of adequately validated modern VSS led to the development of the Concordia Sexual Image Dataset (CSID), a comprehensive database of erotic images that includes heterosexual, lesbian and homosexual content, with norms for valence and arousal by male and female heterosexual participants. These ratings revealed that the evaluation of erotic content was strongly influenced by the gender of the evaluator. Heterosexual men's response patterns for ratings were fairly consistent across content categories, while women displayed substantial variability in their ratings within and between content categories. These findings suggest that researchers should take into account both the content and the emotional impact of the image when selecting relevant VSS. Collectively, the results presented in this thesis have

implications for the objective measurement of sexual response, the conceptualization of cognitive mechanisms implicated in the processing of VSS, and for the identification of cognitive factors associated with individual differences in sexual functioning.

Keywords: Cognition, Attention, Modified Stroop, Visual Sexual Stimuli, Database.

ACKNOWLEDGMENTS

Graduate school has been a long road; a rite of passage; a road less travelled. I know that I would not be here, close to the end of the road, without a heck of a lot of help. Thus, I would like to make the following acknowledgements.

To Dr. Aaron Johnson, thank you for taking a long shot on a Star-Trek (TNG) loving student from Northern Ontario. Thank you for your guidance, your patience and for your continued faith in my abilities. You were a constant motivator through both my failures and successes.

To Dr. Jim Pfaus, thank you for making into a better writer and for helping to ask the right questions. Your passion for your work is a constant source of inspiration.

To the members of both the Vision and Pfaus lab, I consider you all collaborators and look forward to hearing about your future endeavours. To John Brand, you are the greatest comrade in arms an officer of education could ask for. To Lucy and Sherri, this thesis would not have been possible without your guidance. To all the younger scientists who made this accomplishment possible, Marie-Eve Leclerc, Tanya D'Amours, Maria Santaguida, Jacob Applebaum, Karine Elalouf, and Josh, THANK YOU so very much.

To my extended Montreal family, Hil, Levi, Krysten, and John, thank you for helping to heal this lonely heart. To Hilary Duncan in particular, thank you for your friendship and for your deep and unbridled love of caffeine, both of which have been integral contributions to my sanity for the last five years.

To my family, thank you for trusting me in my stubborn pursuit of seemingly unending higher education. To my father, you have been gone for 20 years, but your lessons remain. Dad I learned from you that discomfort is a part of life, not something to be feared, but endured to achieve one's goal. To my mother, I have learned that a person's value stems from how they treat others, a lesson the guides me in my clinical practice. To my siblings, Nat, Hughie, and Caro, who instilled in me the notion of capability and for repeatedly telling me "your time will come.

To my little Eleanor, you are my muse, my inspiration-- I adore you kid. And finally, to my husband, it has been said, "alongside any good [woman] is an even great [man]". David, you have proven not only the validity, but also the necessity of this too true idiom. You are my champion, my friend, and my partner in ridiculousness. Never once throughout the three years living apart did you make me feel that what I was doing wasn't worth the effort. You pick me up, dust me off, and send me out into the world with a whole heart.

Thank you to Concordia University, as well as the funding agencies, the Canadian Institutes of Health Research (CIHR) and The Natural Sciences and Engineering Research Council of Canada (NSERC). Finally, thank you to the other members of my committee: Dr. Mark Ellenbogen, Dr. Joanne-Lucine Rouleau, Dr. David Howes and Dr. Ian Ferguson.

CONTRIBUTION OF AUTHORS

This dissertation consists of a general introduction, three experimental chapters, and a general discussion. All sections were written with general feedback from my supervisors, Dr. Aaron Johnson and Dr. Jim Pfaus. Several undergraduate students contributed to the collection of data. The co-authorships are defined below.

Chapter 2: Attention Capture by Sexual Word Cues and Their Relationship to Women's Sexual Desire
Julie Shilhan, Maria Santaguida, Aaron P. Johnson, James G. Pfaus

Chapter 3: Development and standardization of the Concordia Sexual Image Dataset
Julie Shilhan, James G. Pfaus, Aaron P. Johnson, Tanya D'amours, Karine Elalouf, and Jacob Applebaum

Chapter 4; Examining the Category Specificity of Women's and Men's Attention to Visual Sexual Stimuli
Julie Shilhan, Marie-Eve Leclerc, Aaron P. Johnson, James G. Pfaus

TABLE OF CONTENTS

LIST OF FIGURES

Figures in Chapter 1

Figures in Chapter 2

Figures in Chapter 3

Figures in Chapter 4

LIST OF TABLES

Tables in Chapter 2

Tables in Chapter 3

Tables in Chapter 4

CHAPTER 1: GENERAL INTRODUCTION

Historically, research concerning sexual response and sexual excitement has focused largely on describing the physiological aspects of sexual processes, while other factors, such as cognitive components, have garnered less attention. In 1966, Masters and Johnson proposed what is arguably the most well known conceptualization of human sexual response that focused mainly on physiological indicators. Their EPOR (Excitement-Plateau-Orgasm- Resolution) model outlines a linear, temporal progression of physiological changes. It begins with the excitement phase (reflected in increased blood flow to erogenous tissues), then the plateau phase (maintenance or intensification of blood flow to erogenous erectile tissues), to the orgasm phase (the release of sexual excitement or tension), followed by the resolution phase wherein the individual returns to an unstimulated state (Masters & Johnson, 1966). The EPOR model is based on observations of physiological responses during sexual arousal and sexual intercourse and thus focuses almost exclusively on the genital changes that are associated with each phase of the sexual response cycle.

Helen Singer Kaplan (1977, 1979) added a conscious cognitive and affective overlay on to the EPOR model. She revised the EPOR model's excitement phase to reflect both a bottom-up sexual arousal (reflected in genital engorgement), and a top-down cognitive component of sexual desire (the experience of wanting a sexual encounter and being "turned on"). Unlike the four stages identified in the Masters and Johnson EPOR-model, desire in Kaplan's model is not necessarily associated with genital change, but understood as a motivating force towards engaging in sexual behaviour that could apply to all four of the phases. Although the addition of a desire stage highlighted the psychological aspect of human sexual response, the current understanding of desire still largely supports a physiological conceptualization of how humans respond to sexual cues.

More recently, Rosemary Basson (2000) proposed a circular model of sexual response that captures the interactional nature of psychological and physiological processes by highlighting cognitive and emotional motivational factors for sexual behaviour while also acknowledging the influence of biological and psychosocial factors. Although Basson's model was originally developed to explain sexual response patterns in women, modified versions of her circular model have been shown to be representative of sexual response in some men (Connaughton, McCabe, & Karantzas, 2016). Each of the models described above has been

shown to have application; however no single model of sexual response applies to all men's (Connaughton et al., 2016; Giraldi, Kristensen, & Sand, 2015) or women's sexual response patterns (Ferenidou, Kirana, Fokas, Hatzichristou, & Athanasiadis, 2016; Giraldi et al., 2015; Sand & Fisher, 2011) emphasizing that sexual responses in both men and women are heterogeneous.

Over the last decade researchers have increasingly begun to examine the cognitive processes involved at various stages of the sexual response cycle (O'Ciardha & Gormley, 2012a; O'Ciardha & Gormley, 2013; Koukounas & Over, 2001; O'Ciardha, 2010; Samson & Janssen, 2014; Zappalà et al., 2013). These cognitive processes are also critical components of sexual response that warrant further investigation to provide a more complete understanding of how humans respond to visual sexual stimuli (VSS) in a "top-down" fashion. The underlying rationale for this dissertation is that conscious and unconscious cognitive processes, including attention, emotion, and memory, may provide the necessary context by which visual sexual stimuli and associated physiological responses are interpreted as being specifically "sexual." The overarching goal of the experiments outlined in the current dissertation is to build on previous research examining sexual response by applying a well-established paradigm from cognitive science that measures attention, the modified Stroop, to quantitatively examine the cognitive components of sexual response, including attention and stimulus evaluation. In the classic Stroop test (Figure 1a), participants are presented with words tinted in different colours and they are instructed to name the colour in which the words are presented (Stroop, 1935). Delays and increased error rates are typically found when the colour of the ink is incongruent with the semantic content of the word (e.g., the word "RED" written in blue), reflective of interference between conflicting sources of information (Stroop, 1935). This delay is colour naming when word meaning is not congruent with ink colour is called the "Stroop effect". A modified Stroop paradigm employs a similar method by examining the impact of word (Figure 1b) or image (Figure 1c) saliency on the participant's ability to name the target colour. In this case, words or images with sexual content are used to interfere with the naming of the colour in which the word is printed or the colour of the border surrounding the image.

a) Traditional Stroop Task

b) Modified Sexual Word Stroop Task

c) Modified Sexual Image Stroop Task

Figure 1.1 Example of Stroop tasks: (a) Traditional Stroop Task, (b) Modified Sexual Word Stroop Task, and (c) Modified Sexual Image Stroop Task.

Visual sexual stimuli are presumed to be among the most compelling emotional stimuli, reflected in the common adage "sex sells." However, how humans respond to sexual cues is contingent on a number of distinct and interrelated factors. When human participants view VSS stimuli, there are often discrepancies between autonomic physiological indictors such as erection, vasocongestion, heart rate, and blood pressure and the participants' reported subjective arousal, with this discrepancy occurring more often in women (Bossio, Suschinsky, Puts, & Chivers, 2014; Chivers & Bailey, 2005; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Chivers & Timmers, 2012; Rieger et al., 2015; Rieger & Savin-Williams, 2012; Suschinsky & Lalumière, 2012; Suschinsky, Lalumière, & Chivers, 2009b). The lack of consistency between physiological arousal measures and self-reported subjective sexual arousal suggests that autonomic processes only partially account for how humans react to sexual stimuli. Although researchers investigating sexual response have relied primarily on either subjective ratings of arousal or autonomic end points such as erection or genital vasocongestion (Brotto et al., 2005; Korff & Geer, 1983; Laan, Everaerd, & Evers, 1995; Spape, 2011; Suschinsky et al., 2009b), recent work has begun to examine cognitive processes involved at various stages of the sexual response cycle

Although it is clear that participant variables such as gender, hormone levels, self-identified sexual orientation and sexual functioning, influence the type of content that individuals find psychologically or physiologically arousing (Brotto et al., 2005; Chivers, Seto, & Blanchard, 2007; Chivers et al., 2010; Laan & Everaerd, 1995; Prause, Janssen, & Hetrick, 2008; Prause, Steele, Staley, Sabatinelli, & Proudfit, 2015; Rupp & Wallen, 2009; Spape, Timmers, Yoon, Ponseti, & Chivers, 2014), less is known about how these internal variables interact to determine an individual's sexual response to a given stimulus. As such, a secondary goal of this dissertation is to apply the modified Stroop to examine attentional capture as a potential underlying mechanism that can account for variability in sexual response patterns to different types of visual sexual cues, and how these cues are associated with individual characteristics, such as the participant's gender, self-identified sexual orientation and self-reported sexual desire.

Despite erotic images and films being the most widely utilized stimuli in research examining sexual response, a problem facing researchers is the paucity of available VSS. Researchers hoping to find appropriate erotic images for a particular research question will have great difficulty finding relevant validated stimuli. Most experiments are idiosyncratic, having

chosen stimuli from pictures or videos obtained from various sources. Only one set of validated erotic pictures exists, the International Affective Picture System (IAPS; Lang, 2008). Although this is the most recognized image database, its erotic images were collected more than 30 years ago and are widely considered to be outdated (Chivers et al., 2007; Prause, Steele, Staley, Sabatinelli, & Proudfit, 2015). Furthermore, the IAPS is comprised of only a small set of 79 erotic images, which are limited to heterosexual interactions (i.e., male to female oral sex, penile-vaginal penetration, kissing). Thus, if we hope to advance our knowledge of the psychological and physiological processes involved in sexual response and dissociate the relative influence of individual characteristics such gender and sexual orientation, it is necessary to present contemporary stimuli that appeal to different groups of participants (e.g., homosexual, lesbian, heterosexual), and that have been validated appropriately along several erotic dimensions. To this end, one goal of this thesis was to develop and validate a dataset of erotic images. The development and validation of the Concordia Sexual Image Dataset (CSID), described in Chapter 3, consists of a set of 189 erotic stimuli depicting a variety of same-sex and opposite-sex erotic interactions. This new dataset makes it possible to address a variety of research questions that could not be addressed with the IAPS or sets of non-validated erotic images.

In the following section, literature relevant to the studies of this thesis is reviewed. This review discusses the strengths and limitations of subjective and physiological measurements of human sexual response. I also provide a review of studies measuring neural activation in response to visual sexual stimuli using brain-imaging techniques. Finally, I review the recent application of cognitive paradigms to investigate sexual response and the models on which this research is grounded.

Subjective Measurement of Sexual Response

Sexual response to VSS has typically been measured either subjectively, by asking participants to indicate their self-reported current or past level of sexual interest in a stimulus or objectively, by measuring the participant's genital responses. The real-time measurement of sexual arousal occurs over the course of stimulus presentation. Wincze, Hoon, and Hoon (1977) were the first to develop a paradigm that allowed for the continuous measurement of subjective sexual arousal. Participants were asked to indicate their levels of arousal by moving a pointer that traveled on an arc to rate their arousal on a 10-point scale. Other variants of this technology

have been developed, including a slider that, when moved, reflects the participant's subjective sexual arousal (Janssen, 2002).

A major advantage of real-time measurement of the responses to VSS is that it has the potential to allow researchers to examine the relationship between subjective and genital response over the course of an experimental manipulation. Correlations between the two measures can be used as a strength index of the temporal relationship between the two signals for each participant. Although subjective and genital responses have generally been assumed to assess the same underlying construct, sexual arousal, self-reported sexual arousal and genital response typically have low correlations in women (r=.26) and moderate correlations in men (r=.66) (for a review see Chivers et al., 2010). Heterosexual men report greater genital and self-reported arousal to stimuli consistent with their self-reported sexual orientation (e.g., female naked images; Suschinsky et al., 2009b), while heterosexual women demonstrate a more complex pattern of genital response. Women's subjective arousal, similar to men's, tends to be consistent with their stated sexual preference (Chivers, Seto, & Blanchard, 2007; Chivers et al., 2010; Suschinsky et al., 2009); however, women tend to respond physiologically to a wider variety of stimuli that may or may not be congruent with their stated sexual preference (Chivers et al., 2007; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Laan & Everaerd, 1995). Thus, heterosexual women's subjective sexual arousal tends to be category-specific while their genital response tends to be category non-specific.

Some have also called into question whether the contiguous measurement of subjective and genital arousal may influence both the self-reported and physiological responses by altering the level of attention to the stimulus (Geer & Fuhr, 1976; Janssen, 2002; Masters & Johnson, 1970). Given that attentional processes have been implicated in sexual response (Janssen, Everaerd, Spiering, & Janssen, 2000; Prause et al., 2008; Spiering & Everaerd, 2007), contiguous measurement of sexual response could enhance participants' experience through increased attention to sexual cues or diminish their experience through distraction. For example, a meta-analysis by Chivers (2010) revealed that the contiguous assessment of sexual arousal was associated with lower concordance in men, but showed no effect in women. Another potential disadvantage of using real-time measures of subjective sexual arousal is that they have been shown to lead to increases in spectatoring (Wincze, Venditti, Barlow, & Mavissakalian, 1980)—a process wherein the individual adopts a third person perspective through heightened awareness

of their sexual performance (Janssen, 2002; Masters and Johnson, 1970). Wincze, Vendetti, Barlow, and Mavissakalian (1980) found that contiguous measurement of subjective sexual arousal led to decreased genital responses in men, but had no effect on genital responses in women. In summary, as in many fields, the fact that the response is being measured may influence the response.

Physical Measurement of Sexual Response

When assessing sexual response, self-reported sexual arousal is particularly vulnerable to reporting bias related to impression management, as many questions inquire about social attitudes and taboos (Fortenberry, Cech, Zimet, & Orr, 1997; McCallum & Peterson, 2012; Meston, Heiman, Trapnell, & Paulhus, 1998), leading researchers to more often rely on physiological measures of sexual response. Several types of physiological change believed to be associated with sexual response have been measured with the most commonly used method of measurement being genital vasocongestion (i.e., increased blood flow to the genitals; Levin & Riley, 2007*)*. Genital vasocongestion leads to clitoral erection and vulvar engorgement in women, and penile erections in men (e.g., Levin, 1998; 2003; Levin & Riley, 2007). A number of instruments have been developed to detect and measure changes in genital vasocongestion, with the most common types of measure being plethysmography (Freund, 1963; Zuckerman, 1971) and the increasingly popular use of thermal imaging (Payne & Binik, 2006).

Genital plethysmography.

In men, vasocongestion has typically been measured using penile plethysmography (PPT), which measures changes in the volume or circumference of the penis, with the latter used more often. The penile strain gauge records the maximum penile circumference a man reaches, and any changes in circumference are recorded as a percentage of this maximum response (Abel, Blanchard, Murphy, Becker, & Djenderedjian, 1981; Marshall & Fernandez, 2000). Thus, by analyzing the relative levels of penile response to various stimulus categories (e.g., naked women vs. naked men) the measurement is believed to be reflective of the individual's sexual interest or preference for a given stimulus category. The PPT has been shown to be able to discriminate between heterosexual and homosexual men (Freund, 1963; Mavissakalian, Blanchard, Abel, & Barlow, 1975; Sakheim, Barlow, Beck, & Abrahamson, 1985), identify deviant sexual interests (Coric et al., 2005; Lalumiere, Quinsey, Harris, Rice, & Trautimas, 2006) and discriminate between fetishists from non-fetishists (Kurt Freund, Seto, & Kuban, 1996). In addition, the PPT

has also been able to discriminate between sexually functional men, and those with a sexual dysfunction (e.g., men with premature ejaculation; Rowland, Van Diest, Incrocci, & Slob, 2005).

In women, changes in blood flow are indirectly measured through the use of a vaginal photoplethysmograph; a small acrylic plastic probe that can be inserted into the vagina to record changes in the amount of light reflected from the wall of the vagina (Geer, Morokoff, & Greenwood, 1974; Sintchak & Geer, 1975). An increase in the amount of light reflected is interpreted as evidence of vasocongestion. The vaginal photoplethysmograph measures two components: vaginal blood volume (VBV), which reflects changes in blood pooling; and vaginal pulse amplitude (VPA), which reflects changes in the vaginal pulse wave. Because VPA has demonstrated better discriminant validity, it is the more commonly used measure of vasocongestion (Laan, Everaerd, & Evers, 1995). For example, VPA has been shown to discriminate premenopausal women from postmenopausal women (Brotto & Gorzalka, 2002; Laan, van Driel, & van Lunsen, 2008; Laan, van Lunsen, & Everaerd, 2001). It is still unclear whether VPA can reliably discriminate between sexually dysfunctional and functional women, as most research did not find a difference between women with, and those without, sexual dysfunctions (for a review see Laan et al., 2008). Moreover, the concordance rates in women between subjective and physiological arousal using this technology are low (for a review see Chivers et al., 2010). In particular, heterosexual women's genital arousal, as measured by the vaginal plethysmograph, has been shown to be category non-specific meaning that they respond to stimuli regardless of their sexual preference (Chivers et al., 2007; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Laan & Everaerd, 1995). In summary, while men tend to have strong agreement between self-reported sexual arousal and genital responses as measured by the penile plethysmograph (i.e., high sexual concordance; Chivers et al., 2010; Suschinsky, Lalumière, & Chivers, 2009a), women's sexual concordance tends to be relatively low (Chivers et al., 2010).

However, comparisons across gender using this technology should be made with caution as the instruments yield different dependent measures in men and women (Kukkonen, Binik, Amsel, & Carrier, 2007); penile plethysmography infers vasocongestion from changes in the volume or circumference of the penis, whereas vaginal plethysmography infers vasocongestion from the amount of light reflected from the vaginal walls. Therefore, although these two measurements claim to be measuring the same process (i.e., physiological sexual arousal), they use different instruments that each measure different aspects of genital changes associated with

sexual response (Kukkonen, Binik, Amsel, & Carrier, 2007). Other limitations of this technology include test-retest reliability as experiments cannot ensure that the strain gauge or the vaginal probe are put on or in the same place in different experimental sessions (Woodard & Diamond, 2009) and movement artefact as the technology cannot be used during physical stimulation or orgasm (Woodard & Diamond, 2009). In an effort to implement a measure of sexual arousal that facilitates comparison between gender groups and is less subject to movement artefacts, the technology of thermal imaging has become increasingly popular.

Thermal imaging. Thermal imaging ("thermography") is an alternate measure of genital vasocongestion that records changes in genital temperature associated with vasocongestion, measured in degrees Celsius and thus allows for between-group comparisons (Huberman & Chivers, 2015; Kukkonen, Binik, Amsel, & Carrier, 2010; Kukkonen et al., 2007; Kukkonen, Binik, Amsel, & Carrier, 2010). Thermal imaging is based on the principle that, with increasing body temperature, there is a proportional increase in infrared energy emitted (Kukkonen, Binik, Amsel, & Carrier, 2007). Thus, this technology can indirectly track vasocongestion by measuring changes in genital temperature through the use of a thermographic camera aimed at the genitals while the patient is lying down. Another advantage of thermography over photoplethysmography is that it is less invasive, as this method does not require genital contact.

Only a few studies have used thermography to examine sexual response across gender. Their results suggest that thermography can accurately discriminate between sexual and other types of arousal in both men and women (Abramson et al., 1981; Kukkonen et al., 2007, 2010; Rubinsky, Hoon, Eckerman, & Amberson, 1985). For example, Kukkonen et al. (2007) found that both men and women assigned to a sexually explicit film condition demonstrated an increase in genital temperature, as compared to participants assigned to the neutral or humor conditions. Consistent with their earlier findings, Kukkonen et al. (2010) also found that men and women assigned to a sexually explicit film condition experienced a significant average increase in genital temperature from baseline when compared to participants in the neutral, anxiety arousal, or positive arousal conditions. Taken together, these results provide support for thermography as a means of discriminating between sexual and other types of arousal.

As with the plethysmography findings, genital thermography has found gender differences in physiological responses to VSS. Huberman and Chivers (2015) examined the specificity of heterosexual men and women's genital arousal to films depicting men masturbating

(female sexual condition), women masturbating (male sexual condition), and a nature film (neutral condition) using both concurrent plethysmography and thermography. In line with previous research, heterosexual men's genital responses, as measured by thermography, were consistent with their sexual preference (i.e., women masturbating), while women's genital responses were non-specific, responding to images of both men and women masturbating. Some question the validity of using this technology to compare across groups, as it remains unclear whether a given change in temperature has the same meaning across gender or among different age groups (Kukkonen, 2015). It also remains unclear how long it takes for genital temperature to return to baseline after the participant is presented with a sexual cue, making the use of a within-subject design difficult (Chivers et al., 2010; Huberman & Chivers, 2015b).

Overview of limitations of measures of vasocongestion

By focusing exclusively on genital response, researchers are likely missing key processes involved in the cognitive or conscious processing of sexual responses. Genital response is one, typically late, point in a complex process of stimulus evaluation whereby moment-to-moment input is processed, at both a conscious and unconscious level that includes assessments of autonomic function, subjective arousal, and desire (Rupp & Wallen, 2009; Spiering, Everaerd, & Laan, 2004), if not also assessments of disgust, context, and ongoing processing of sexual stimulation. In addition, measures of genital arousal have consistently displayed low concordance with self-reported arousal in women (Chivers et al., 2010; Kukkonen, 2015; Meston et al., 2010). Thus, researchers have started to use other objective methodologies such as functional magnetic resonance imaging (fMRI; Georgiadis et al., 2010; Jordan, Fromberger, Laubinger, Dechent, & Müller, 2014; Maravilla & Yang, 2007; Walter et al., 2008) and cognitive paradigms (O'Ciardha & Gormley, 2012a; Prause, Janssen, & Hetrick, 2008b; Wallen & Rupp, 2010) to provide insight on the neural substrates and cognitive factors that are implicated in sexual response.

Neural Measures of Sexual Response

Over the past decade, functional magnetic resonance imaging (fMRI) has been applied to investigate the neural substrates involved in the processing of sexual cues (Cacioppo et al., 2012). The application of this technique is based on the assumption that changes in neuronal activity are associated with blood-volume changes in the brain, or changes in the concentration of oxygen (as measured by the blood oxygenated level dependent or BOLD) which is the

dominant technique used in fMRI (explained in detail in Logothetis, Pauls, Augath, Trinath, & Oeltermann, 2001). This BOLD signal change is then applied as a dependent measure of neural responses to sexual cues across gender or sexual orientation. A majority of neuroimaging studies have examined sexual response exclusively on heterosexual men (e.g., Arnow et al., 2002; Ferretti et al., 2005; Georgiadis et al., 2010; Poeppl et al., 2011; Redouté et al., 2000), with only a few studies comparing male and female participants (Hamann, Herman, Nolan, & Wallen, 2004; Karama et al., 2002; Sabatinelli, Flaisch, Bradley, Fitzsimmons, & Lang, 2004; Sylva et al., 2013a; Walter et al., 2008), or individuals of varying sexual orientations (Berglund, Lindstrom, & Savic, 2006; Kranz & Ishai, 2006; Savic, Berglund, & Lindström, 2005; Sylva et al., 2013a). Most evidence comparing male and female participants has shown that the pattern of neural activation is similar in men and women (Georgiadis, Kringelbach, & Pfaus, 2012; Karama et al., 2002; Sabatinelli et al., 2004; Walter et al., 2008). In a recent review, Georgiadis, Kringelbach and Pfaus (2012) noted that when VSS are presented subliminally, a majority of changes in brain activation can be observed in the ventral striatum, the amygdala, the anterior cingulate cortex (ACC) and the orbitofrontal cortex (OFC). However, consistent differences have been demonstrated in the relative magnitude of brain activation. More specifically, some research has shown that women display less activation in certain brain regions involved in sexual response, specifically the amygdala and hypothalamus (Hamann et al., 2004; Karama et al., 2002; Sylva et al., 2013b). Moreover, consistent with research using measures of vasocongestion, when viewing preferred VSS that is in-line with their sexual preference, males display increased activity across multiple brain regions when compared to viewing non-preferred (or neutral) images (Safron et al., 2007; Sylva et al., 2013b). These regions include, but are not limited to, visual processing regions (e.g., primary visual cortex) and regions traditionally viewed to be implicated in emotion and motivation (e.g., amygdala, anterior cingulate cortex, ventral striatum, medial orbitofrontal cortex, hippocampus, ventral anterior cingulate and ventral tegmental area of the midbrain (Cacioppo et al., 2012; Georgiadis et al., 2012; Stoléru, Fonteille, Cornélis, Joyal, & Moulier, 2012; Walter et al., 2008). Meanwhile, women have shown some evidence of category-specific responses in certain brain regions, such as visual processing regions, which include the primary and extrastriate visual cortex, although these regions display greater differential activity in men (Sylva et al., 2013b) Overall, the pattern of results using fMRI technology to investigate sexual response suggests that men, as compared to women, tend to

display a more differentiated pattern of neural activation to images consistent with their sexual orientation.

Although recent studies using fMRI technology have provided insights into patterns of brain activation that accompany different sexual responses, they do not reveal real-time changes in brain activation during VSS. This is because, in comparison with other measures of neuronal activity (e.g., electroencephalogram (EEG) and magnetoencephalography (MEG)), the temporal resolution of fMRI cannot capture responses related directly to neuronal firing, which peaks and resolves long before the image is captured (Logothetis et al., 2001). The fMRI measures the hemodynamic response, which occurs over the course of several seconds. Thus, although fMRI can accurately locate an area of the brain in which a large population of neurons has recently fired, it cannot provide information about changes that occur in short periods of time (i.e., less than 3 seconds). Fast responses, such as the initial evaluation of a sexual cue have been shown to occur in less than one second (Dewitte, 2016; Snowden, Wichter, & Gray, 2008), by which time a complete snapshot of the brain cannot been acquired. Thus, the temporal constraints of fMRI are a major limitation if one wants to understand what aspect of stimulus processing leads to change in the BOLD signal.

Cognitive Models of Sexual Response

While there are differences across cognitive models of sexual response, they converge on the notion that a brief perception of a sexual stimulus will elicit affective and attentional processes that either facilitate or disrupt sexual response (e.g., Barlow, 1986; Janssen et al., 2000; Spiering & Everaerd, 2007). Barlow (1986) developed one of the first cognitive models of sexual response based on psychophysiological research establishing factors that could differentiate men with or without psychogenic erectile difficulties (Barlow, 1986; Cranston-Cuebas & Barlow, 1990). He argued that how a stimulus is processed, and how attention is captured, can trigger either a functional or dysfunctional feedback loop. If the viewer evaluates the cue negatively, attentional focus will be directed toward non-erotic cues (e.g., body image, sexual performance anxiety) or negative consequences of sexual performance. Continued cognitive processing of non-erotic or performance related cues may result in disruption of any sexual response, and lead to avoidance behavior (i.e., averting eyes to remove the cue from the field of view). Alternatively, if the viewer evaluates the cue positively, their attentional focus

will be directed to erotic stimuli with continued attentional focus on sexually related cues, leading to a genital response and sexual approach behavior.

Building on Barlow's model, cognitive information-processing models of sexual response have been developed (e.g., Janssen, Everaerd, Spiering, & Janssen, 2000; Spiering & Everaerd, 2007) that define the roles of both automatic and controlled cognitive processes, as well as the influence of attention in generating both subjective and physiological sexual arousal. Automatic processes involve the pre-attentive, unconscious, selection of sexually relevant features. If these pre-attentively selected sexual features are matched with representations of sexual stimuli in implicit memory, a genital response becomes activated (Janssen et al., 2000; Spiering & Everaerd, 2007). Controlled processes include the integration of the automatic and the deliberate processes. Specifically, focal attention to the sexual aspects of a stimulus (e.g., moving eyes to directly look at the genitalia) leads to a conscious appraisal of sexual features. If the stimulus is consistent with sexual meaning in explicit memory, then the appraisal acts to facilitate the sexual response, leading to the conscious experience of sexual arousal. Thus, the model assumes that sexual response depends on the appraisal of a stimulus, which is achieved through the integration of memory and attention. Several studies have shown that the time it takes to make decisions increases when sexual content is perceived (Conaglen, 2004; Geer & Melton, 1997; Geer & Bellard, 1996; Laws & Gress, 2004). This relative delay in decision making related to erotic material is a phenomenon that has been termed the Sexual Content Induced Delay (SCID; Geer & Bellard, 1996).

Sexual Content Induced Delay

The term Sexual Content Induced Delay (SCID) was introduced by Geer and colleagues (Geer & Bellard, 1996; Geer & Melton, 1997) and refers to the specific tendency of delayed responses on cognitive tasks when participants are presented with sexual stimuli compared to non-sexual stimuli, and more broadly to the processing of sexual information. Geer and Bellard (1996) originally investigated the SCID phenomenon through the use of an unprimed lexical decision task. In this task, participants were asked to quickly determine whether a string of letters formed a word. The experimental conditions consisted of sexual (e.g., PENIS), neutral (e.g., PLANT) and scrambled non-words (e.g., OEECTRIN). They found that decisions on sexual words were slower than either neutral words or scrambled non-words and inferred that the sexual content of the words distracted the participants, resulting in a delay in responding. Geer and

Melton (1997) further examined SCID by using a primed lexical decision task whereby decisions for sexual, neutral and non-words were preceded by a sentence that ended with a double entendre word (e.g., screw, pussy). The sentences provided either erotic or neutral biasing context. As the authors predicted, participant's decisions were quicker when both the context of the priming sentence (e.g., erotic vs. neutral) and the meaning of the target word were congruent (e.g., erotic target sentence---*"Under the covers, they began to hump"*--- erotic target word*: "SEX")*. Of even greater interest, decisions were faster in trials in which the sentence context and the target word were both neutral when compared to trials in which either the context or target word were sexual. Taken together, these findings provided the first empirical basis for the SCID phenomenon.

Some researchers have argued that the underlying cognitive mechanism that is driving the SCID phenomenon is a form of attentional bias (e.g., Conaglen, 2004; Janssen et al., 2000; Price, Beech, Mitchell, & Humphreys, 2013a), which is commonly understood as a tendency to shift attention toward or away from a salient stimulus (Kagerer et al., 2014; Schimmack, 2005). However, performance in the lexical decision task is understood as evidence for implicit memory involvement in this task, but is not designed to measure attentional processes. In contrast, the modified Stroop task is a more established measure of attentional bias that can be used to examine attentional processes that become activated when a participant views VSS.

Modified Stroop.

The modified-Stroop task is a variant of the classical Stroop task (Stroop, 1935) that was developed to examine interference between conflicting sources of information—colour names and colour word meaning. In the classic (therefore non-modified) Stroop test, participants are presented with words tinted in different colours and they are instructed to name the colour in which the words are presented (Stroop, 1935). Delays and increased error rates are habitually found when the colour of the ink is incongruent with the semantic content of the word (e.g., the word "RED" written in blue), reflective of interference between conflicting sources of information – colour word meaning and colour names (Stroop, 1935). This delay in colour naming when word meaning is not congruent with ink colour is called the "Stroop effect."

A modified Stroop paradigm employs a similar method by examining the impact of word or image saliency on the participant's ability to name the target colour. Although the terms emotional Stroop and modified Stroop are often used interchangeably, the term emotional Stroop

implies that the emotional content of the word is what is driving the effect. To avoid this assumption, in this thesis, a more general term of modified Stroop task is used. In the modified Stroop Task, the to-be-ignored stimulus (i.e., word or image content) is placed in conflict with the to-be-attended stimulus (i.e., colour naming). The to-be-attended stimulus is always colour, which can be either the colour of the font in which a word is written (word Stroop) or the colour of the border or filter of an image (pictorial Stroop). Participants are asked to respond with the colour in which the word or image is tinted. Accuracy and response time delays are used as indices of attentional interference between the task demand (i.e., colour-naming) and the content of the word or image, with slower naming of emotional, as compared to neutral, stimuli being reflective of an attentional bias towards emotionally salient information (Conaglen & Evans, 2006). The modified Stroop paradigm has been applied extensively in the study of mood (Liu, Xin, & Lin, 2014), anxiety (Becker, Rinck, Margraf, & Roth, 2001; Holle, Neely, Heimberg, & Heimberg, 1997; Mineka & Sutton, 1992), and substance-use disorders (Hester, Dixon, & Garavan, 2006) and has consistently demonstrated interference effects for semantic content specific to the psychopathology (e.g., PTSD and rape: Bloemers et al., 2010; Cane, Sharma, & Albery, 2008; Wilson & Wallis, 2012.)

Modified Stroop and sexual stimuli. The modified Stroop paradigm has also been used to examine attentional biases associated with sexual content (O'Ciardha & Gormley, 2012; O'Ciardha & Gormley, 2013; Price, Beech, Mitchell, & Humphreys, 2013). A majority of these researchers have focused on whether the modified Stroop can reliably predict sexual preference in adult males, often referred to in the literature as sexual interest (Bourke & Gormley, 2012; O'Ciardha & Gormley, 2012; O'Ciardha & Gormley, 2013). It has shown to have potential in predicting the sexual interest of non-offenders (Bourke & Gormley, 2012; Ó. Ciardha & Gormley, 2012b; O'Ciardha & Gormley, 2013) and differentiating between offenders and non-offenders (Price et al., 2013), but has shown mixed findings in its ability to differentiate between different types of offenders (Ó. Ciardha & Gormley, 2012; S. A. Price et al., 2013; Smith & Waterman, 2004).

Modified word Stroop and sexual word stimuli. Smith and Waterman (2004) examined between-group differences in the processing of sexual information using the modified word Stroop. Participants included both forensic (n=10 sex offenders, n=10 non violent offenders) and non-forensic (n=10) individuals. The task included a random presentation of 25 words from each

of the following themed categories: aggression, sexual words related to offending, positive valence, negative valence, and neutral valence. All words were matched with regard to word length and word frequency. Bias scores were calculated by subtracting the mean response times for neutral word presentations from each of the other stimulus word condition means; sexual, aggression, positive, and negative. Both sexual and violent offenders displayed longer latencies in colour naming for words related to sexual offending, with the effect being strongest for those convicted of sexual offences.

Price and Hanson (2007) replicated and extended the 2004 Smith and Waterman study with forensic (n=15 sex offenders against children, n=15 sex offenders against adults, and n=15 non-violent offenders) and non-forensic (n=15) participants. Their results were consistent with those of the Smith and Waterman (2004) study, demonstrating that both groups convicted of sexual offences experienced interference effects for salient stimuli that were relevant to past sexual behavior. In the same article, they presented a second study in which they developed and tested a new word set to examine whether different types of sexual offenders (i.e., offenders against adults vs. offenders against children) could be differentiated based on their latencies for word lists that were specific to their type of sexual offending behavior. No significant differences were found between offender types across the word categories. Price and Hanson (2007) identified a key limitation that could account for their null finding in the second experiment; specifically, that because the words used in their experiment were not normatively rated they may not reflect the experience of sexual offenders and may not have been perceived as a sexually salient cue.

Although Price and Hanson's (2007) second experiment was not able to discriminate between different types of sexual offenders, it does raise the important point about stimulus standardization. The authors themselves highlighted the need for a standard set of sexual word stimuli rated by different types of offenders and a community sample. They also urged that this set of stimuli include lexical characteristics to allow experimenters to select stimuli relevant to their experimental paradigm. In response to the need for a validated word dataset with sexual words, Stevenson and colleagues (2010) developed the Indiana Sexual and Affective Word Set (ISAWS). Participants (n=1099) rated words on two dimensions (e.g., valence and arousal) and from a discrete emotion perspective (e.g., happiness, disgust). In addition, ratings were collected for sexual valence, arousal, and energy. Thus, the ISAWS was designed to address the current

limitations in available sexual word stimuli by providing a standardized database of sexual and affective words.

Advantage of using images over words.

Although some research questions can be addressed by using words, images provide two distinct advantages. The first advantage is that images or scenes can be processed more quickly than words. Using the electroencephalogram (EEG), researchers have demonstrated that an object or scene is processed with a shorter latency (~140ms) than a word describing the same scene (~200ms: Chanceaux et al., 2012). This electrophysiological evidence also agrees with behavioral data; participants have been able to extract the meaning, or the "gist," of a scene with only a brief perception of the stimulus (i.e., 20ms; Fabre-Thorpe, 2011; Flevaris, MartÃnez, & Hillyard, 2014). Thus, not only are images processed more quickly than words, participants are also able to quickly extract the meaning of a scene. The second advantage of images over words is that they allow for greater scope and flexibility when choosing stimuli that are potentially sexually salient for the participant. For example, previous research has shown that the angle (i.e. person looking at camera or away) at which an image is taken and the type of sexual act depicted have a differential impact on individuals of different sexual orientations (Chivers et al., 2010; Rupp & Wallen, 2009). Furthermore, researchers can also manipulate the age, gender, and ethnicity of the characters portrayed in the pictures, something that is difficult, if not impossible, to do with a single sexual word.

Visual sexual stimuli (e.g., still images and film) are the most common cues used in research investigating sexual response; however, researchers interested in using still erotic images encounter a major challenge because the availability of standardized and validated erotic images is quite limited. Typically, investigations examining sexual response select images from the International Affective Picture System (IAPS; Lang et al., 2008) or small sets of images that have not been standardized on relevant stimulus parameters. IAPS contains images from a variety of emotion content categories, but contains only a small set of erotic images (n=79), with limited variability in sexual interactions (i.e., male to female oral sex, penile-vaginal penetration, kissing), that were collected over thirty years ago and are thus generally considered to be outdated (Chivers et al., 2007; Prause et al., 2015). Additional erotic images sets exists, as I will outline in detail in Chapter 3; however, the Concordia Sexual Image Dataset (CSID), which was developed as part of this dissertation, is the largest and most comprehensive dataset of erotic

images, depicting a variety of sexual situations, varying in explicitness, which include lesbian, homosexual and heterosexual content.

Modified pictorial Stroop and visual sexual stimuli.

O'Ciardha and Gormley (2011; 2012) were the first to use visual sexual stimuli in a modified Pictorial Stroop to examine sexual preference. In the modified pictorial Stroop, images are tinted (or there is a coloured border surrounding the image in some designs) and participants are asked to respond with the colour in which it is tinted or bordered. In the first study, O'Ciardha & Gormley (2011) used the pictorial modified Stroop procedure to examine patterns of interference for sexual content in heterosexual (n=12) and homosexual (n=9) males. Stimuli were created by the authors using computer-morphing technology and photos of large cats were used as control images. They employed a block presentation trial in which images from the same categories were grouped together in one block resulting in five blocks: adult males, adult females, child males, child females, and large cats. The authors only found a significant difference between heterosexual and homosexual males when comparing response times to adult female images, with straight men taking longer to respond. A receiver-operating characteristic (ROC) curve was plotted to assess how well difference scores, comparing mean reaction time to adult male and adult female images, was able to predict the self-reported sexual preference of the participant. The analysis showed an area under the ROC curve of .93 (p=.001; SE=.061), which demonstrated excellent predictive ability.

In another study within the same article, the authors included offenders against children (n=24) and control participants (n=24). The images were the same as the first experiment (i.e., adult males, adults females, child males, child females, and large cats). However, the authors adopted a clustered presentation in which matching stimuli (e.g., adult males) were presented in small blocks (or clusters), with clusters being pseudo-randomly presented such that no cluster with the same stimuli would be presented back to back. The results of the study indicated differences in the pattern of responding between groups of participants, with control participants showing the longest delays for images consistent with their sexual orientation, while the high deviance group response times were the same for adult and child stimuli.

More recently, O'Ciardha and Gormley (2012) applied a pictorial modified Stroop task to once again examine the sexual interest in a sample of heterosexual (n=14) and homosexual male (n=11) participants. Similar to their first study, the aim of their second article was to identify

whether slower responses time on a sexual pictorial Stroop task could be used to discriminate between the sexual interest of homosexual and heterosexual participants. Using the same stimuli from their previous article, they found that homosexual men were slower to respond with the tint of pictures of adult males than heterosexual men. Correspondingly, heterosexual men were slower to respond with the tint of pictures of adult females than homosexual men. Taken together, these findings suggest that both the modified word and pictorial Stroop can detect differences in the way that individuals attend to VSS and how these differences are associated with the sexual interest of the participant and the content of the stimuli.

The modified Stroop has many advantages over traditional, widely utilized paradigms (e.g., self-report, plethysmography) and less common methods of measurement (e.g., thermography and fMRI). First, visual attention to VSS can be measured objectively and adaptations to the modified Stroop design (e.g., block vs. random trial presentations) can allow for the investigation of the both automatic and controlled attentional processes implicated in sexual response. Second, given that the modified Stroop is a relatively unintrusive measure, it may reduce the likelihood of a volunteer bias. Participants unwilling to take part in research using genital measures may be willing to participate in an experiment involving less invasive technology, and thus could potentially increase the generalizability of the findings. Finally, the output using this technology (i.e., response time) is directly comparable in men and women unlike measures of genital vasocongestion.

Thesis Outline

The overarching purpose of the present thesis was to quantitatively examine the cognitive components of sexual response, including attention and stimulus evaluation, to elucidate mechanisms that could account for variability in sexual response patterns. Another major goal of this dissertation was to increase the availability of visual sexual cues through the development of a new validated sexual image dataset that contains many more images than any existing published datasets, both in terms of the types erotic situations depicted, and the sexuality of the characters, and can therefore be used for investigating a variety of research questions.

The specific goal of the experiments in Chapter 2 was to examine attentional capture as a possible mechanism that may account for variability in sexual desire in heterosexual females using sexual word cues in a modified Word Stroop task.

The specific goal of the experiments in Chapter 3 was to outline the development and standardization of the Concordia Sexual Image Dataset, a comprehensive set of 189 erotic images that include heterosexual lesbian and homosexual content that are normatively rated by both male and female participants self-identified as heterosexual.

Finally, the specific goal of the experiments in Chapter 4 was to examine the relative degree of attention allocated to preferred and non-preferred stimuli with the aim of potentially identifying mechanisms that contribute to gender differences in the specificity of sexual response. Relevant cues were selected from the Concordia Sexual Image Dataset developed in Chapter 3.

Chapter 2: Attention Capture by Sexual Word Cues and Their Relationship to Women's Sexual Desire

Attention Capture by Sexual Word Cues and Their Relationship to Women's Sexual Desire

Julie Shilhan [1,2] ● Maria Santaguida [1,2] ● Aaron P. Johnson [1] ● James G. Pfaus [1,2] ●

[1] Department of Psychology, Concordia University, 7141 Sherbrooke W., Montréal, QC H4B 1R7 Canada

[2] Center for Studies in Behavioral Neurobiology, Department of Psychology, Concordia University, 7141 Sherbrooke W., Montréal, QC H4B 1R7 Canada

Introduction

Low sexual desire, with or without accompanying arousal difficulties, is the most common sexual health complaint in women (Laumann et al., 2005; Laumann, Paik, & Rosen, 1999; Mercer et al., 2003; Simons & Carey, 2001), affecting an estimated 10% of adult women (Bitzer, Giraldi, & Pfaus, 2013; Goldstein et al., 2017). If low (or absent) desire for, or fantasy about, sexual activity is persistent and/or recurrent and results in marked distress or interpersonal difficulties, it may warrant a diagnosis of hypoactive sexual desire disorder (HSDD; American Psychiatric Association, 2000). Although emerging treatments for low desire difficulties in women seem promising (Gao, Yang, Yu, & Cui, 2015; Pfaus, 2013) there is no single therapeutic strategy that is effective for all women struggling with sexual desire difficulties and no single model of sexual functioning that applies to all women (Kingsberg, Clayton, Pfaus, 2015; Brotto, Graham, Paterson, Yule, & Zucker, 2015; Nowosielski, Wróbel, & Kowalczyk, 2016). Researchers have found a variety of biological and psychological mechanisms that influence human sexual functioning (Georgiadis et al., 2012; Kim et al., 2013; Pfaus, 2009; Pfaus, Kippin, & Coria-Avila, 2003), but the relative degree of activation of these regulatory mechanism has been shown to vary within and between subjects (Kingsberg et al., 2015). Thus, the development of additional efficacious therapeutic options for the treatment of low desire difficulties is contingent on an evolved understanding of the interrelated mechanisms that influence sexual response and how these mechanisms vary depending on individual differences in sexual functioning. Cognitive models of human sexual response propose that sexual desire arises from a complex interaction of cognitive mechanisms that include attention, emotion, and memory (Barlow, 1986; Janssen et al., 2000; Spiering & Everaerd, 2007). These mechanisms provide the context by which sexual cues and associated physiological changes are interpreted as sexual. The overarching goal of the study outlined in this chapter is to examine unconscious attentional mechanisms that may account for variability in sexual desire in response to sexual word cues in order to further the understanding of the complex interaction between the cognitive and physiological processes that produce subjective sexual desire.

In his cognitive model of sexual functioning, Barlow (1986) predicted that an individual's initial affective response to a sexual cue, and the attention captured by the cue, determines whether a functional or dysfunctional feedback loop will be triggered. As such, the model assumes that the perception of a sexual cue automatically triggers evaluative processes

that evaluate the cue as positive or negative. Individuals who evaluate the cue negatively will direct their attentional focus towards contextual information (e.g., body image) or feared consequences that could result from a sexual encounter (e.g., inability to maintain genital arousal). Continued attentional focus on non-erotic or performance-related cues could result in disruption of sexual response or avoidance behaviour. Conversely, individuals who evaluate the cue positively are likely to experience an increase in autonomic arousal and attentional focus to erotic cues, eventually leading to sexual approach behaviour. Thus, the model predicts that both attentional and affective processes are involved in the processing of sexual stimuli.

While Barlow (1986) did not explicitly link the affective processes in sexual response to sexual desire, it is plausible that the negative evaluation of sexual information is a factor involved in the etiology and/or maintenance of low sexual desire (Nobre & Pinto-Gouveia, 2009). Consistent with Barlow's (1986) explanation of the emotional determinants of sexual dysfunction, individuals with sexual dysfunctions, including individuals with clinically low sexual desire (i.e., hypoactive sexual desire disorder) have reported negative thoughts when presented with written vignettes of sexual situations (Nobre & Pinto-Gouveia, 2009). Additionally, individuals with low sexual desire have been shown to rate sexual images and sexual words as less pleasant than individuals with average or high sexual desire (Conaglen, 2004; Conaglen & Evans, 2006). In sum, individuals with low sexual desire are more likely to experience sexual information as more unpleasant and interpret sexual stimuli more negatively than individuals with average or high sexual desire (Conaglen, 2004; Conaglen & Evans, 2006; Nobre & Pinto-Gouveia, 2009).

Although several studies that examine how women with low sexual desire appear to differ from women with average or high sexual desire in their evaluations of sexual stimuli using self-report, only a few studies have applied cognitive paradigms to examine attentional processes implicated in sexual desire. Prause, Janssen, and Hentrick (2008) investigated the extent to which attention to sexual stimuli predicted a woman's levels of sexual desire, by using a dot probe task. In the dot-probe, two cues (e.g., test cue vs. control cue) are presented simultaneously on a computer screen. Directly following the display of the two cues, a target stimulus (typically a small dot) appears in the location of one of the cues. In turn, participants are asked to signal as soon as they detect the dot. Attentional bias is measured indirectly through the duration of time it takes for the participant to locate the dot: faster reactions to dots that appeared in the location of

certain test cues (e.g., sexual cue) as compared to another cue category (e.g., neutral cue) are believed to be reflective of an attentional bias for that cue category. Contrary to their hypotheses, Prause and colleagues (2008) found that individuals were slower to detect target dots following a sexual cue compared to a neutral cue and the effect was larger for participants who reported higher levels of sexual desire. To account for their findings, Prause et al. (2008) suggested that women with higher levels of desire may have been more absorbed by the sexual content, which tied up their processing and interfered with their ability to perform the task. This explanation of their findings is analogous to the "modified Stroop" effect in which the content of the cue draws on attentional resources which, in turn, interferes with the participant's ability to perform the task (i.e., colour detection). In contrast to the findings of Prause et al. (2008), Brauer and colleagues (2012) did not find a statistically significant difference between the low and high desire groups in their response times to probes following sexual images. Brauer et al. (2012) suggested that methodological differences in how both studies defined low and high desire groups could account for the inconsistencies across the two studies; Prause et al.'s study (2008) sample consisted of a nonclinical sample who varied in their levels of desire as assessed by the Sexual Desire Inventory-II (described in detail below), while Brauer et al. (2012) compared a clinical sample of women diagnosed with HSDD and a non clinical sample of sexually functional women. In this study I am most interested in comparing women with increasing levels of sexual desire (from low through high) in their attention to sexual stimuli, which will be measured using a self-report measure, the Sexual Desire Inventory-II (SDI-II; Spector, Carey, & Steinberg, 1996).

Another aspect of this study it is to examine the impact of stimulus valence on interference effects for both positive and negative sexual content. Whereas previous literature has examined the relationship between attention and sexual desire, it is unclear whether the affective characteristics (i.e., word valence) of the sexual cues influence this relationship. Thus, I compared positively-valenced sexual words, negatively-valenced sexual words, and neutral non-sexual words that were matched on relevant lexical properties to examine the relative influence of stimulus valence on attentional capture in participants with varying levels of sexual desire.

In summary, the aim of the present study was to examine whether the amount of attention captured by a sexual cue can predict a women's level of sexual desire. Female participants completed a series of questionnaires related to their sexual desire. Participants also completed a

modified Stroop task that included positively-valenced sexual words, negatively-valenced sexual words, and neutral words. Based on Barlow's (1986) cognitive model of sexual functioning, which posits that, when a sexual cue is encountered, those that evaluate the sexual cue more positively will maintain attention to the stimulus and enter a "functional" process loop leading to sexual response, it was predicted that there would be a significant positive relationship between self-reported levels of sexual desire and interference scores for positively-valenced sexual words. Further, also based on Barlow's model, it was predicted that this same relationship would not exist for negative valence words and scores on the SDI-II.

Method

Participants

Participants were 34 female undergraduates enrolled at Concordia University. Participants' ages range from 19 to 35, with a mean age of 22.15 (*SD* = 3.67). To partake in the study, participants were required to be at least 18 years of age, heterosexual, and fluent in English. Participants were recruited via the Participant Pool website of the psychology department at Concordia University. Participants received one participant pool credit for taking part in the study.

Measures

The Sexual Desire Inventory-II. (SDI-II; Spector, Carey, & Steinberg, 1996)**.** This 14-item self-report measure is used to assess the respondent's desire to think about or engage in sexual activity with a partner or with themselves within the past month (see Appendix 1). The SDI-II consists of items Likert-scaled 0 to 7 or 0 to 8, for which higher numbers indicate greater sexual desire. The "solitary" sexual desire scale consists of 5 items that measure an individual's desire for autoerotic activity. An example of an item from the "solitary" sexual desire scale is "*How important is it for you to fulfill your sexual desires to behave sexually by yourself?*" The "dyadic" sexual desire scale consists of 9 items that measure an individual's desire for sexual activity with a partner. An example of an item from the "dyadic" sexual desire scale is "*When you have sexual thoughts, how strong is your desire to engage in sexual behavior with a partner*?" The 14 items are summed to calculate a total score that may range from 0 – 112. This measure has an internal consistency of .88 in our sample. The SDI scale was used as an indicator of each participant's level of sexual desire.

Sexual Stroop Task. In this computer-based task, participants are instructed to respond with the color of the word/letters presented on the screen, as quickly and accurately as possible. The Sex Stroop task program presents a fixation cross on the screen for 1000 milliseconds. Next, 40 practice trials are presented where the participant must respond with the color of a string of X's (i.e., XXXXX) that appear on the screen. Each presentation of a string of X's was tinted in one of four possible colours (i.e., red, green, blue, yellow). A new string appears immediately after a participant's response. Participants are given up to 2000 milliseconds until the next string

appeared. After the practice trials, 240 trials are presented where the participant must respond with the color of a word that appears on the screen. A new word appears immediately after a participant's response. Each word is presented four times, one time for each of the four colors (i.e., red, green, blue, yellow). Participants receive up to 1000 milliseconds to respond before the next word appears.

Verbal Stimuli. Sexual and non-sexual words that were presented in the sex Stroop task were derived from the Indiana Sexual and Affective Word Set (ISAWS; Stevenson et al., 2011). The ISAWS consists of 1450 sexual and non-sexual words. Each word has been assigned specific values for valence, arousal, and dominance through ratings by native English-speaking undergraduate students at Indiana University (n = 1099). For the purposes of this investigation, words were selected based upon valence ratings. In the ISAWS, word valence was rated on a 9-point scale from 1 (*extremely negative)* to 5 (*neutral)* to 9 (*extremely positive)*. The words selected for the Sex Stroop Task were 10 positively-valenced sexual words (ratings ranged from 6.5 - 9), 13 negatively-valenced sexual words (ratings ranged from 1- 4.5), and 10 neutral words (ratings ranged from 4.9 - 5.5; see Appendix A). The derived words were recognized by at least 95% of the participants in the ISAWS. Word frequencies for the stimuli were derived from the *Corpus of Contemporary American English* (Davies, 2012).

Apparatus

Participants were tested on a Dell Quad-Core PC equipped with a 21" color monitor, and a standard USB keyboard and two-button mouse device. The keyboard's arrow keys were marked with different colored markers (i.e., blue, red, yellow, and green). The Sex Stroop task ran on a program (Experiment Builder, SR Research, Ottawa, Ontario) that enables direct millisecond recording of the response times to the stimuli.

Procedure

Participants signed up for an appointment via the Participant Pool website at Concordia University. These participants were contacted by e-mail with directions to the Concordia Vision Lab. Before participants began the one-hour session, participants were asked to sign a consent form. Participants were assured anonymity, confidentiality, and the right to withdraw from the study without penalty at any time. Participants were then seated behind a computer in a quiet, windowless room. The experimenter verbally instructed the participants that they would be completing a color-naming task where the objective was to respond with the color of a string of

letters or word, using colored response keys, as quickly and accurately as possible. The experimenter provided the opportunity for the participants to ask questions and they were encouraged to seek clarification if there were any uncertainties about the protocol. The participants were informed that they would have the opportunity to complete 40 practice trials in which they would respond with the color of strings of letters. Next, they would complete 240 trials where they would be required to respond with the color of words. They were informed that there would also be on-screen instructions before the task began. After the experimenter addressed the participants' questions or concerns, the experimenter left the testing room until the participants completed the task. After the participants completed the task, the experimenter set up the questionnaires on the computer for the participant. The participants were told that the questionnaires contained questions about their sexuality, and were offered the opportunity to ask any further questions. After questionnaire completion, participants were granted one participant pool credit for taking part in the study.

Design

To investigate the hypotheses, correlational analyses were used to examine the degree of covariation between response times to positively-valenced sexual words and sexual desire, as well as the degree of covariation between response times to negatively-valenced sexual words and sexual desire. Two bivariate correlations and confidence intervals were calculated. The predictor, or independent variable, is the participant's sexual desire score on the SDI-II. The criterion variables, or dependent variables, are the interference scores for positively-valenced sexual words and to negatively-valenced sexual words.

Results

Data Integrity

The data were verified for any incorrect or missing values. Missing values were dealt with by mean substitution, by which a missing score was replaced by the variable of interest's overall sample mean. Missing data were random (less than 2% of the sample data). All the variables of interest showed normal distributions, with values of skewness below 3 and values of kurtosis below 10.

Prior to conducting the correlations, there are several assumptions of correlations that must be met, which include: (a) linear relationship between two continuous variables and (b) no significant outliers. A thorough visual inspection through the use of scatter plots indicated that

there was indeed a linear relationship between the variables. To determine the presence of outliers, the scores were transformed to standardized scores (i.e., z-scores). In turn, the standardized scores were investigated and outliers were removed that were found to be three standard deviations from the mean (Z ±3). One participant had their data excluded from the analysis due to outliers across three of the variables of interest (i.e., mean response times for positively-valenced sexual words, mean response times for negatively-valenced words, mean response times for neutral words), reducing the sample from 34 to 33 participants. After the exclusion of this participant's data, all assumptions were verified and there were no violations.

Lexical equivalence check

A one-way analysis of variance (ANOVA) was conducted to assess mean differences in word frequency across the three word categories, with eta squared used as a measure of effect size. The one-way ANOVA revealed group difference across word categories, $F(2,987)=123.30$, $p<.01$, $n^2=.19$. In turn, a series of independent t-test were conducted and it was found that negatively-valenced sexual words were significantly less frequent than neutral words, $t(10.09) = -2.49$, $p < 0.05$, $d = 1.02$. However, there were no statistically significant differences between positively-valenced sexual words and neutral words in regard to frequency ($p > 0.05$, $d < .21$). In addition, there were no statistically significant differences between positively-valenced sexual words and negatively-valenced sexual words on frequency ($p> 0.05$, $d < .14$; see Table 2.1).

Furthermore, a one-way analyses of variance (ANOVA) was conducted to assess mean differences in word length and no statistically significant differences was found for word length across word categories [$F>.05$]. Thus, word length was the same across all word categories.

Table 2.1. Independent samples t-tests for mean differences on word frequency across positively-valenced sexual words, negatively-valenced sexual words and neutral words

Word Categories	*t*	*df*	*p*	*d*
Positively-valenced Sexual Words and Negatively-valenced Sexual Words	1.22	10.49	0.24	0.50
Positively-valenced sexual words and neutral words	-1.78	13.47	0.09	0.76
Negatively-valenced sexual words and neutral words	-2.49	10.09	0.03*	1.02

Note. *= $p < .05$

Interference and Sexual Desire

To determine the response times to positively-valenced sexual words and negatively-valenced sexual words, two emotional interference scores were calculated; a positive interference score and a negative interference score (Dresler, Mériau, Heekeren, & van der Meer, 2009). The positive interference score was calculated by subtracting the mean reaction time for neutral words from the mean reaction time for positively-valenced sexual words. The negative interference score was calculated by subtracting the mean reaction time for neutral words from the mean reaction time for negatively-valenced sexual words.

Consistent with my hypothesis, there was a significant positive correlation between participants' scores on the SDI-II (i.e., measure of sexual desire) and positive interference scores, $r(31) = .31$, $p < .05$ (see Figure 2.1). Furthermore, there was a significant positive correlation between participants' scores on the SDI-II (i.e., measure of sexual desire and negative interference scores, $r(31) = .29$, $p < .05$ (see Figure 2.2). Together these findings suggest that, as sexual desire increases, there is a corresponding increase in response times to both negatively-valenced sexual words and positively-valenced sexual words.

Differential Impact of Interference

A confidence interval was created to determine whether the strength of association of the correlation between positive interference scores and SDI-II scores, $r(31) = .31$, $p < .05$ and the correlation between negative interference scores and SDI-II scores, $r(31) = .29$, $p < .05$ were significantly different. As a means of comparing the correlations, a confidence interval was calculated for the difference between the two correlations (Zou, 2007). Based upon the confidence interval for correlation coefficient difference, the strength of association between positive interference scores and SDI-II scores was not statistically significantly greater than the strength of association between negative interference scores and SDI-II, 95% CI [-0.32, 0.38], $p > .05$. This indicates that the relationship between sexual desire and interference scores is similar for positive-sexual and negative-sexual words.

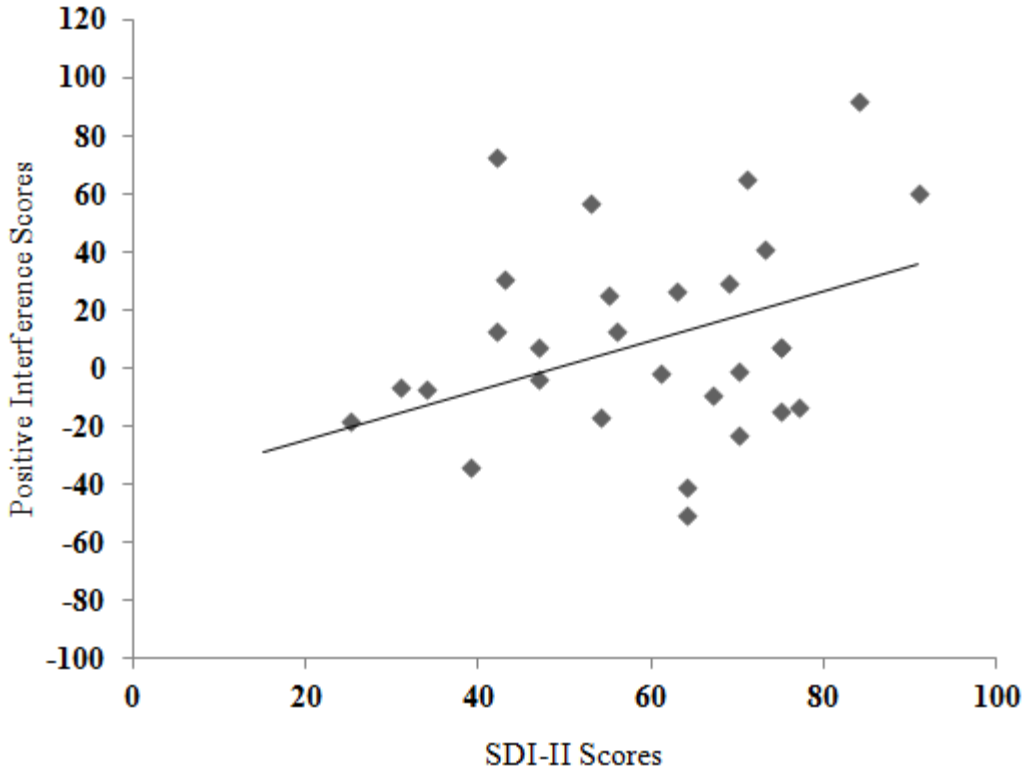

Figure 2.1. Relationship between SDI-II scores and Positive Interference Scores.

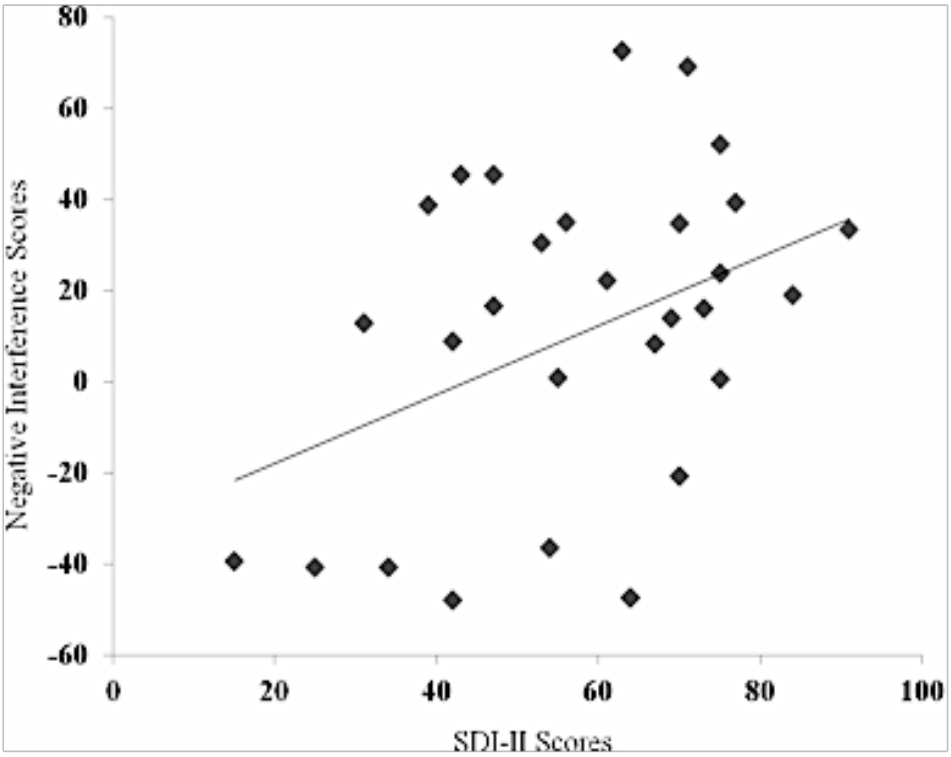

Figure 2.2. Relationship between SDI-II scores and Negative Interference Scores.

Discussion

The overarching goal of the study outlined in this chapter was to examine unconscious attentional mechanisms that may account for variability in sexual desire (measured by the Sexual Desire Inventory-II) in a healthy student sample. This was achieved by applying a modified Stroop paradigm to assess the relationship between scores on the Sexual Desire Inventory II and response times on a modified sex Stroop task that included positively-valenced and negatively-valenced sexual words. It was hypothesized that there would be a significant positive relationship between self-reported levels of sexual desire (as measured by Sexual Desire Inventory-II) and attentional bias for positively-valenced sexual words, measured by subtracting each participant's response latency for neutral words from positively-valenced sexual words. Further, it was hypothesized that the same relationship would not exist for negative valence words and scores on the SDI-II. The results indicated that, indeed, a significant positive relationship existed between self-reported sexual desire and sexual word latency for positive words, but contrary to my second hypotheses, this same relationship was also found for negative sexual words. Thus, as self-reported sexual desire increased, performance was slower for both positive and negative sexual words. The theoretical underpinnings of my hypothesis correspond with Barlow's cognitive model of sexual dysfunction. Barlow (1986) theorized that individuals who evaluate sexual cues positively are more likely to have their attention captured by the sexual stimuli, eventually resulting in sexual approach behaviors. Furthermore, individuals who evaluate sexual cues negatively may be more likely to attend to non-erotic issues (e.g., body image), which may ultimately result in sexual dysfunction or avoidance behavior. Within our sample, the increase in sexual desire may have been associated with increases in sexual interest or positive evaluations of sexual stimuli. As sexual interest increased, sexual stimuli may have captured more attention, thereby leaving less attentional capacity for the demands of the task (i.e., colour naming).

These results are also in line with dual-control models of sexual response that conceptualize individual differences in sexual response resulting from an interplay between excitatory and inhibitory processes (Bancroft, Graham, Janssen, & Sanders, 2009; Bloemers et al., 2013; Erick Janssen & Bancroft, 2007; Pfaus, 2009). A large aggregate of animal and human literature support this conceptualization, which has led to the recent development of novel on-demand drug treatments for women with HSDD. Of particular relevance to the present work are two recent drugs under development that combine testosterone with other agents (Poels et al., 2014) and

highlight the role of attentional mechanisms implicated in sexual response. Research supporting these drugs suggest that different causal pathways lead to sexual dysfunction in women with HSDD (Kingsberg et al., 2015a; Poels et al., 2013a; Van Der Made et al., 2009; van Rooij et al., 2013); in one proposed subgroup, HSDD is believed to result from a relatively insensitive system for sexual cues, while in the other subgroup, HSDD is theorized to result from dysfunctional activation of sexual inhibitory mechanisms. The modified Stroop task has been used to place women into these two subgroups by using differences in attentional bias to sexual cues between subjects as an indication of differences in sexual cue sensitivity. Preliminary findings suggest that women with low sexual cue sensitivity receiving a treatment regime, which combines testosterone and busiprone (an anti-anxiety medication) (Poels et al., 2013b) exhibited an increase in sexual motivation, whereas women with high cue sexual sensitivity responded to a treatment that combines testosterone and sildenafil (which contains the same active ingredient in the erectile dysfunction drug Viagra; (van Rooij et al., 2013)). Preliminary support for these drugs as effective treatment for HSDD subtypes comes from randomized, double-blind, placebo-controlled, crossover trials (Poels et al., 2013a; van der Made et al., 2009; Van Der Made et al., 2009; van Rooij et al., 2013). Future work could apply the paradigm described in this study to examine whether altering the affective characteristics of the words (e.g., valence or arousal) would influence the distinction between low and high cue sensitivity groups which could potentially increase the efficacy of the drug treatments.

The present study also sought to address whether the differences in the valence of sexual words may account for variability in response delays to sexual stimuli (often referred to as sexual content induced delay (SCID)), and we found that the valence of sexual words did not account for variability in response times in our sample. Nevertheless, the finding that valence may not contribute to differences in response times to sexual stimuli still does not rule out the possibility that other aspects of emotional content are a factor in the SCID effect. According to Lang (1979), an individual's experience of emotion can be determined by the pleasantness associated with the stimulus (i.e., valence) and the extent of stimulation that the stimulus elicits (i.e., arousal). While researchers have considered valence as a factor in responses to sexual stimuli (e.g., Geer & Bellard, 1996), Dresler and colleagues (2009) found arousal-related interference effects (i.e., longer color naming latencies) on a modified Stroop task that were not present for word valence. Dresler and colleagues (2009) asserted that stimulus arousal (i.e., emotional

intensity or degree of activation by the stimulus) could be what is driving the delay. Thus, research building on this project could also control for other relevant lexical parameters, including word arousal, to further our understanding of how emotion impacts the cognitive processing of sexually relevant stimuli.

Although some research questions can be addressed by using words, images have been shown to have certain advantages over words that are relevant to research investigating sexual response. To begin with, images allow for the age gender, and ethnicity of the individual(s), to be depicted allowing for more flexibility in generating sexually salient stimuli. In addition, previous research has shown that words require more elaborative processing than biological pictures to elicit an affective reaction (Hinojosa, Carretié, Valcárcel, Méndez-Bértolo, & Pozo, 2009; Kensinger & Schacter, 2006) In chapter four, we used a pictorial modified Stroop paradigm to further examine attentional mechanisms implicated in sexual response.

In conclusion, the present study found a relationship between self-reported sexual desire and response times to sexual words. Specifically, as sexual desire increases, there is a corresponding increase in response times to sexual words, regardless of their valence. I infer that higher levels of sexual desire may be associated with greater interest in sexual content and may predispose the individual to engage more attentional resources towards sexual information. Furthermore, I infer that lower levels of sexual desire may be associated with decreased interest in sexual content and may lead to the inhibition of attentional resources towards sexual information. Future studies should determine whether these findings are consistent in a larger sample of both nonclinical and clinical participants.

Chapter 3: Development and standardization of the Concordia Sexual Image Dataset

Development and standardization of the Concordia Sexual Image Dataset

Julie Shilhan[1,2] ● James G. Pfaus[1,2] ● Aaron. P. Johnson[1] ● Tanya D'Amours[1] ● Karine Elalouf[1] ● Jacob Applebaum[1]

[1] Department of Psychology, Concordia University, 7141 Sherbrooke W., Montréal, QC H4B 1R7 Canada

[2] Center for Studies in Behavioral Neurobiology, Department of Psychology, Concordia University, 7141 Sherbrooke W., Montréal, QC H4B 1R7 Canada

Introduction

Several methodologies have been developed to study the complex interplay of biological, cognitive and emotional processes involved in sexual response which include, but are not limited to, self-report, physiological measures, and cognitive paradigms. However, the accuracy and reliability of these measures is entirely contingent on the ability of a stimulus to evoke a sexual response. For example, research investigating variability in preferences for visual sexual stimuli (VSS) suggests that the features of a sexual stimulus that render it to be sexually salient may be different for men and women. Heterosexual men demonstrate greater physiological and self-reported arousal to stimuli consistent with their self-reported sexual orientation (e.g., pictures of naked females; Chivers et al., 2007; Peterson & Janssen, 2007). In contrast, heterosexual women have demonstrated a more complex pattern of genital response, typically responding physiologically to a wider variety of stimuli that may or may not be congruent with their stated sexual preference, while their self-reported arousal tends to be consistent with their sexual preference (Chivers et al., 2007; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Laan & Everaerd, 1995).

Given the importance of stimulus features, visual images must be chosen carefully in research on human sexual response. Stimuli used must be selected based on a-priori criteria that are entirely dependent on the research question, the design of the project, and the measurement technique that most adequately captures the thoughts, emotion, or behaviour of interest. Although a variety of stimuli have been used in the laboratory setting to elicit sexual response in humans, which include, both internal (i.e., fantasy: e.g., Heiman, 1980) and auditory (e.g., Sakheim, Barlow, Beck, & Abrahamson, 1985) cues; typically, researchers utilize visual stimuli (i.e., still images and/or video: e.g., Ellen Laan & Everaerd, 1995; Prause et al., 2008).

If still images are to be utilized for a specific research paradigm, investigators conducting research related to sexual response encounter a major challenge that stems from the fact that images vary in many ways that may or may not be relevant to the variable in question. Perceptual and affective characteristics have been shown to be relevant variables to consider when selecting visual stimuli (Marchewka, Zurawski, Jednoróg, & Grabowska, 2014; Schimmack & Derryberry, 2005; Wrase et al., 2003), thus control over these characteristics is essential for the development of robust methodology investigating sexual response. Consequently, some sex researchers have highlighted the importance of stimulus standardization and have made efforts to standardize

stimuli prior to their experimental investigations a (Prause et al., 2014; Rupp & Wallen, 2007; Spiering et al., 2004). These image erotic sets will be discussed in detail in the next section, which will outline the advantages and limitations of each of these efforts, and note how the current proposal will fill in the remaining gaps in erotic stimulus availability.

Normative sets of erotic images

Until recently, the most commonly used set of VSS in research investigating sexual response are images take from the International Affective Pictures System (IAPS; Lang, Bradley, Cuthbert, 2008). The IAPS contains over 800 color images that depict diverse semantic content (e.g., natural scenes, food, erotic images). Norms have been collected in accordance with a dimensional theory of emotion (Mauss & Robinson, 2009), which includes the dimensions of valence, emotional arousal, and dominance. Several cross-validation studies have demonstrated the reliable induction of expressive and psychological emotion responses with the IAPS images (Grühn & Scheibe, 2008; Lasaitis, Ribeiro, & Bueno, 2008; Silva, 2011). However, there are several limitations that arise with the use of the IAPS database for research examining sexual response. For example, the database contains only 79 erotic pictures, of which only half display erotic interactions. Additionally, within the IAPS erotic category, there is little variability in terms of the sexuality of the target persons (i.e., heterosexual only), the sexual act (i.e., male to female oral sex, penile-vaginal, kissing), or explicitness of the sexual activity depicted (i.e., heterosexual foreplay and intercourse without explicit exposition of genitals). The small sample of images to draw from, and lack of content variability, has become increasingly relevant with the application of experimental methods that typically require multiple trials per condition (e.g., fMRI) as several stimuli are needed within each category to avoid experimental habituation; thus, making it difficult for a researcher to gather enough stimuli specific to their research question**.**

Another major critique of the erotic pictures in the IAPS dataset is that the content of the pictures are outdated (Chivers et al., 2007; Prause et al., 2015). The original images contained within the IAPS were collected in 1970s, and depict the physical characteristics and appearance of that time period (e.g., hairstyles and personal grooming habits), and as a consequence, many of the images fall outside of what is considered current. In addition, the quality of the images is poor as most of the IAPS erotic images were scanned from magazines in the 1970s, and thus contain image artifacts that are produced by scanning such as print grain and moiré patterns (i.e.,

cross-hatch) which degrade the quality of the image. The growing and consistent need for erotic pictures in the field of sex research, depicting a variety of sexual situations, and reflective of current social norms, have led a handful of research groups to develop additional standardized erotic image sets.

Rupp and Wallen (2007, 2009) developed an unpublished dataset of 216 images that include explicit photos of heterosexual couples compiled into the following categories: oral sex to male, oral sex to female, female dominant intercourse facing male partner, female dominant intercourse facing away from male partner, male dominant intercourse from front of female partner, and male dominant intercourse from behind female partner. In addition, the authors matched each of these images with a paired picture that depicted the same actors, but varied by either the level of genital focus or the direction of gaze of the female actor. The images were in turn, rated by seven male and seven female participants on a four point Likert scale on the dimension of sexual attractiveness (1—least attractive to 4—most attractive). As to date, images from this dataset have been employed in experiments utilizing eye-movement technology to examine gender differences in the processing of VSS and potential fluctuations in women's sexual interest across the menstrual cycle (Rupp & Wallen, 2009, 2007) . The images have also been used to examine changes in the amygdala response to sexual stimuli in postpartum versus nulliparous women (Rupp et al., 2013). The main limitations of this dataset are that ratings were collected from a very small sample (i.e., N=7 males and N=7 females) and the inherent asymmetry of its content. More specifically, the dataset contains only images that received a positive rating of sexual attractiveness with stimuli found to be aversive or negative being excluded. Although sexual stimuli are typically processed as pleasant, sexual stimuli have also been shown to provoke levels of negative emotional response (Cacioppo & Berntson, 1994; Larsen & McGraw, 2011; Staley & Prause, 2013). Thus, researchers interested in disentangling emotional and sexual responses would need access to stimuli that are representative of the entire affective space.

Another group of researchers have recently developed a set of stimuli that represent the entire spectrum of sexual and affective dimensions (Prause et al., 2014). A total of 200 images were taken from public domain website reflective of the following categories: Pleasant-Sexually activating, Pleasant-Sexually inhibiting, Unpleasant-Sexual activating, Unpleasant-Sexually inhibiting. All stimuli were limited to photographs of individual females in which the females'

body was oriented towards the camera and were independently rated by 80 undergraduate students on sexual (i.e., "not at all sexual" to "very sexual) and affective (i.e., valence; "very unpleasant" to "very pleasant") dimensions. Although the images are limited to only female characters, and the authors did not provide clarification on the participant characteristics of the raters (e.g., gender, sexuality), the apparent symmetry of this database in terms of its representation of affective and sexual dimensions represents a useful feature of this unpublished picture set.

VSS sets also vary in the explicitness of their content. For instance, Ponseti and colleagues (2010) developed a set of images depicting engorged vulvas and erect penises for their research examining gender specificity in sexual response. The torso is visible within some of the photographs, but limbs and faces are never displayed. Meanwhile, Jacob and colleagues (2011) developed and published a dataset of non-explicit erotic images, depicting heterosexual couples engaged in erotic scenes that did not display explicit sexual intercourse, and images of males without exposed genitals. A sample of heterosexual females (N=41) rated the images on the dimensions of valence (ranging from 'unpleasant' to 'pleasant'), arousal (ranging from 'calm' to 'excited'), and dominance (ranging from 'in control' to 'dominated') using the same rating system as the IAPS dataset (Lang et al., 2008). The authors also sought to examine the consistency of their participant ratings with those collected from the International Affective Picture System by asking participants to also rate 20 erotic images from the IAPS dataset. They found that both erotic pictures sets were similar ($p>.05$) on all dimensions. A major constraint of this database is that normative ratings have only been collected for heterosexual females, which would limit the applicability of the images to research with this specific population.

Finally, there are published sets made from computer-modified images such as the Not Real People Visual Stimulus Set (NRP; Laws & Gress, 2004) and the Virtual People Set (VPS; Dombert et al., 2013). The images from both the NRP and VPS vary in term of the gender of the character (i.e., male/female), the explicitness of the content (nude/clothed), and the stages of pubertal development (i.e. development of primary and secondary sexual characteristics). The NRP and VPS were developed to function as stimulus material for assessing pedophilic sexual interest and has been used for this purpose in various studies with adult males convicted for offences against children (Dombert et al., 2013; Mokros et al., 2013; Mokros, Dombert, Osterheider, Zappalà, & Santtila, 2010) and to examine sexual preference in male non-offenders

(Dombert et al., 2013). Given that the stimulus material available through these virtualized datasets does not depict real people, thus making it more likely to meet contemporary legal and ethical requirements, they provide a major advantage for researchers interested in investigating pedophilic sexual arousal. However, it remains to be seen whether these artificial images are effective at arousing the interest of individuals who report a sexual preference for adults (i.e., teleiophilia).

The normative sets of erotic images described above are a necessary first step, but are limited in their scope. Thus, the aim of our current study was to develop a comprehensive and current database of erotic images that includes heterosexual, lesbian and homosexual content, normatively rated on valence and arousal by male and female heterosexual participants. Dimensional theories of emotion claim that the motivational organization of affective states are typically defined by emotional valence (positive/pleasant vs. negative/aversive), arousal (intensity of motivation/activation; Lang & Bradley, 2010), and can also include the dimensions of dominance (control vs. dominated; Mauss & Robinson, 2009). Given that this database is designed to provide a tool for researchers interested in investigating emotional, cognitive and physiological responses to erotic stimuli, this study will focus on both the appetitive and motivational mechanisms (i.e., valence and arousal) measured using the Self-Assessment Manikin (SAM; Lang, 1980). SAM is a widely used system of graduated scales that depict a range of images intended to represent the dimensions of valence (i.e., from smiling figure to a frowning figure) and arousal (i.e., from an excited to a relaxed figure) (Libkuman, Otani, Kern, Viger, & Novak, 2007). Although not outlined in this article, additional physical qualities of the pictures (i.e., luminance, contrast, and color composition) have been measured and recorded.

Method

The research protocol was approved by the human research ethics committee at Concordia University, in accordance with the Canadian Tri-Council Policy Statement of ethical conduct for research involving humans.

Stimuli

An extensive online Internet search led to a total of 1030 colour images being chosen and downloaded from free sites on the Internet. From these, 780 images were selected. The main rules for inclusion during the selection process were that the images did not contain any commercial logotypes, or individuals whom are widely known to the general public. In addition, we excluded blurred images, and pictures with a resolution lower than 1024 X 768 (landscape) or 768 X 1024 (portrait) pixels. We looked for the following pictures categories: (1) oral sex: heterosexual, homosexual, lesbian (2) vaginal penetration: penile or dildo; (3) anal penetration: penile or dildo; (4) kissing: heterosexual, homosexual, lesbian; (5) naked cuddling: heterosexual, homosexual, lesbian (6) clothed cuddling; heterosexual, homosexual, lesbian (7) half-nude: male or female (8) full-nude: male or female (9) ejaculation: male or female. Although interpersonal erotic situations clearly may involve a group of individuals, no erotic stimuli showing more than two individuals were collected. Also, in order to attempt to account for the diversity of human sexual preferences we attempted to find images with characters that represented different ethnic groups: Black, Asian, White. Of these 780 images, five to ten images were selected by the experimenters that corresponded which each of the categories for a total of 213 images. Additionally, in order to be able to compare groups, all participants rated 15 pictures. This small set was composed of two-to-three images from each category, proportional to the initial number of pictures in each category in the database.

Participants:

A total of 217 participants (165 women, 62 men) from Concordia University in Montréal, QC Canada participated in the study. The mean age in the sample was 26.73 (SD=3.61). Men and women did not differ significantly in age (M_w=25.96, SD_w=4.31; M_m=26.63, SD_m=5.11; p=0.63). Sixty percent of the participants were psychology students (N=192). For the purpose of the study, only the data of heterosexual participants was retained for analysis, as measured by those that scored 0 (i.e., exclusively heterosexual) or 1 (i.e., predominantly heterosexual, only incidentally homosexual) on the Kinsey Scale (Kinsey, 1948). This criterion left us with 147

female participants, and 57 males. All participants provided written informed consent prior to participating, and received compensation for their participation.

Demographic and Sexual History

Participants were asked to complete a questionnaire that requested demographic on age, ethnicity, sex/gender, religion, and degree of religiosity. Questions pertaining to sexual information included: sexual orientation (as measured by the Kinsey scale), presence of sexual concerns, relationship status, number of sexual and romantic encounters, and masturbation frequency (see Appendix 2 for full survey).

Rating Scales and Stimulus Presentation

Prior to the experimental session, the participants were provided with details about the image content and an overview of the relevant dimensions of valence and arousal. Experimental sessions were run in groups ranging in size from one to six individuals; each participant was separated by a panel divider that obscured their ability to see the other participants, but did not obstruct their ability to see the screen on which the images were projected. They were also informed that they were free to withdraw at any time if they felt any discomfort during the session.

The stimuli were distributed in two counterbalanced sets of 129 images each. To be able to compare groups, all participants rated 15 pictures. Set 1A was composed of three to four images from each subcategory, proportional to the number of pictures that were available within each category in the database. A pseudo-random sequence of stimulus presentation was designed to be relatively unpredictable for the participants with regard to sexual content category. Furthermore, attention was paid to succession of the pictures such that no more than two images from one category were present in sequence. Set 1B consisted of the same images as 1A, but the image presentation was counterbalanced such that the last 65 images from 1A were presented first, followed by the first 64 images from 1A. Set 2A contained: 15 randomly selected images from the Set 1, 30 erotic IAPS pictures that had not been presented in the first set, as well as, an additional 84 images which was composed of 2 to 5 images from each subcategory. Consistent with Set1A, all images in 2A were presented in a pseudo-random sequence, while images in set 2B were presented in order to counterbalance the images presentation from Set2A.

The rating session began with an instruction screen that reviewed the details of the experiment, followed by eight trials to allow participants to familiarize themselves with the

handset and the corresponding rating scales. Participants were instructed to respond with their "first and immediate reaction to the image". During the experiment, a black screen with the following instructions was written, "*Rate the next image along the (e.g., valence) dimension"*. After this instruction, a rating scale was displayed on the right and the image was presented on the left side of the screen. The participants had 3s to complete ratings on the valence dimension. After the 3s had passed, the image was presented for a second time and the participant had three seconds to rate the image on the arousal dimension. When the three seconds elapsed the sequence continued with the next picture. An obligatory five-minute break was implemented after half the images had been presented. Participants were instructed that during this time they were not to use any electronic devices. In total, the experiment lasted roughly one hour.

Ratings were completed on the dimensions of valence (ranging from 'unpleasant' to 'pleasant') and arousal (ranging from 'calm' to excited) with an adapted version of the Self-Assessment Manikin (SAM; Lang, 1980). As discussed in the introduction, SAM is an affective rating scale that depicts the dimensions of arousal, valence and dominance through the use of a graphic figure. Figure 1 demonstrates the dimensions of arousal (from excited to a relaxed figure) and pleasure (from smiling to a frowning figure). The SAM was abbreviated from the 9-point version of the scale to reduce participant burden and allow for the use of the I-Clicker response system which only has five response buttons, resulting in a two 5-point scales: one for valence (1 = very unpleasant, 3 = neutral, and 5 = very pleasant), and one for arousal (1 = very low arousal, 5 = very high arousal). The core software for stimulus presentation and data acquisition was created using I-Clicker Software. All data was analyzed further using the Statistical Package SPSS (version 20).

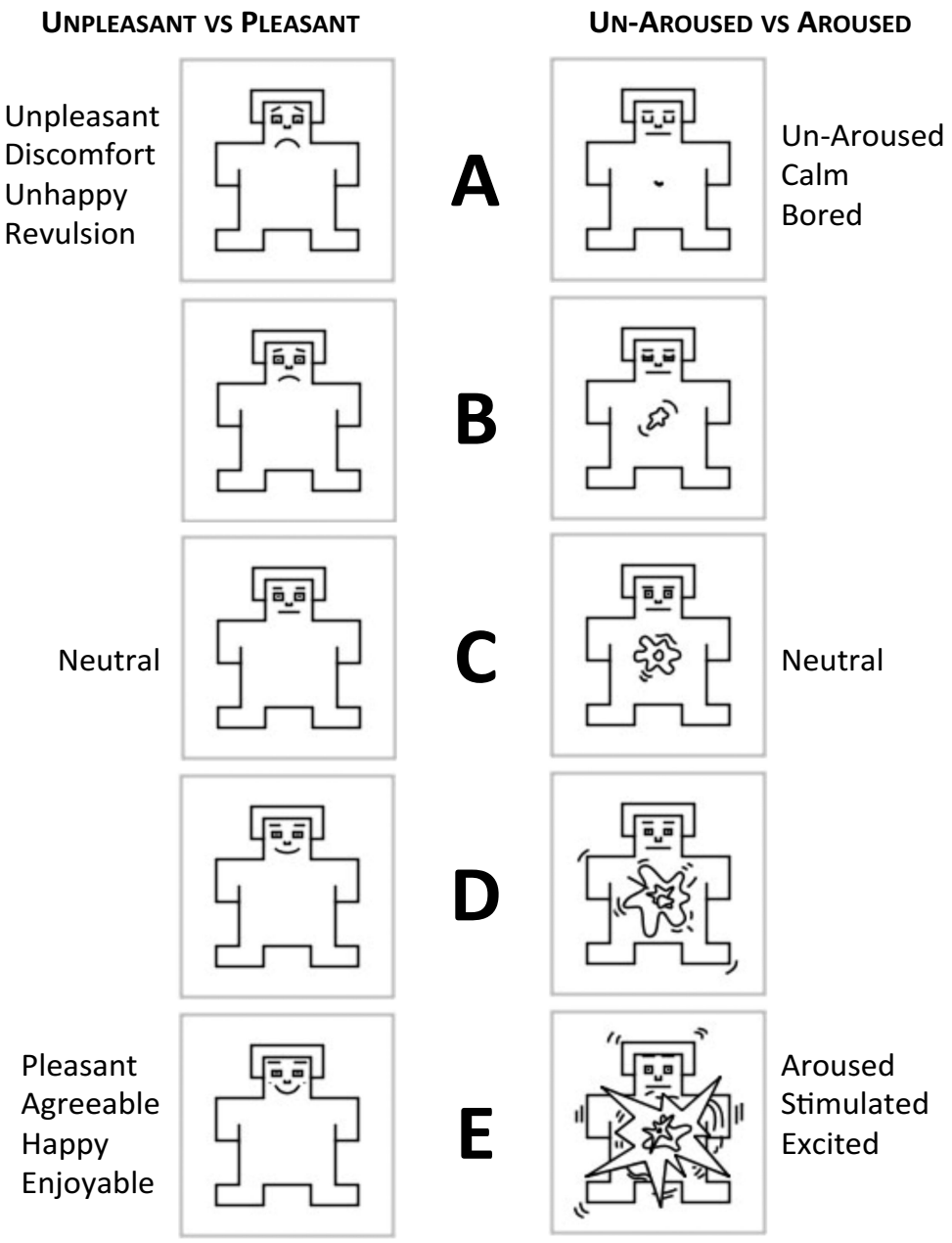

Figure 3.1. Self-Assessment Manikin

Results

Data Cleanup

Altogether, 96,883 ratings were collected across both dimensions. However, data was missing for some individuals, and for some individuals there was a lack of variability in responses (i.e. providing the same ratings for all images). Therefore, I implemented the following procedure to cleanup these data. First, approximately 4% of the data was removed due to missing responses, lack of variability in responses (i.e. providing the same rating for all images in the list), or the completion of less than 90% of ratings. This resulted in a retaining 37,895 observations for Valence ratings (96.4% of the original data pool), and 37,857 observations for Arousal (93.4% of the original data pool).

Ratings across image sets

Ratings of the 15 common images were compared across each of the rated image sets (i.e., compared Set 1 and Set 2). Both valence ratings ($r(13)$=.98, p<.001, r^2=.96) and arousal ratings ($r(13)$=.95, p<.001, r^2=.90) were found to strongly correlated. Consistent with these findings, independent samples t-tests were conducted (with Hedges g used as an effect size measure), and the results indicated no significant difference between Set 1 and Set 2 for valence $t(14)$=-.88, p=.38, g=.16, and arousal ratings $t(14)$=-.42, p=.68, g=.08. Thus, the two image sets were considered to be part of the same sample, and the ratings for the 213 pictures could be considered as one database with comparable ratings.

Ratings by Image and Content Category

For each picture, average ratings were obtained for valence and arousal. The ratings for the 213 images are archived at the following site: http://cvl.concordia.ca/CSID. The archived ratings include the means and standard deviations for arousal and valence for the complete sample; and for male and female participants only. To ensure consistency within sexual content categories, we explored the possibility of outlier images within each category of image. To achieve this goal, we calculated means and standard deviations for each image, and for each category for both male and female participants. Next we removed any images within a category that deviated more than two standard deviations from the mean category rating. By implementing these criteria, 24 pictures were removed, leaving 189 pictures in the database.

Gender based descriptive analyses of emotional dimensions by content categories

The relevancy of gender differences has been documented in cognitive processes such as memory and emotion (Cahill, 2006). As described above, findings indicate that visual stimuli can elicit different patterns of sexual response in males than in females (Chivers et al., 2010). The most reliable gender differences in response to sexual stimuli are the subjective ratings of sexual arousal and interest. Typically, heterosexual males rate images of naked males, male masturbation, or male to male sexual scenes, as less arousing than stimuli that depict females characters (Costa, Braun, & Birbaumer, 2003; Rupp & Wallen, 2009). Relative to men, heterosexual women display a more complex pattern of subjective arousal; at times rating images of both genders as comparably arousing, but display greater preference for stimuli depicting female-male sex and solitary masturbation (Chivers et al., 2007). However, both males and females demonstrate subjective preferences for images that depict a member of their own sex, receiving, but not providing, oral sex (Rupp & Wallen, 2009) .

Outlier Removal-Gender-Content Category

Separate outlier analysis was conducted for males and females to remove participant outliers by sexual content category. Mean and standard deviations were calculated for each content category. In turn, two separate outlier analyses were completed for men and women. Outliers were defined as response ratings that fell outside of two standard deviations from the mean for the content category. Individuals with greater than 20% of their responses falling outside of two standard deviations were removed; resulting in four males (ID=70A, 21A, 108, 109) and four females (ID=13A, 98. 33A, 80) being removed. In turn, mean substitution was used to replace outliers that were removed.

Gender Comparison-Content Category

Gender comparisons were performed in order to examine potential differences in ratings of image categories between men and women. Given the large number of categories within the dataset, we selected eight categories that we believe represent a range of sexual activities. To begin with, we compared the entire sample of 147 women to the sample of 57 men. In turn, due to the potential influence of unequal sample sizes, we performed the same analysis with a random subsample of 57 women. Table 2 presents mean scores for valence and arousal ratings of the eight representative categories for men and women (complete sample and random

subsample), as well as, the mean differences between men and women based on estimated marginal means together with their confidence intervals.

With the exception of images that portrayed heterosexual kissing; there was an effect of gender across all representative image categories - for both valence and arousal - indicating that men and women responded differently to content categories. More specifically, heterosexual males rated images with lesbian and heterosexual content as more pleasant and arousing than heterosexual women. However, heterosexual women rated images with male homosexual content as more pleasant and arousing than heterosexual men. The pattern of results was similar whether the entire set of women was used or just a subset.

Table 3.1. Male and female ratings of sexual content categories for total sample of women *N*=147 and random subsample of women *N*=57

Image Type	Rating	Men *M (SD)*	Women *M (SD) N=57*	*N*=57 Women Mean Difference and 95% CI of the main gender effect	Women *M (SD) N=147*	*N*= Women Mean Difference and 95% CI of the main gender effect
Anal						
Heterosexual	Valence	3.60 (.67)	2.29 (.84)	1.31* (1.01, 1.62)	2.32 (.79)	1.29* (1.03, 1.54)
	Arousal	3.55 (.77)	2.36 (.94)	1.18* (.90, 1.47)	2.36 (.88)	1.19* (.94, 1.43)
Homosexual	Valence	1.25 (.23)	1.71 (.58)	-.46* (-.60, -.32)	1.70 (.61)	-.45 *(-.59, -.32)
	Arousal	1.05 (.10)	1.40 (.47)	-.35* (-.57, -.13)	1.45 (.50)	-.39 *(-.60, -.19)
Vaginal						
Heterosexual	Valence	3.78 (.29)	2.80 (.68)	.99* (.75, 1.23)	2.90 (.71)	.88* (.68, 1.09)
	Arousal	3.55 (.48)	2.94 (.85)	.62* (.37, .86)	3.01 (.77)	.55* (.33, .77)
Cunnalingus						
Heterosexual	Valence	3.76 (.51)	2.84 (.79)	.92* (.63, 1.20)	2.93 (.81)	.82* (.56, 1.08)
	Arousal	3.60 (.73)	3.08 (.96)	.53* (.25, .80)	3.21 (.94)	.40* (.18, .62)
Lesbian	Valence	3.40 (.40)	2.23 (.76)	1.17* (.93, 1.41)	2.25 (.72)	1.15* (.93, 1.38)
	Arousal	3.19 (.40)	2.04 (.82)	.79* (.85, 1.46)	2.12 (.81)	1.08* (.80, 1.36)
Fellatio						
Heterosexual	Valence	3.43 (.48)	2.55 (.78)	.88* (.60, 1.17)	2.51 (.79)	.92* (.66, 1.18)
	Arousal	2.99 (.72)	2.24 (.98)	.75* (.49, 1.01)	2.36 (.95)	.63* (.42, .85)
Homosexual	Valence	1.28 (.24)	1.71 (.60)	-.43* (-.60, -.27)	1.74 (.60)	-.46 *(-.61, -.31)
	Arousal	1.09 (.16)	1.44 (.57)	-.35* (-.55, -.14)	1.49 (.54)	-.39* (-.60, -.18)
Fingering						
Heterosexual	Valence	3.85 (.56)	3.06 (1.09)	.79* (.43, 1.16)	3.10 (1.04)	.75* (.44, 1.06)
	Arousal	3.72 (.69)	3.26 (1.28)	.46* (.21, .71)	3.25 (1.13)	.47* (.26, .67)
Lesbian	Valence	3.31 (.43)	1.91 (.64)	1.41* (1.18, 1.64)	2.00 (.66)	1.31* (1.10, 1.53)
	Arousal	3.04 (.58)	1.79 (.77)	1.25* (1.03, 1.48)	192 (.77)	1.12* (.92, 1.32)
Kissing						
Heterosexual	Valence	4.03 (.56)	4.44 (.50)	-.41* (-.67, -.16)	4.46 (.49)	-.43* (-.68, -.18)
	Arousal	3.21 (.97)	3.05 (.79)	.16 (-.15, .47)	3.24 (.87)	-.04 (-.29, .22)
Lesbian	Valence	3.15 (.66)	2.33 (.70)	.82* (.57, 1.06)	2.45 (.77)	.70* (.49, .91)
	Arousal	2.78 (.76)	1.64 (.65)	1.14* (.87, 1.42)	1.77 (.68)	1.01* (.79, 1.22)
Homosexual	Valence	1.54 (.42)	2.46 (.89)	-.92* (-1.13, -.71)	2.50 (.93)	-.96* (-1.18, -.74)
	Arousal	1.11 (.16)	1.49 (.69)	-.38 *(-.51, -.24)	1.71 (.79)	-.60* (-.73, -.47)
Naked Image						
Male	Valence	1.99 (.46)	2.88 (.57)	-.89* (-1.12, -.66)	2.92 (.66)	-.93 *(-1.15, -.72)
	Arousal	1.68 (.34)	2.25 (.74)	-.57* (-.76, -.39)	2.34 (.77)	-67* (-.83, -50)
Female	Valence	4.14 (.27)	3.06 (.72)	1.08* (.88, 1.28)	3.11 (.66)	1.02* (.83, 1.22)
	Arousal	3.77 (.52)	1.82 (.70)	1.95* (1.74, 2.15)	2.01 (.73)	1.76* (1.57, 1.96)

Half Nak Image						
Male	Valence	2.18 (.58)	3.89 (.50)	-1.71* (-1.95, -1.46)	3.92 (.57)	-1.74* (-1.96,-1.52)
	Arousal	1.20(.23)	2.70 (.74)	-1.50* (-1.64, -1.36)	2.79 (.75)	-1.59* (-1.72,-1.46)
Female	Valence	3.95 (.51)	3.01 (.64)	.93* (.72, 1.14)	3.05 (.68)	.89* (.68, 1.10)
	Arousal	3.59 (.66)	1.66 (.62)	1.93* (1.72, 2.15)	1.85 (.73)	1.74* (1.55, 1.92)

CSID images in Affective Space

Taking images as cases, we used Pearson's correlations to examine the relationships between ratings of valence and arousal for male and females separately. Figure 3.2 (top) represents each of the 189 images in the affective space plot formed by plotting arousal on the x-axis (i.e., abscissa) and valence on the y-axis (i.e., ordinate). The quadrating correlation for valence and arousal were significant for both men ($r(187) = .91, p < .0001$) and women ($r(187) = .61, p < .0001$) indicating that as images were rated more pleasant they also tended to be rated as more arousing. Figure 3.2 (bottom) illustrates a two-dimensional affective space by plotting means, and 95% confidence intervals for valence and arousal ratings for the representative sexual content categories. If the quadrants are determined based on the midpoint of each scale (3), the different categories appear to represent different quadrants of the affective space (valence and arousal) in males and females. In males, most data points fell within the high arousal-valence quadrant with the exception of homosexual content and images depicting male nudes and half-nudes. In contrast, the female ratings display a more dispersed pattern of ratings. More specifically, the largest grouping of data points falls within the low arousal-valence quadrant representing lesbian and homosexual content categories, images of naked males, and images depicting heterosexual fellatio and anal sex. The only image categories that fell within the high arousal-valence quadrant were the images depicting heterosexual kissing and fingering.

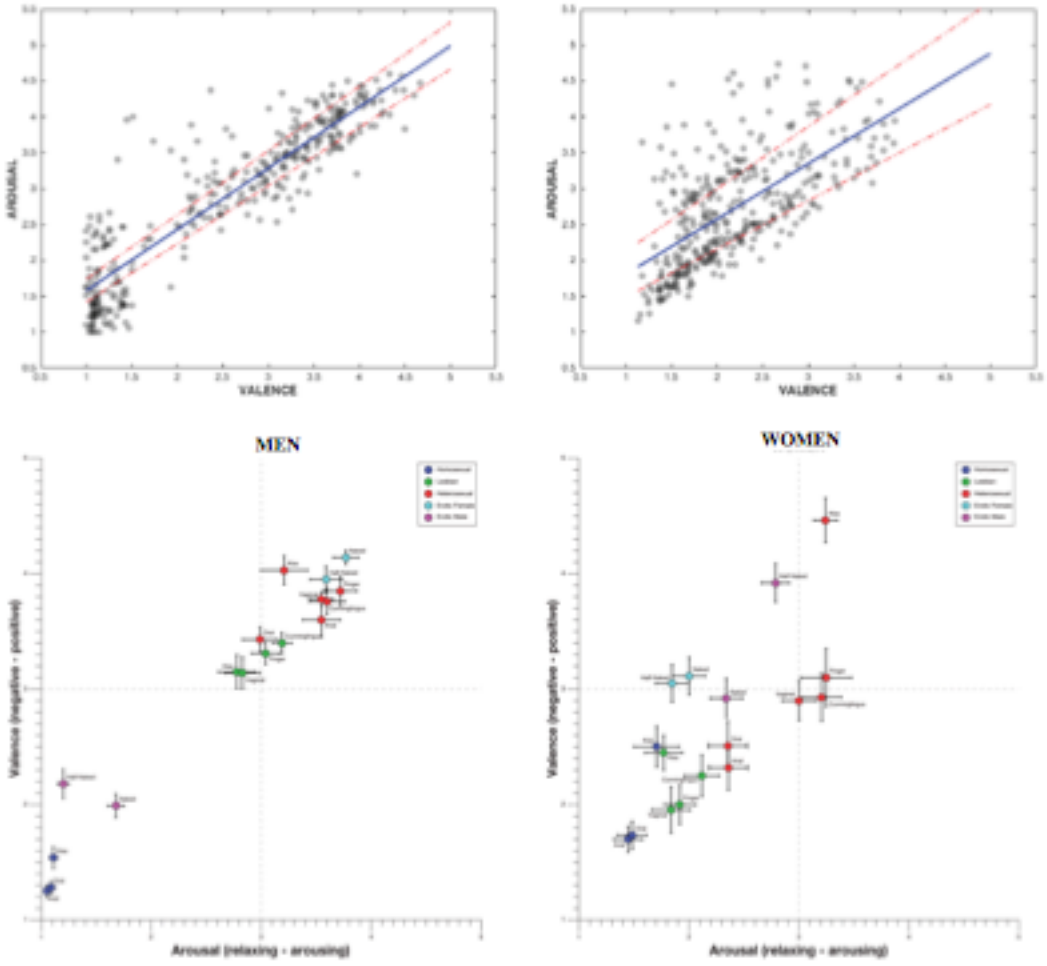

Figure 3.2. Top panel: A scatter plot of the 189 rated in the two-dimensional affective space defined by the mean pleasure and arousal rating of each image, separately for men (left panel) and women (right panel). Bottom panel: A scatter plot of representative sexual activities which demonstrates that the gender of the rater, and the sexuality of the characters depicted in the images, impacts the images location in affective space. (e.g., lesbian content found in upper right quadrant when rated by males and bottom right content when rated by women)

Discussion

The Concordia Sexual Image Dataset (CSID), developed and described above, is a comprehensive set of 189 static visual sexual stimuli. The dataset contains images representing different sexual activities of varying sexual orientations (i.e., heterosexual, homosexual, and lesbian), which distinguishes this database from other sets of visual sexual stimuli. Ratings were collected for male and female heterosexual participants and comparisons across gender revealed that content evaluations were strongly influenced by the gender of the evaluator (i.e., we found gender differences across all categories except heterosexual kissing). Consistent with previous research that has examined content specificity in physiological and self-reported arousal, our findings provide further evidence of male and female heterosexuals displaying different content preferences (Chivers & Bailey, 2005; Ellen Laan & Everaerd, 1995). As expected, males displayed a more binary pattern of response ratings; typically they both liked the image and rated it as arousing or they disliked the image and rated it as unarousing. More specifically, images depicting naked females, as well as, heterosexual and lesbian erotica were rated as pleasant and arousing, while images of naked males and homosexual erotic were rated as unpleasant and unarousing. Meanwhile, women displayed substantial variability in their ratings within and between content categories. Taken together, my findings suggest that men's response patterns were fairly consistent, while women displayed substantial variability in their ratings within and between content categories, suggesting that researchers should take into account both content and rating parameters when selecting a sexually preferred stimulus.

I also examined the impact of gender on the relationship between valence and arousal for erotic images across the content categories. Visual inspection of the residual plots revealed that the assumption of homoscedasticity had been violated. Further inspection of the residual plots and scatterplots (Figure 1 –top panels) revealed differences in the relative distribution of variance as a function of gender. Men displayed a stronger association between valence and arousal with increasing valence. More specifically, when men rated images as unpleasant (e.g., homosexual content, half-naked single males) ratings varied from unarousing (for homosexual content) to moderately arousing (for half naked single males); meanwhile, when men rated images as pleasant, they typically rated also rated the image as more arousing. In contrast, women displayed increased variability in their responses with increasing valence. When women rated images as unpleasant they displayed less variability in their arousal ratings, but when

images were rated as pleasant (e.g., clothed heterosexual cuddling, heterosexual kissing, half naked-men), ratings varied from low arousing (e.g., clothed heterosexual cuddling) to moderately arousing (e.g., half-naked males). These findings are in line with previous research that has shown that women display a stronger correlation between valence and arousal for unpleasant images, while the association between men's rating of valence and arousal are stronger for pleasant images (Bradley & Lang, 2007; Silva, 2011). However, if we consider that only a few of our images were rated as highly arousing by women, the lack of high arousing data points may account for the variability in women's ratings of pleasant images.

The limited amount of highly arousing images as rated by heterosexual women can be considered a limitation of our dataset, but is in line with a recurring finding in the literature that women have a tendency to rate erotic images as moderately arousing (Jacob, Arntz, Domes, Reiss, & Siep, 2011b; Murnen & Stockton, 1997). However, this recurring finding may be in fact be an artifact of how images are typically collected (i.e., downloaded from public domain websites). A recent content analysis of the popular pornographic websites that coded for the content of the image, found that women were less likely to receive manual or oral stimulation from a man or to experience orgasm (Klaassen & Peter, 2015). Considering these findings, it is not surprising that we had difficulty accessing images that women find highly arousing given the preponderance of erotic content on the internet that is focused on male pleasure (Fritz, 2015). Current efforts are being made to collect and validate additional images from pornographic sites geared towards female pleasure, with the goal of amassing a large collection of images that women find highly arousing.

When compared with other available erotic datasets (Lang, Bradley, & Cuthbert, 2008; Laws & Gress, 2004; Ponseti & Bosinski, 2010; Prause et al., 2014; Rupp & Wallen, 2009; Rupp & Wallen, 2007), the erotic images tested in the current study covers a broader range of image categories. That being said, the number of images in certain categories were lower (e.g., only three images depicting homosexual men engaged in clothed cuddling), and certain sexual acts were not included. For example, we did not include images that focused exclusively on engorged penises and vaginas (without the torsos showing), which have recently been shown to produce a category-specific pattern of genital response in both heterosexual men and women (Spape et al., 2014).

Another potential limitation of our dataset was that data were rated only on dimensions of valence and arousal. I chose to focus on these dimensions as several investigations have shown that models that include only the dimensions of valence and arousal capture more of the affective space of images than models that include additional dimensions (Kousta, Vinson, & Vigliocco, 2009; Mauss & Robinson, 2009). Including a sexual dimension would have been useful, but there is little consistency in the operationalization of the sexual characteristics of an image across the visual sexual stimulus sets described above (e.g., defined as sexual arousal in Ponseti, Hartmut, Bosinksi, 2010; as sexual attractiveness in Rupp and Wallen, 2009; and as how sexual in Prause et al., 2014). Nonetheless, including a dimension that includes the sexual quality of the image would be a valuable addition to the CSID ratings.

In conclusion, the Concordia Sexual Image Dataset (CSID) provides researchers with 189 erotic images normatively rated on the dimensions of valence and arousal. The images depict a variety of sexual situations, varying in explicitness, which include lesbian, homosexual and heterosexual content. Comparisons of valence and arousal across gender provides the opportunity for researchers to select stimuli based on different content and emotion parameters, allowing for a variety of research designs. The CSID is available to the scientific community, for non-commercial use by request at http://cvl.concordia.ca/CSID.

Chapter 4: Examining the Category Specificity of Women's and Men's Attention to Visual Sexual Stimuli

Examining the Category Specificity of Women's and Men's Attention to Visual Sexual Stimuli

Julie Shilhan [1,2] ● Marie-Eve Leclerc [1] ● Aaron P. Johnson [1] ● James G. Pfaus [1,2]

[1] Department of Psychology, Concordia University, 7141 Sherbrooke W., Montréal, QC H4B 1R7 Canada

[2] Center for Studies in Behavioral Neurobiology, Department of Psychology, Concordia University, 7141 Sherbrooke W., Montréal, QC H4B 1R7 Canada

Introduction

Gender differences in the type of visual sexual stimuli (VSS) that trigger a sexual response are well established. Heterosexual men have been shown to consistently demonstrate greater physiological and self-reported arousal to stimulus cues consistent with their self-reported sexual preference (e.g., pictures of nude females), thus displaying a category specific pattern of sexual response. (Chivers et al., 2007; Peterson & Janssen, 2007). Meanwhile, heterosexual women display a more complex pattern of sexual response with their genital response, and at times subjective sexual arousal, responding to a wider variety of stimuli that may or may not be congruent with their stated sexual preference (i.e., category non-specific: Chivers et al., 2007; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Laan & Everaerd, 1995). In the current investigation, I examined whether the gender differences in patterns of specificity to sexual cues that have been previously observed using genital response measures (e.g., plethysmography, thermography: Chivers et al., 2010; Huberman & Chivers, 2015) may also be observed when measuring visual attentional allocation using the modified pictorial Stroop. By applying this paradigm, I aim to further explore attentional mechanisms implicated in sexual response, by examining the relative degree of attention allocated by heterosexual men and women to preferred and non-preferred VSS. For the purposes of this study, the VSS were selected from the Concordia Sexual Image Dataset developed in Chapter 3.

Cognitive models of sexual response suggest that both automatic and controlled attentional processes are implicated in the evaluation of VSS, which in turn initiate a sexual response. It may be that men and women differ in their pattern of activation of these attentional mechanisms, which may be a contributing factor in the differences found in their genital responding. Spiering and Everaerd (2007) proposed a cognitive model in which the interaction between automatic and controlled cognitive processes generates a sexual response and increases the influence of attentional processes in generating both psychological and physiological arousal. Automatic attentional processes involve the automatic appraisal of cues as sexual or nonsexual through the unconscious allocation of attention to sexually relevant features, which are in turn matched with representations in implicit memory (Janssen et al., 2000; Spiering & Everaerd, 2007). If there is a match, then the cue is appraised as being sexual with further attentional resources being directed toward it. Controlled attentional processes include the integration of automatic and deliberate processes leading to the conscious appraisal of the sexual stimulus.

Increased attentional focus on the sexual aspects of the stimulus activates the individual's explicit memory allowing for further elaboration of the stimulus and leads to the subjective experience of sexual arousal.

Another aspect of this study was to directly compare the automatic and controlled attentional processes through the manipulation of the trial format for the modified Pictorial Stroop to include both random and block presentations (Wilson & Wallis, 2013). Modifying the trial format to include images from all category types presented in a random sequence has been used as an index of automatic attention; conversely a trial format that includes images from the same category presented in blocks has been used as an index of controlled attentional processes (Mama, Ben-Haim, & Algom, 2013; McKenna & Sharma, 2004; Price et al., 2013; Wilson & Wallis, 2013). Studies supporting response times in the random modified Stroop trial format as an index of preconscious, or automatic, attentional engagement to emotionally salient cues has been well established, with longer interference delays for threat related stimuli (e.g. Bradley, Mogg, Millar, & White, 1995; Egloff & Schmukle, 2004; Holle, Neely, & Heimberg, 1997; McNally, Riemann, Louro, & Lukach, 1992; Mogg et al., 2000; Wikström, Lundh, & Westerlund, 2003) and addiction related stimuli (e.g. Carpenter, Schreiber, Church, & McDowell, 2006; M. Field, 2005; Hester et al., 2006). Validation of response times in the block trial format as an index of consciously controlled attention for salient cues is found in research in which participants take longer to respond to threatening than neutral stimuli (Liu et al., 2014; McKenna & Sharma, 2004).

Both random and block presentations of the modified Pictorial Stroop method have been applied to the evaluation of sexual preference (or sexual interest) in the literature (O'Ciardha & Gormley, 2012; O'Ciardha & Gormley, 2013; Price et al., 2013; Smith & Waterman, 2004). However, only one study to date has directly compared both trial formats (O'Ciardha and Gormley, 2010). That study compared response times to images of half-naked males, half naked females, and a neutral image condition (i.e., pictures of cats) in heterosexual males. The authors explained that if interference effects for preferred VSS (i.e., naked females) were related to automatic attentional processes, then relative response time delays would be observed for preferred content across both random and block presentations; however, if controlled cognitive processes were driving the effect, then the strongest interference effects would be found for the block design, with minimal (if any) interference effects for the random design. They found that

male heterosexuals displayed longer interference delays for images of half-naked females compared to images of half-naked males and images of cats and that this effect was found only for the block design. Based on these findings, O'Ciardha and Gormley (2010) suggested that interference effects for preferred visual stimuli were largely due to more elaborate processing of the stimuli (i.e., controlled processing). However, a limitation of their research is that they did not use adequately validated stimuli, as a majority of the adult images were created by the authors using computer-morphing technology and were not validated on relevant emotional dimensions (i.e., valence and arousal). Thus, by not collecting information on relevant stimulus parameters, their findings could be partially accounted for by these uncontrolled parameters.

Having established the validity of the modified Pictorial Stroop methodology to examine both automatic and controlled attentional processes, the present study applied the same method to examine potential gender differences in attentional bias to visual sexual stimuli taken from the validated image dataset developed in Chapter 3. To this end, heterosexual men and women were presented with images of naked females (preferred stimulus for men), naked males (preferred stimulus for women) and low arousing stimuli (images of clothed heterosexual couples cuddling), and differences in interference delays for these different content categories were examined. Automatic and controlled attentional processes were examined after modifying the methodology to include both random (automatic) and block (controlled) designs. It was hypothesized that heterosexual men's automatic and controlled attention would be category specific, displaying longer interference delays for their sexually preferred stimulus (i.e., images of naked women) than their sexually non-preferred stimulus (i.e., images of naked men). It was also expected that women would display a category non-specific pattern of response in their automatic attention by displaying similar interference delays across categories, but that their controlled attention, reflective of top-down processing, would be category-specific, producing longer delays for preferred content (i.e., images of naked men) than other categories.

Method

Participants

A total of 62 participants (34 women, 28 men) from Concordia University in Montreal, Quebec took part in the study. The mean age in the sample was 22.31 (*SD*=2.89). Forty percent of the participants were psychology students. For the purpose of the study, only the data of heterosexual participants were retained for analysis, as measured by those that score 0 (i.e., exclusively heterosexual) or 1 (i.e., predominantly heterosexual, only incidentally homosexual) on the Kinsey Scale (Kinsey, 1948). This criterion left us with 26 female participants, and 25 males. All participants provided written informed consent prior to participating, and received compensation for their participation. The Concordia University Human Research Ethics Committee approved all procedures.

Apparatus and Stimuli

Participants were tested on a Dell Quad-Core PC running Microsoft Windows 7, equipped with a USB keyboard. The keyboard's arrow keys were colour-coded (i.e., blue, red, yellow, green). Stimuli were presented on a 21" monitor (Viewsonic G225fb) with a screen resolution of 1024x768 pixels. Participants viewed the screen from a distance of 65cm, resulting in a viewing angle of 1 degree of visual angle per 31 pixels. The distance from the screen was fixed by having participants use a chin rest.

The images used in the Stroop experiment were extracted from the CSID Sexual Imagery database developed in Chapter 3. The CSID is a new image database for use by sex researchers. It is representative of individuals of different racial backgrounds and sexual orientation (i.e., heterosexual and homosexual content). These images also depict a variety of sexual situations (e.g., kissing, cuddling, oral, intercourse, anal penetration etc.). Each image in the database has been previously rated along the dimensions of arousal (i.e., unaroused to aroused), and valence (i.e., really dislike to really like), on a five-point Likert scale. For the purposes of the study we were interested in images that contained similar content (i.e., images that depicted a single person naked), and which were rated high on arousal for males or rated high on arousal for females. As a result, we extracted the 10 images of Naked Women that were rated highest by males on the dimensions of arousal and the 10 images of Naked Men rated highest by females on the dimensions of arousal; gender differences were found across each image ($p<.01$). For low arousing stimuli, we were interested in stimuli rated low on arousal and that were rated similarly

on this dimension for both men and women. This resulted in a low arousing category of clothed heterosexual couples cuddling. Each image was converted from its original RGB colour format into a grey scale image using the MATLAB *rgb2gray* function, since the tinting of color over a colourful image would create distortion in the colors. Images were then normalized for mean luminance and contrast, to ensure that each image has the same low-level image statistical properties. Thus, any difference between image categories must be due to high-level content (i.e., female nude, male nude, clothed couples cuddling) contained within the image. The images were then converted back into RGB colour images, by placing the image content either into each colour channel (i.e., red, green, blue), or into two channels (i.e., red and green) to produce a yellow image (see sample images in Figure 4.1)

Figure 4.1. Examples of stimuli used in each of the three image categories. Each image was converted from its original colour to the colour-tinted image (as described in the measures section). All images were presented in all four colours (here images are only shown with the yellow tint). A) Image rated as highly arousing for males. B) Image rated as highly arousing for females. C) Image rated as low arousing by both males and females.

Procedure

Upon arrival to the laboratory, participants were provided with an informed consent statement and given an opportunity to ask questions about the study prior to signing the document. After agreeing to participate, they were given a subject ID, which was not connected with their informed consent statement. They were then fitted with a head mounted eye tracker connected to Gazetracker software. Eye-tracking technology was used to ensure that participants' viewing patterns remained within the assigned area of the screen where the image appeared. If the eye-tracking record indicated that the participant did not look within the assigned parameter of the images but rather looked away from the stimuli, the participant would be removed from the data analysis. One participant's data was removed from the analysis for this reason.

Once the eye tracker was calibrated, participants were reminded that they would be viewing a series of sexually explicit images. They were again told that they could stop the experiment at any time and to let the experimenter know if they were uncomfortable at any point. Participants were instructed to identify the ink color of each image and ignore the content. The Stroop section contained several subsections that included: (a) practice trials to familiarize the participant with the colour response box, (b) a Block Pictorial Stroop, and (c) a Random Pictorial Stroop. Participants were counterbalanced across the Block Pictorial and Random Pictorial tasks. Instructions were given that discouraged a speed-accuracy trade-off, in that participants were told to respond as rapidly as possible without making too many errors. In turn, participants were then given the opportunity to ask questions and obtain further clarifications about the protocol. Instructions for the task were also presented on the computer screen.

All participants completed a set of 40 practice trials to familiarize themselves with the task and colour button response box. Participants responded with the color of a string of Xs (i.e., XXXXX) that appear on the screen. Each presentation of a string of X's was tinted in one of four possible colours (i.e., red, green, blue, yellow). Feedback was given in the form of a red X appearing if the wrong colour was selected. Participants could not continue to the next string until they responded correctly (this was to ensure that participants properly understood the procedure). Feedback was not given on the experimental trials and participants did not have the opportunity to correct mistakes.

Experiment 1A: blocked sexual pictorial Stroop.

Stimuli were grouped according to stimulus type, resulting in three blocks (naked males, naked females, and clothed couples cuddling). Each block contained 10 images tinted in each of the four colours for a total of 40 trials per block. Block order was randomized across participants and trials were randomized within blocks without repeating colour or image identities on two consecutive trials. In order to limit carry-over effects between blocks, participants completed 12 practice trials prior to each of the experimental blocks, with stimuli consistent with information contained within the block (i.e., images of naked females in the naked female block).

Experiment 1B: random sexual pictorial Stroop.

Stimuli were randomly presented in three blocks: one third of the trials within each block included naked males, one third included naked females, and one third included clothed couples cuddling. Although equivalent, the order of the blocks was randomized across participants. In order to remain consistent across trial types, participants completed 12 practice trials with images representing each of the three categories presented randomly.

Ratings.

Immediately following the Stroop task, participants viewed all stimuli a second time and rated each image along the dimensions of valence (i.e., 1=really dislike to 9=really like) and arousal (i.e., 1=unaroused to 9=highly aroused). After completing the ratings, participants were asked to complete a short questionnaire, administered on the computer over a password-protected server. The participants were told that the questionnaires contained questions about their sexual behavior and sexual preference, and they were offered the opportunity to ask any further questions. Once they had completed the questionnaire, participants were debriefed and compensated for their time**.**

Results

Subjective Ratings

Two separate 2 X 3 (Gender: Male, Female) X Image Type: Naked Females, Naked Males, Clothed Couples Cuddling) mixed ANOVAs were completed for valence and arousal ratings. A gender by image type interaction was found for both valence, $F(2,48) = 107.73$, $p < .001$, $n^2 = .68$, and for arousal, $F(2,48) = 104.01$, $p < .01$, $n^2 = .68$. A series of paired t-tests were completed to examine male and female participants' valence and arousal ratings for each image

type (i.e. naked females, naked males, couples cuddling). Results showed that female participants (N=26) rated naked male images as significantly more arousing [$t(25)= 4.365$, $p<0.001$, $d = .86$] and more pleasant [$t(25)=5.627$, $p<0.001$, $d = 1.10$] than naked female images. Female participants also rated naked male images as significantly more arousing [$t(25)=5.433$, $p<0.001$, $d = 1.06$] than images of clothed couples cuddling, but rated images of clothed couples cuddling as more pleasant than naked male images [$t(25)=3.064$, $p=0.005$, $d = .60$]. While there was no significant difference in female ratings of arousal between naked female images and images of clothed couples cuddling [$t(25)=0.616$, $p=.21$, $d = .12$], female participants rated images of clothed couples cuddling as significantly more pleasant than naked female images[$t(25)=7.803$, $p<0.001$, $d = 1.53$]. For male participants, naked female images were rated as significantly more arousing and more pleasant than both clothed coupled cuddling images [arousal: $t(24)=11.228$, $p<0.001$, $d = 2.25$; pleasant: $t(24)=4.923$, $p<0.001$, $d = .98$] and naked male images [arousal: $t(24)=20.325$, $p<0.001$, $d = 4.08$; pleasant: $t(24)=11.831$, $p<0.001$, $d = 2.37$, $d = 2.57$]. Finally, clothed couples cuddling images were rated as significantly more arousing [$t(24)=4.414$, $p<0.001$, $d = .89$] and pleasant [$t(24)=9.747$, $p<0.001$, $d = 1.95$] than naked male images. Statistics for the ratings are displayed in Table 4.1.

Table 4.1. Average Self-Reported ratings of valence and arousal for males and females

	Male			Female		
Valence	***M***	***SD***	**95% CI**	***M***	***SD***	**95% CI**
Naked Male	2.79	1.56	[2.16 – 3.42]	6.43	1.06	[6.01 – 6.86]
Naked Female	7.90	1.07	[7.53 – 8.39]	4.19	1.95	[3.40 –4.98]
Clothed Couples	6.36	1.36	[5.81 – 6.91]	7.29	0.98	[6.89 – 7.69]
Arousal						
Naked Male	1.49	0.75	[1.19 – 1.79]	4.86	1.69	[4.18 – 5.54]
Naked Female	7.40	1.25	[6.90 – 7.90]	3.13	2.01	[2.32 – 3.94]
Clothed Couples	3.27	2.07	[2.43 - 4.11]	2.88	1.69	[2.20 – 3.56]

Analysis of the pictorial modified Stroop Task

Based on previous literature, we expected that Stroop-interference scores would be consistent with the individual's sexual preference. Mean interference reaction times were computed for the three image categories (naked male, naked female, clothed couples cuddling) and are displayed in Table 4.2. RTs were entered into a 2 (gender) x 2 (trial type) X 3 (image type) mixed factorial ANOVA with sexual preference as a between-subject variable, and image type and trial type (Block vs. Random) as the within-subject variable. We observed no statistically significant interaction between sexual preference, image type, and trial type $F(2, 147) = .99, p = .395, n^2 = 02$. However, there was a statistically significant interaction between gender and image type $F(2, 147) = 8.09, p = .001, n^2 = .25$ (see Figure 4.1). In order to identify the source of the interaction, further analyses were carried out. Simple main effects, separated by participant gender, showed a significant effect of image type for males, $F(1, 24) = 17.82, p < .001, n^2 = .43$, but not for females, $F(1,24) = .759, p = .47, n^2 = .03$, see figure 4.2. Thus, the response time latencies for the female participants were similar across all categories. Further analyses of image categories within male participants revealed that males showed significantly greater latencies to naked female images than both naked male images $t(24)=4.02, p<.01$ and images of clothed couples cuddling $t(24)=5.01, p<.01$.

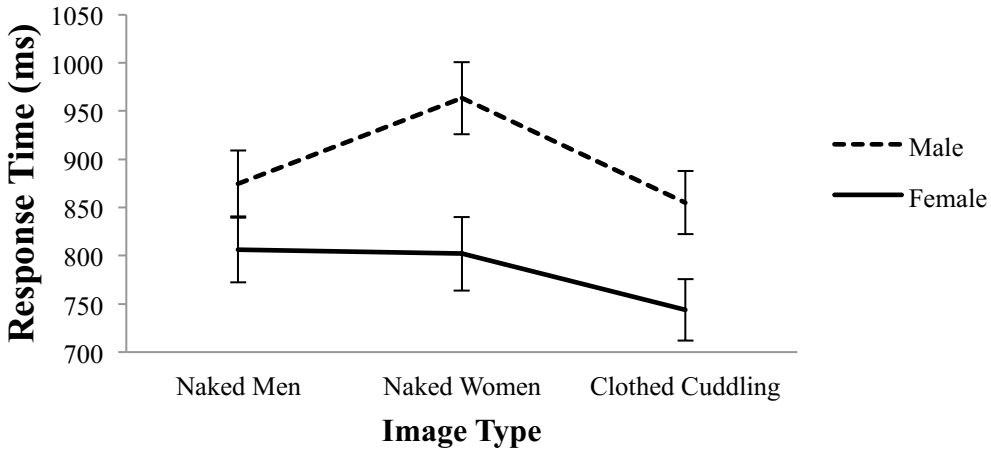

Figure 4.2. Interaction between gender and image type as a function of response time (in milliseconds). Error bars represent 95% confidence intervals around the mean, calculated with the t-Distribution (Prister & Janczyk, 2013).

Table 4.2. Mean interference scores (msec) as a function of gender and image type

	Male			Female		
Block	***M***	***SD***	**95% CI**	***M***	***SD***	**95% CI**
Naked Male	855.93	173.06	[783.31,928.54]	816.66	187.67	[745.46,887.87]
Naked Female	965.73	193.64	[885.38, 1046.08]	802.58	205.77	[723.78, 881.37]
Clothed Cuddling	833.03	185.17	[755.77,910.29]	784.61	198.78	[708.85, 860.37]
Random						
Naked Male	892.94	194.92	[818.27, 967.62]	796.47	176.60	[723.24, 869.69]
Naked Female	961.46	243.22	[877.35, 1045.58]	801.56	170.46	[719.08, 844.04]
Clothed Cuddling	857.83	188.43	[781.09, 934.56]	798.09	193.29	[722.84, 873.33]

Discussion

In this study, a modified Pictorial Stroop task was used to examine potential gender differences in attentional bias to preferred and non-preferred visual sexual stimuli in heterosexual men and women. To this end, images were selected from the Concordia Sexual Image Dataset developed in Chapter 3, representing the following content categories: naked females (i.e., preferred stimulus for men), naked males (i.e., preferred stimulus for women) and clothed couples cuddling (i.e., low arousing stimuli). Differences in interference delays (as measured by reaction times) for these different content categories were recorded in both heterosexual men and women. Both automatic and controlled attentional processes were tested separately using a modified Pictorial Stroop, that included a random trial presentation to examine automatic attentional processes, and a blocked trial presentation to examine controlled attentional processes. As predicted, heterosexual men's automatic and controlled attention was category specific, displaying longer interference delays for their sexually preferred stimuli (i.e., images of naked women) than their sexually non-preferred stimuli (i.e., images of naked men). These interference delays were consistent across both automatic (randomized within-block trials) and controlled (randomized between-block trials) attentional processes. These findings suggest that the attentional system of men is biased towards sexually relevant stimuli, meaning stimuli that are consistent with their sexual preference. It was also hypothesized that women would display a category non-specific pattern of response in their automatic attention, displaying similar interference delays across categories, but that their controlled attention, reflective of top-down processing, would be category-specific displaying longer delays for preferred content (i.e., images of naked men) than other content categories. However, for women these hypotheses were only partially supported, as response time delays were the same across all categories in both the random and block trials. The results would indicate that women display a non-specific pattern of attentional response. Given that O'Ciardha and Gormley's (2012) study did not include women participants, it is unknown whether their results would have been in agreement with these findings.

Taken together, the findings of this study confirm that heterosexual men show a category-specific response to visual sexual stimuli, in this case automatic and controlled attention to images of naked women; whereas heterosexual women do not display evidence of category specificity toward images of naked men. In other words, men's pattern of attentional

engagement is category-specific, while women's is not. This pattern of responses is also consistent with Spiering and Everaerd's cognitive model of sexual response (Janssen et al., 2000; Spiering & Everaerd, 2007), which assumes that attention engagement to a sexually relevant stimulus can lead to the occurrence of genital responses and the conscious experience of sexual arousal. If men's attentional systems are selectively attuned to input from sexual preferred stimuli, it makes sense that they are more likely to generate a genital response to preferred stimuli. If women's attentional systems are more broadly attuned to input from sexual stimuli (i.e., non-specific), this could in part account for the lack of specificity in their genital response pattern. Although this premise is speculative, it offers a plausible theory as to why disagreement between genital and subjective sexual arousal occurs more often in women than in men (Chivers et al., 2010; Huberman & Chivers, 2015b). In other words, men's and women's attentional systems may have adapted to be attuned differently to the processing of visual sexual stimuli.

It was also of interest to examine participants' conscious and explicit affective responses to erotic stimuli. Participants were asked to rate the VSS used in the modified Pictorial Stroop on the dimensions of valence and arousal. The findings from the subjective ratings showed that heterosexual men rated the images of nude females as more pleasant and arousing than the images of nude males, and women rated the images of nude males as more pleasant and arousing than images of nude females. However, the magnitude of the difference between the images was much larger for men than for women, which can be interpreted as men being more categorical in their evaluations of visual sexual stimuli than women. Consequently, women's less differentiated preference for VSS used in this experiment might account for their null effects. These findings are consistent with the result from Chapter 3, and many other studies investigating men's and women's responses to VSS, that have shown that women tend to rate images of men and women similarly on dimension of sexual attractiveness, while men's responses are more differentiated (Dawson & Chivers, 2016; Snowden, Curl, Jobbins, Lavington, & Gray, 2016). The pattern of results from this study is also congruent with those using genital response technology, showing that men display strong categorical effects for their preferred gender in both their subjective and objective response, while women display weak effects.

Limitations and Future Directions

The results of this study provide further evidence that men and women appear to process sexual stimuli differently, and that these differences are reflected in automatic and controlled

attentional processes when using a modified Pictorial Stroop methodology. That being said, this study had some noteworthy limitations. Although the results were described in terms of gender differences, it is understood that generalizations across gender would require a more diverse sample of individuals with varying sexual preferences. For example, future research should include men and women with diverse sexual preferences, including individuals self-identified as homosexual or bisexual, which would allow for a more comprehensive examination of gender effects in the processing of sexual stimuli.

Although relevant low-level stimulus features such as contrast and luminance were controlled for, along with certain affective characteristics (e.g., arousal and valence), it could be argued that contextual factors in the images (e.g., the setting, the model's body language, etc.) may have distracted from the sexually preferred content in such a way that it may have inhibited the processing of sexually relevant features. Indeed, there is evidence to suggest that contextual cues impact the elaborate processing of VSS differently for women than men (Tsujimura et al., 2009). In line with this, a recent study by Spape and colleagues (2014) found that, by removing contextual cues in images of aroused genitals, women displayed specificity in their genital and self-reported arousal to images of erect penises. Thus, future studies could vary the contextual cues and the sexual explicitness of sexually preferred content (e.g., flaccid vs. erect penises) to examine how these factors influence the patterns of activation and attention in men and women.

Conclusion

The current study examined automatic and controlled attention to preferred and non-preferred visual sexual stimuli in heterosexual men and women using a modified Stroop task. Heterosexual men displayed a category-specific response to VSS, in this case longer delays across both automatic and controlled attention to images of naked women, whereas heterosexual women did not display evidence of category specificity. Although these results cannot be compared directly to those derived from genital response measures (e.g., plethysmography) as different methodologies were used, the pattern of results found in the current study provide preliminary support for attention as a potential mechanism that can account for gender difference in the category specificity of sexual response. Specifically, the results suggest that the attentional systems of men and women may have adapted to be attuned differently to the processing of visual sexual stimuli.

Chapter 5. General Discussion

The main goal of this thesis was to examine cognitive processes implicated in sexual response in a quantitative analysis, while also developing a comprehensive and current database of erotic image stimuli. The first goal was achieved by the studies presented in Chapters 2 and 4, where a modified word (Chapter 2) and pictorial Stroop paradigm (Chapter 4) was used to examine attentional responses to Visual Sexual Stimuli (VSS). Results from these studies have implications for the objective measurement of sexual response, the conceptualization of cognitive mechanisms implicated in the processing of VSS, and for the identification of cognitive factors associated with individual differences in sexual functioning. The second goal of this thesis was to develop a dataset of erotic image stimuli that have been rated for valence and arousal by a large sample of heterosexual males and females. This was achieved in Chapter 3 of the thesis. This dataset has potential applications for psychologists interested in obtaining validated modern VSS that can be used in a variety of research paradigms.

The study of human sexual response has focused largely on subjective arousal or autonomic end points (e.g., erection or genital vasocongestion: Brotto & Gorzalka, 2002; Laan, van Driel, & van Lunsen, 2008; Laan, van Lunsen, & Everaerd, 2001). However, genital responses are not unambiguous indices of sexual arousal, as there are often discrepancies between autonomic physiological indictors and self-reported subjective arousal when participants view VSS. This discrepancy occurs more often in women than men (Chivers et al., 2007; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Laan & Everaerd, 1995). This inconsistency has led researchers to examine other mechanisms that may be operative, and how these processes are influenced by individual differences. Of specific interest to the current thesis are the cognitive contributions of attention and stimulus evaluation that provide the framework in which VSS are processed and which can lead to the initiation of sexual response (Barlow, 1986; Janssen et al., 2000; Spiering & Everaerd, 2007; Spiering et al., 2004). The modified Stroop was chosen as a paradigm as it allows for the assessment of both early attentional processes (by including a random trial format: O'Ciardha & Gormley, 2013; McKenna & Sharma, 2004; Spada & Jeglic, 2015; Waters & Feyerabend, 2000) as well as late, or more controlled, attentional processes (by including a block trial format: O'Ciardha & Gormley, 2012; Waters & Feyerabend, 2000)) thus providing the opportunity to directly compare the role of the early and late attentional processes in the processing of VSS.

Chapter 2 of the thesis sought to examine unconscious attentional mechanisms that may account for variability in sexual desire in female participants (N =34) by applying a modified word Stroop paradigm that included positively valenced sexual words (e.g., orgasm), negatively valenced sexual words (e.g., hooker) and neutral non-sexual words (e.g., friend). The results demonstrate that as sexual desire increases, there is a corresponding increase in response time when viewing sexual words, regardless of valence. These results are consistent with the findings of Prause, Janssen and Hentrick (2008) who posited that women with higher levels of desire may have been more absorbed by the sexual content, which consequently interfered with their ability to perform the demands of the task. These results are also consistent with cognitive models of sexual functioning (Barlow, 1986; Janssen et al., 2000; Spiering & Everaerd, 2007), which suggest that individuals who experience automatic positive evaluations of sexual stimuli will maintain their attentional focus on sexually relevant features of the stimulus, ultimately resulting in sexual approach behaviors. Meanwhile, individuals that experience automatic negative evaluations of sexual stimuli are more likely to attend to non-erotic features (e.g., body image) that can eventually lead to avoidance behavior. Within our sample of heterosexual women, this increase in sexual desire may have been associated with an increase in positive evaluations of sexual stimuli resulting in more attentional capture by the stimulus, thereby leaving less attentional capacity for the demands of the task (i.e., colour naming). Consistent with this interpretation, individuals with low sexual desire have been shown to be more likely to experience sexual information as more unpleasant and interpret sexual stimuli more negatively than individuals with average or high sexual desire (Conaglen, 2004; Conaglen & Evans, 2006; Nobre & Pinto-Gouveia, 2009). Taken together, the findings from my study examining attention and sexual desire, as well as the research by Prause, Janssen and Hentrick (2008), provide further support for attentional capture as a mechanism implicated in sexual desire (Barlow, 1986; Janssen et al., 2000; Spiering & Everaerd, 2007).

An additional goal of Chapter 2 was to examine the relevant impact of stimulus valence on interference effects for both positive and negative sexual content. A direct comparison of the slopes of the correlations between positive-sexual interference and desire and negative-sexual interference and desire indicates that the relationship was similar regardless of valence (Zou, 2007). This finding is consistent with the motivated attention model of emotion (Bradley, Codispoti, Cuthbert, & Lang, 2001; Kousta, Vinson, & Vigliocco, 2009; Lang, Bradley and

Cuthbert, 1997; Lang & Bradley, 2010), which states that attention is captured and held by motivationally relevant stimuli, regardless of valence, over neutral stimuli. Given that the Sexual Desire Inventory - the index of sexual desire in the current study - has been shown to be strongly correlated with a measure of sexual motivation (King & Allgeier, 2000); those with higher sexual desire may experience sexual cues as more motivationally relevant, regardless of polarity.

Although some research questions can be addressed by using words, erotic images are generally understood to be more ecologically relevant stimuli for research investigating sexual response (Jacob, Arntz, Domes, Reiss, & Siep, 2011; Prause et al., 2014; Rupp & Wallen, 2009). The lack of a modern validated set of erotic images led to the development of the Concordia Sexual Image Dataset in Chapter 3, a comprehensive set of 189 erotic images. In turn, these images were used in a modified pictorial Stroop in Chapter 4, with the goal of further elucidating cognitive mechanisms implicated in sexual response.

The most commonly used set of standardized visual affective image stimuli is the International Affective Pictures System (IAPS; Lang et al., 2008). The IAPS contains images from a variety of content categories including erotic content; however, it offers only a small selection of erotic images (79 total) that were collected in the 1970s and 1980s and are considered to be outdated in terms of their content (e.g., extensive pubic hair) with poor image resolution. Consistent with this assumption, our participants on average rated the IAPS images between 2 and 3 points lower in terms of arousal than the original ratings. The general lack of adequately validated modern erotic stimuli has frequently led researchers to select images from the internet and understandably the properties of these images have rarely been controlled for (e.g., Nummenmaa, Hietanen, Santtila, & Hyönä, 2012). Other researchers have started to develop their own sets of erotic stimuli (as reviewed in detail in Chapter 3), but these sets are limited in their scope or are currently unavailable for general usage. The goal of Chapter 3 was to develop a comprehensive and current database of erotic images that includes heterosexual, lesbian, and homosexual content, with norms for valence and arousal by male and female heterosexual participants. The Concordia Sexual Image Dataset (CSID), presented in Chapter 3, provides erotic images along with their normative ratings of valence and arousal for heterosexual male and female participants. These ratings revealed that the evaluation of erotic content was strongly influenced by the gender of the evaluator. Consistent with previous research, males were more categorical in their judgments of sexual stimuli (Snowden et al., 2016), rating images

depicting heterosexual or lesbian couples engaged in sexual activity as highly pleasant and highly arousing, while conversely images depicting homosexual content were rated as unpleasant and unarousing. Similarly, images of naked and half-naked females were rated as highly pleasant and highly arousing, while images of naked and half-naked males were rated as unpleasant and unarousing. In other words, although males did display some variability in their ratings, their ratings were more categorical and bimodal—they either really liked an image and found it arousing, or really disliked it and found it unarousing. In contrast, women displayed more variability in their ratings, especially with increasing emotional valence (i.e., pleasant-unpleasant dimension). Images rated as unpleasant (e.g., lesbian content, fellatio) were typically rated low on arousal; however, images rated as pleasant (e.g., clothed heterosexual cuddling, heterosexual kissing, half naked-men), varied in ratings from low arousing (e.g., clothed heterosexual cuddling) to moderately arousing (e.g., half-naked males). These findings are consistent with previous work that found that when male and female participants are presented with positive and negative images, males' subjective ratings of images - rated as equally positive by both groups - are more highly correlated with arousal ratings (Bradley & Lang, 2007; Silva, 2011).

As outlined above, there are other normative erotic datasets available in the public domain, but the CSID is the only dataset that allows researchers to select stimuli based on a variety of attributes while controlling for low level visual features, such as luminance and colour, that have been shown to bias viewer responses (Delplanque, N'diaye, Scherer, & Grandjean, 2007; Knebel et al., 2008). In addition, this is the first dataset to include non-heterosexual content, such as lesbian and gay interactions, along with heterosexual content rated by both male and female heterosexual participants. Thus, stimuli can be chosen based on categorical attributes (e.g., type of sexual activity depicted) and/or participant mean ratings of valence and arousal. Furthermore, results from statistical analyses are also provided, included group mean differences and effects sizes. This information will allow researchers interested in examining gender differences in heterosexuals to ensure that their image selection is in line with their research parameters (e.g., content, rating, and gender of the rater).

Images from the CSID database were used in Chapter 4 to further assess the attentional mechanisms implicated in sexual response through the use of a modified pictorial Stroop paradigm, by examining the relative degree of automatic and controlled attention to preferred and non-preferred VSS in heterosexual men and women. Stimuli were either presented in a

random format, to examine automatic processes, or in a block trial format that included images from the same category presented consecutively, as an index of controlled attentional processes. Consistent with research examining gender differences in the category specificity of genital response (Chivers et al., 2007; Peterson & Janssen, 2007), heterosexual males displayed both automatic and controlled attentional biases for images consistent with their sexual preference (i.e., images of naked females). These findings would suggest that heterosexual men's attentional processes are biased towards sexually relevant targets. Also, consistent with observed gender differences in the specificity of genital arousal (Chivers et al., 2007; Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Laan & Everaerd, 1995), women displayed a category non-specific pattern of attentional engagement with response times for both automatic and controlled trials being similar across all categories. Researchers using other cognitive paradigms aimed at quantifying attentional processes have found similar results. For example, Snowden and colleagues (2016) used the dot-probe paradigm, a well-established technique to examine selective attention, and found that early attentional processes in heterosexual men were category-specific, displaying increased spatial attention to images of naked women, while women's attention was category-nonspecific toward men, displaying similar attentional allocation towards male and female stimuli. In addition, Fromberger at al. (2012) used eye tracking to examine automatic and controlled attentional processes in heterosexual men and found that men displayed an attentional bias to sexually relevant stimuli. Our findings, together with previous research, provide support for the theory that men and women may have evolved to be attuned differently to the processing of sexual cues.

The results of this thesis indicate that the modified Stroop task can be used to examine attentional processes implicated in sexual response, and that those processes can vary depending on individual differences, such as the participant's gender or level of sexual desire. The modified Word Stroop showed that interference delays for sexual content were positively correlated with self-reported sexual desire in heterosexual women, demonstrating that women with higher levels of desire experienced more attentional capture by the sexual content. Interestingly, interference delays for sexual content were not found in heterosexual women using the modified Pictorial Stroop for both automatic and controlled trials. Recent findings in the area of drug research in the treatment of Hypoactive Sexual Desire Disorder (HSDD) may shed light on these seemingly inconsistent findings (Kingsberg et al., 2015a; Poels et al., 2013a; Van Der Made et al., 2009;

van Rooij et al., 2013). As briefly outlined in Chapter 2, recent findings suggest that different causal pathways lead to sexual dysfunction in women with Hypoactive Sexual Desire Disorder (HSDD) which are partially related to individual differences in the sensitivity to sexual cues (Kingsberg et al., 2015a; Poels et al., 2013a; Van Der Made et al., 2009; van Rooij et al., 2013). In one proposed subset of women with HSDD, low desire difficulties are believed to result from a low sensitivity to sexual cues, while in the other subset, they are theorized to result from dysfunctional overactivation of sexual inhibitory mechanisms (Kingsberg, Clayton, & Pfaus, 2015). Individual differences in sexual cue sensitivity have been measured through the use of a masked modified Word Stroop task in which words were backwardly masked by a cue of randomly reassembled letters to prevent conscious processing of the stimuli (Poels et al., 2013; Van Der Made et al., 2009; van Rooij et al., 2013). Thus, longer response times in colour naming of masks preceded by sexual words as compared to neutral words is believed to be reflective of a preconscious attentional bias to sexual cues. This variation in response times has been used as an index of sexual cue sensitivity. The lack of an interference effect for sexual content in women in the Pictorial Stroop may reflect individual differences in the cue sensitivity of female participants. That is, the response pattern of women with low cue sensitivity would have washed out any effect that would have been found for the high cue sensitivity group, thus making it appear that delays for sexual content were not found in our female participants. Further investigation into the influence of low and high sexual cue sensitivity on attention-based measures could provide additional evidence of the cognitive influence on sexual interests, desires and behaviours.

Limitations

Although the modified Stroop paradigm is a measure of attentional bias that can be adapted to measure both automatic and controlled attention, inferring meaning from momentary response delays of attention is problematic. Clearly, the modified Stroop task measures attention; however, it does not tell us the reason why the person attended to the stimuli. It is possible that the stimuli may have been perceived by the participants as novel, which is a characteristic that has been shown to influence attention-based latency measures such as the modified Stroop (Krebs, Fias, Achten, & Boehler, 2013) Also, it could be that the characteristics of the stimuli, or particular images from the categories presented, had greater influence on attentional processes, thus making it seem that women's responses were category non-specific. For example,

heterosexual women may have been motivated to attend to female nudes for the purpose of social comparison (Lykins, Meana, & Strauss, 2008), or images of certain ethnicities may have had a greater influence. Currently, we are not able to rule out alternate theories as to what is driving interference delays in the modified Stroop; however, the same can be said about other relevant cognitive paradigms such as dot probe (Snowden et al., 2016a) or viewing time (Israel & Strassberg, 2009).

Another limitation of the experiments presented is that they only included heterosexual participants, which limits the generalizability of our findings across sexual orientation**.** A recent study has shown that women displaying any degree of sexual attraction to women showed significantly more genital response to films clips depicting lesbian content than women who reported exclusive attraction to men (Chivers, Bouchard, & Timmers, 2015). Future research should include men and women of diverse sexual preferences, and also compare cis and transgender individuals, in order to provide a more comprehensive examination of mechanisms implicated in sexual response.

Future Directions

To further assess the validity of the modified Stroop as a quantitative measure of attentional mechanisms implicated in sexual response, studies should incorporate and address variables that have been shown to influence latency assessments such as the age (Davidson, Zacks, & Williams, 2003), intellectual capability, and the level of education of the participants (Van der Elst, Boxtel, Breukelen, & Jolles, 2006). Other areas worth investigating are the influences of novelty and habituation. Further investigation into these factors will allow for the establishment of best practices in experimental design using the modified Stroop methodology by which to further explore the cognitive processes of individuals with or without sexual dysfunctions.

An additional set of research questions would focus on examining the influence of ethnicity, which includes the concept of race and culture, as well as the influence of societal expectations on attention based measures of sexual response. Traditionally, Western culture has provided men with more sexual freedom, with more constraints being placed on women in their display of sexual desire and interest in sexual content, a sexual double standard that maintains to date (Crawford & Popp, 2003; England & Bearak, 2014). A recent survey of sexually active undergraduate women (N=415) revealed that endorsement of traditional gender roles and sexual

scripts was a relevant predictor of women's sense of sexual self-agency (Seabrook, Ward, Cortina, Giaccardi, & Lippman, 2016). Gender has also been shown to interact with age to create particularly restrictive standards for older women with a recent study showing that older women (over the age of 65) are perceived as being less interested in sexual activity than older men (Lai & Hynie, 2011). According to Spiering and Everaerd's (2007) cognitive model of sexual response, social sexual standards contribute to learned sexual scripts that are integrated into an individual's implicit sexual memory, which is viewed as a mediator between stimulus and physiological response. Future research should examine the inhibition or enhancement of socialization on attentional responding to visual sexual stimuli.

Conclusion

The conclusion of this thesis parallels its beginning, namely the importance of examining cognitive processes implicated in the processing of visual sexual stimuli (VSS). Findings from both the Word and Pictorial modified Stroop highlighted the importance of attentional factors in the assessment of visual sexual stimuli and how these factors are influenced by participants' gender and self-reported sexual desire. Further, findings of the last chapter posited that men's and women's attentional systems may have adapted to be attuned differently to the processing of VSS. Understanding of these individual differences in cognitive processing of VSS has important practical implications in terms of future research on sexual response that aims to develop more efficacious treatments that are tailored to different underlying etiologies. It also has important theoretical implications in terms of increasing our understanding of individual differences in cognition.

Additionally, the Concordia Sexual Image Database is a major contribution to the field of sex research as it provides researchers with a tool to test their hypotheses as they relate to the sexual orientation and gender of the participants by quantifying the characteristics that are particularly appealing to heterosexual men and women. It is particularly well designed to explore questions related to factors that moderate responses to sexual stimuli in different participant groups and how these factors interact with specific stimulus features. Finally, the database can be used for various clinical purposes, such as investigating the neural correlates of sexual cue reactivity in individuals with or without sexual dysfunctions.

References

Arnow, B. A., Desmond, J. E., Banner, L. L., Glover, G. H., Solomon, A., Polan, M. L., … Atlas, S. W. (2002). Brain activation and sexual arousal in healthy, heterosexual males. *Brain*, *125*(5).

Bancroft, J., Graham, C. a., Janssen, E., & Sanders, S. a. (2009). The Dual Control Model: Current Status and Future Directions. *Journal of Sex Research*, *46*(2–3), 121–142. http://doi.org/10.1080/00224490902747222

Barlow, D. H. (1986). Causes of sexual dysfunction: The role of anxiety and cognitive interference. *Journal of Consulting and Clinical Psychology*, *54*(2), 140–148.

Becker, E. S., Rinck, M., Margraf, J., & Roth, W. T. (2001). The emotional Stroop effect in anxiety disorders: General emotionality or disorder specificity? *Journal of Anxiety Disorders*, *15*(3), 147–159. http://doi.org/10.1016/S0887-6185(01)00055-X

Berglund, H., Lindstrom, P., & Savic, I. (2006). Brain response to putative pheromones in lesbian women. *Proceedings of the National Academy of Sciences*, *103*(21), 8269–8274. http://doi.org/10.1073/pnas.0600331103

Bitzer, J., Giraldi, A., & Pfaus, J. (2013). Sexual Desire and Hypoactive Sexual Desire Disorder in Women. Introduction and Overview. Standard Operating Procedure (SOP Part 1). *The Journal of Sexual Medicine*, *10*(1), 36–49. http://doi.org/10.1111/j.1743-6109.2012.02818.x

Bloemers, J., Gerritsen, J., Bults, R., Koppeschaar, H., Everaerd, W., Olivier, B., & Tuiten, A. (2010). Induction of sexual arousal in women under conditions of institutional and ambulatory laboratory circumstances: A comparative study. *Journal of Sexual Medicine*, *7*(3), 1160–1176. http://doi.org/10.1111/j.1743-6109.2009.01660.x

Bloemers, J., van Rooij, K., Poels, S., Goldstein, I., Everaerd, W., Koppeschaar, H., … Tuiten, A. (2013). Toward Personalized Sexual Medicine (Part 1): Integrating the "Dual Control Model" into Differential Drug Treatments for Hypoactive Sexual Desire Disorder and Female Sexual Arousal Disorder. *Journal of Sexual Medicine*, *10*(3), 791–809. http://doi.org/10.1111/j.1743-6109.2012.02984.x

Bossio, J. a, Suschinsky, K. D., Puts, D. a, & Chivers, M. L. (2014). Does menstrual cycle phase influence the gender specificity of heterosexual women's genital and subjective sexual arousal? *Archives of Sexual Behavior*, *43*(5), 941–52. http://doi.org/10.1007/s10508-013-0233-7

Bourke, A. B., & Gormley, M. J. (2012). Comparing a pictorial stroop task to viewing time measures of sexual interest. *Sexual Abuse : A Journal of Research and Treatment*, *24*(5), 479–500. http://doi.org/10.1177/1079063212438922

Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion*, *1*(3), 276–298. http://doi.org/10.1037/1528-3542.1.3.276

Bradley, M. M., & Lang, P. J. (2007). The International Affective Picture System (IAPS) in the study of emotion and attention. In J. A. Coan & J. J. B. Allen (Eds.), *Handbook of emotion elicitation and assessement* (pp. 29–46). Oxford University Press.

Brotto, L. A., Gehring, D., Klein, C., Gorzalka, B. B., Thomson, S., & Knudson, G. (2005). Psychophysiological and subjective sexual arousal to visual sexual stimuli in new women. *Journal of Psychosomatic Obstetrics and Gynaecology*, *26*(4), 237–44.

Brotto, L. A., Graham, C. A., Paterson, L. Q., Yule, M. A., & Zucker, K. J. (2015). Women's Endorsement of Different Models of Sexual Functioning Supports Polythetic Criteria of Female Sexual Interest/Arousal Disorder in DSM-5. *Journal of Sexual Medicine*, *12*(9), 1978–1981. http://doi.org/10.1111/jsm.12965

Cacioppo, J. T., & Berntson, G. G. (1994). Relationship between attitudes and evaluative space: A critical review, with emphasis on the separability of positive and negative substrates. *Psychological Bulletin*, *115*(3), 401–423. http://doi.org/10.1037//0033-2909.115.3.401

Cacioppo, S., Bianchi-Demicheli, F., Frum, C., Pfaus, J. G., Lewis, J. W., Hatfield, E., … Bianchi-Demicheli, F. (2012). The common neural bases between sexual desire and love: a multilevel kernel density fMRI analysis. *The Journal of Sexual Medicine*, *9*(4), 1048–54. http://doi.org/10.1111/j.1743-6109.2012.02651.x

Cane, J. E., Sharma, D., & Albery, I. (2008). The addiction Stroop task: examining the fast and slow effects of smoking and marijuana-related cues. *Journal of Psychopharmacology*, *23*(5), 510–9. http://doi.org/10.1177/0269881108091253

Chivers, M. L., & Bailey, J. M. (2005). A sex difference in features that elicit genital response. *Biological Psychology*, *70*(2), 115–20. http://doi.org/10.1016/j.biopsycho.2004.12.002

Chivers, M. L., Bouchard, K. N., & Timmers, A. D. (2015). Straight but not narrow; within-gender variation in the gender-specificity of women's sexual response. *PLoS ONE*, *10*(12), 1–21. http://doi.org/10.1371/journal.pone.0142575

Chivers, M. L., Seto, M. C., & Blanchard, R. (2007). Gender and sexual orientation differences in sexual response to sexual activities versus gender of actors in sexual films. *Journal of Personality and Social Psychology*, *93*(6), 1108–21. http://doi.org/10.1037/0022-3514.93.6.1108

Chivers, M. L., Seto, M. C., Lalumière, M. L., Laan, E., & Grimbos, T. (2010). Agreement of self-reported and genital measures of sexual arousal in men and women: a meta-analysis. *Archives of Sexual Behavior*, *39*(1), 5–56. http://doi.org/10.1007/s10508-009-9556-9

Chivers, M. L., & Timmers, A. D. (2012). Effects of gender and relationship context in audio narratives on genital and subjective sexual response in heterosexual women and men. *Archives of Sexual Behavior*, *41*(1), 185–97. http://doi.org/10.1007/s10508-012-9937-3

Ciardha, C. O., & Gormley, M. (2012a). Using a Pictorial-Modified Stroop Task to Explore the Sexual Interests of Sexual Offenders Against Children. *Sexual Abuse: A Journal of Research and Treatment*, *24*(2), 175–197. http://doi.org/10.1177/1079063211407079

Ciardha, C. O., & Gormley, M. (2012b). Using a Pictorial-Modified Stroop Task to Explore the Sexual Interests of Sexual Offenders Against Children. *Sexual Abuse: A Journal of Research and Treatment*, *24*(2), 175–197. http://doi.org/10.1177/1079063211407079

Ciardha, C. O., & Gormley, M. (2013). Measuring sexual interest using a pictorial modified Stroop task, a pictorial Implicit Association Test and a Choice Reaction Time task. *Journal of Sexual Aggression*, *19*(2), 158–170. http://doi.org/10.1080/13552600.2012.677486

Ciardha, C. Ó., & Gormley, M. (2012). Using a pictorial-modified stroop task to explore the sexual interests of sexual offenders against children. *Sexual Abuse : A Journal of Research and Treatment*, *24*(2), 175–97. http://doi.org/10.1177/1079063211407079

Conaglen, H. M. (2004). Sexual content induced delay: A reexamination investigating relation to sexual desire. *Archives of Sexual Behavior*, *33*(4), 359–367. http://doi.org/10.1023/B:ASEB.0000028889.63425.fb

Connaughton, C., McCabe, M., & Karantzas, G. (2016). Conceptualization of the Sexual Response Models in Men: Are There Differences Between Sexually Functional and Dysfunctional Men? *The Journal of Sexual Medicine*, *13*(3), 453–463. http://doi.org/10.1016/j.jsxm.2015.12.032

Coric, V., Feuerstein, S., Fortunati, F., Southwick, S., Temporini, H., & Morgan, C. A. (2005). Assessing sex offenders. *Psychiatry (Edgmont (Pa. : Township))*, *2*(11), 26–9.

Costa, M., Braun, C., & Birbaumer, N. (2003). Gender differences in response to pictures of nudes: A magnetoencephalographic study. *Biological Psychology*, *63*(2), 129–147. http://doi.org/10.1016/S0301-0511(03)00054-1

Cranston-Cuebas, M., & Barlow, D. H. (1990). Cognitive and Affective Contributions to Sexual Functioning. *Annual Review of Sex Research*, *1*(1), 119–161.

Crawford, M., & Popp, D. (2003). Sexual Double Standards: A Review and Methodological Critique of Two Decades of Research. *The Journal of Sex Research*, *40*(1), 13–26. http://doi.org/10.1080/00224490309552163

Davidson, D. J., Zacks, R. T., & Williams, C. C. (2003). Stroop interference, practice, and aging. *Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition*, *10*(2), 85–98. http://doi.org/10.1076/anec.10.2.85.14463

Dawson, S. J., & Chivers, M. L. (2016). Gender-specificity of initial and controlled visual attention to sexual stimuli in androphilic women and gynephilic men. *PLoS ONE*, *11*(4), 1–22. http://doi.org/10.1371/journal.pone.0152785

Delplanque, S., N'diaye, K., Scherer, K., & Grandjean, D. (2007). Spatial frequencies or emotional effects?: A systematic measure of spatial frequencies for IAPS pictures by a discrete wavelet analysis. *Journal of Neuroscience Methods*, *165*(1), 144–150. http://doi.org/10.1016/j.jneumeth.2007.05.030

Dewitte, M. (2016). Gender Differences in Implicit Processing of Sexual Stimuli. *European Journal of Personality*, *30*(2), 107–124. http://doi.org/10.1002/per.2031

Dombert, B., Mokros, A., Brückner, E., Schlegl, V., Antfolk, J., Bäckström, A., … Santtila, P. (2013). The virtual people set: developing computer-generated stimuli for the assessment of pedophilic sexual interest. *Sexual Abuse : A Journal of Research and Treatment*, *25*(6), 557–82. http://doi.org/10.1177/1079063212469062

England, P., & Bearak, J. (2014). The sexual double standard and gender differences in attitudes toward casual sex among U.S. university students. *Demographic Research*, *30*(1), 1327–1338. http://doi.org/10.4054/DemRes.2014.30.46

Ferenidou, F., Kirana, P.-S., Fokas, K., Hatzichristou, D., & Athanasiadis, L. (2016). Sexual Response Models: Toward a More Flexible Pattern of Women's Sexuality. *The Journal of Sexual Medicine*, *13*(9), 1369–1376. http://doi.org/10.1016/j.jsxm.2016.07.008

Ferretti, A., Caulo, M., Del Gratta, C., Di Matteo, R., Merla, A., Montorsi, F., … Romani, G. L. (2005). Dynamics of male sexual arousal: distinct components of brain activation revealed by fMRI. *NeuroImage*, *26*(4), 1086–1096. http://doi.org/10.1016/j.neuroimage.2005.03.025

Fortenberry, J. D., Cech, H., Zimet, G. D., & Orr, D. P. (1997). Concordance between self-report questionnaires and coital diaries for sexual behaviors of adolescent women with sexually transmitted infections. In J. Bancroft (Ed.), *Researching sexual behavior: Methodological issues* (pp. 237–257). Indiana University Press.

Freund, K. (1963). A laboratory method for diagnosing predominance of homo- or hetero- erotic interest in the male. *Behaviour Research and Therapy*, *1*(1), 85–93. http://doi.org/10.1016/0005-7967(63)90012-3

Freund, K., Seto, M. C., & Kuban, M. (1996). Two types of fetishism. *Behaviour Research and Therapy*, *34*(9), 687–694. http://doi.org/10.1016/0005-7967(96)00047-2

Fritz, N. (2015). *From Cum Shots to Cunnilingus, the Agentic and Objectifying Scripts of Feminist and Mainstream Pornography*. Indiana University, Bloomington.

Fromberger, P., Jordan, K., von Herder, J., Steinkrauss, H., Nemetschek, R., Stolpmann, G., & Müller, J. L. (2011). Initial Orienting Towards Sexually Relevant Stimuli: Preliminary Evidence from Eye Movement Measures. *Archives of Sexual Behavior*. http://doi.org/10.1007/s10508-011-9816-3

Gao, Z., Yang, D., Yu, L., & Cui, Y. (2015). Efficacy and Safety of Flibanserin in Women with Hypoactive Sexual Desire Disorder : A Systematic Review and Meta-Analysis. *Journal of Sexual Medicine*, 2095–2104. http://doi.org/10.1111/jsm.13037

Geer, J., & Bellard, H. (1996). Sexual content induced delays in unprimed lexical decisions: Gender and context effects. *Archives of Sexual Behavior*, *25*(4), 379–395. http://doi.org/10.1007/BF02437581

Geer, J. H., & Fuhr, R. (1976). Cognitive factors in sexual arousal: the role of distraction. *Journal of Consulting and Clinical Psychology*, *44*(2), 238–43. http://doi.org/10.1037/0022-006X.44.2.238

Geer, J., & Melton, J. (1997). Sexual content-induced delay with double-entendre words. *Archives of Sexual Behavior*, *26*(3), 295–316.

Georgiadis, J. R., Farrell, M. J., Boessen, R., Denton, D. A., Gavrilescu, M., Kortekaas, R., … Egan, G. F. (2010). Dynamic subcortical blood flow during male sexual activity with ecological validity: A perfusion fMRI study. *NeuroImage*, *50*(1), 208–216. http://doi.org/10.1016/j.neuroimage.2009.12.034

Georgiadis, J. R., Kringelbach, M. L., & Pfaus, J. G. (2012). Sex for fun: a synthesis of human and animal neurobiology. *Nature Reviews Urology*, *9*(9), 486–498. http://doi.org/10.1038/nrurol.2012.151

Giraldi, A., Kristensen, E., & Sand, M. (2015). Endorsement of Models Describing Sexual Response of Men and Women with a Sexual Partner: An Online Survey in a Population Sample of Danish Adults Ages 20–65 Years. *The Journal of Sexual Medicine*, *12*(1), 116–128. http://doi.org/10.1111/jsm.12720

Goldstein, I., Kim, N. N., Clayton, A. H., DeRogatis, L. R., Giraldi, A., Parish, S. J., … Worsley, R. (2017). Hypoactive Sexual Desire Disorder: International Society for the Study of Women's Sexual Health (ISSWSH) Expert Consensus Panel Review. *Mayo Clinic Proceedings*, *92*(1), 114–128. http://doi.org/10.1016/j.mayocp.2016.09.018

Grühn, D., & Scheibe, S. (2008). Age-related differences in valence and arousal ratings of pictures from the International Affective Picture System (IAPS): Do ratings become more extreme with age? *Behavior Research Methods*, *40*(2), 512–521. http://doi.org/10.3758/BRM.40.2.512

Hamann, S., Herman, R. A., Nolan, C. L., & Wallen, K. (2004). Men and women differ in amygdala response to visual sexual stimuli. *Nature Neuroscience*, *7*(4), 411–416. http://doi.org/10.1038/nn1208

Heiman, J. R. (1980). Female sexual response patterns. Interactions of physiological, affective, and contextual cues. *Archives of General Psychiatry*, *37*(11), 1311–1316.

Hester, R., Dixon, V., & Garavan, H. (2006). A consistent attentional bias for drug-related material in active cocaine users across word and picture versions of the emotional Stroop task. *Drug and Alcohol Dependence*, *81*(3), 251–7. http://doi.org/10.1016/j.drugalcdep.2005.07.002

Hinojosa, J. A., Carretié, L., Valcárcel, M. A., Méndez-Bértolo, C., & Pozo, M. A. (2009). Electrophysiological differences in the processing of affective information in words and pictures. *Cognitive, Affective & Behavioral Neuroscience*, *9*(2), 173–89. http://doi.org/10.3758/CABN.9.2.173

Holle, C., Neely, J. H., Heimberg2, R. G., & Heimberg, R. G. (1997). The Effects of Blocked Versus Random Presentation and Semantic Relatedness of Stimulus Words on Response to a Modified Stroop Task Among Social Phobics1. *Cognitive Therapy and Research*, *21*(6), 681–697.

Huberman, J. S., & Chivers, M. L. (2015a). Examining gender specificity of sexual response with concurrent thermography and plethysmography. *Psychophysiology*, *52*(10), 1382–1395. http://doi.org/10.1111/psyp.12466

Huberman, J. S., & Chivers, M. L. (2015b). Examining gender specificity of sexual response with concurrent thermography and plethysmography. *Psychophysiology*, *52*(10), 1382–95. http://doi.org/10.1111/psyp.12466

Israel, E., & Strassberg, D. S. (2009). Viewing time as an objective measure of sexual interest in heterosexual men and women. *Archives of Sexual Behavior*, *38*(4), 551–8. http://doi.org/10.1007/s10508-007-9246-4

Jacob, G. A., Arntz, A., Domes, G., Reiss, N., & Siep, N. (2011a). Positive erotic picture stimuli for emotion research in heterosexual females. *Psychiatry Research*, *190*(2–3), 348–351. http://doi.org/10.1016/j.psychres.2011.05.044

Jacob, G. A., Arntz, A., Domes, G., Reiss, N., & Siep, N. (2011b). Positive erotic picture stimuli for emotion research in heterosexual females. *Psychiatry Research*, *190*(2–3), 348–51. http://doi.org/10.1016/j.psychres.2011.05.044

Janssen, E. (2002). Psychophysiological measurement of sexual arousal. In B. E. Wierderman, M.W. & Whitley (Ed.), *Handbook for Conducting Research on Human Sexuality* (pp. 139–171). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Janssen, E., & Bancroft, J. (2007). The Dual Control Model : the Role of Sexual Inhibition & Excitation in Sexual Arousal and Behavior. *The Psychophysiology of Sex*, *15*, 197–222.

Janssen, E., Everaerd, W., Spiering, M., & Janssen, J. (2000). Automatic processes and the appraisal of sexual stimuli: Toward an information processing model of sexual arousal. *Journal of Sex Research*, *37*(1), 8–23.

Jordan, K., Fromberger, P., Laubinger, H., Dechent, P., & Müller, J. L. (2014). Changed processing of visual sexual stimuli under GnRH-therapy--a single case study in pedophilia using eye tracking and fMRI. *BMC Psychiatry*, *14*, 142. http://doi.org/10.1186/1471-244X-14-142

Kagerer, S., Wehrum, S., Klucken, T., Walter, B., Vaitl, D., & Stark, R. (2014). Sex attracts: Investigating individual differences in attentional bias to sexual stimuli. *PLoS ONE*, *9*(9). http://doi.org/10.1371/journal.pone.0107795

Karama, S., Lecours, A. R., Leroux, J.-M., Bourgouin, P., Beaudoin, G., Joubert, S., & Beauregard, M. (2002). Areas of brain activation in males and females during viewing of erotic film excerpts. *Human Brain Mapping*, *16*(1), 1–13. http://doi.org/10.1002/hbm.10014

Kensinger, E. A., & Schacter, D. L. (2006). Amygdala Activity Is Associated with the Successful Encoding of Item, But Not Source, Information for Positive and Negative Stimuli. *Journal of Neuroscience*, *26*(9), 2564–2570. http://doi.org/10.1523/JNEUROSCI.5241-05.2006

Kim, S. W., Schenck, C. H., Grant, J. E., Yoon, G., Dosa, P. I., Odlaug, B. L., … Pfaus, J. G. (2013). Neurobiology of Sexual Desire. *NeuroQuantology*, *11*(2). http://doi.org/10.14704/nq.2013.11.2.662

King, B. E., & Allgeier, E. R. (2000). The Sexual Desire Inventory as a measure of sexual motivation in college students. *Psychological Reports*, *86*(1), 347–50. http://doi.org/10.2466/pr0.2000.86.1.347

Kingsberg, S. A., Clayton, A. H., & Pfaus, J. G. (2015a). The Female Sexual Response: Current Models, Neurobiological Underpinnings and Agents Currently Approved or Under Investigation for the Treatment of Hypoactive Sexual Desire Disorder. *CNS Drugs*, *29*(11), 915–933. http://doi.org/10.1007/s40263-015-0288-1

Kingsberg, S. A., Clayton, A. H., & Pfaus, J. G. (2015b). The Female Sexual Response: Current Models, Neurobiological Underpinnings and Agents Currently Approved or Under Investigation for the Treatment of Hypoactive Sexual Desire Disorder. *CNS Drugs*, *29*(11), 915–933. http://doi.org/10.1007/s40263-015-0288-1

Klaassen, M. J. E., & Peter, J. (2015). Gender (In)equality in Internet Pornography: A Content Analysis of Popular Pornographic Internet Videos. *The Journal of Sex Research*, *52*(7), 721–735. http://doi.org/10.1080/00224499.2014.976781

Knebel, J.-F., Toepel, U., Hudry, J., Le, J., Ae, C., & Murray, M. M. (2008). Generating

Controlled Image Sets in Cognitive Neuroscience Research. *Brain Topography*, *20*. http://doi.org/10.1007/s10548-008-0046-5

Korff, J., & Geer, J. H. (1983). The Relationship Between Sexual Arousal Experience and Genital Response. *Psychophysiology*, *20*(2), 121–127. http://doi.org/10.1111/j.1469-8986.1983.tb03276.x

Koukounas, E., & Over, R. (2001). Habituation of male sexual arousal: effects of attentional focus. *Biological Psychology*, *58*(1), 49–64. http://doi.org/10.1016/S0301-0511(01)00096-5

Kousta, S. T., Vinson, D. P., & Vigliocco, G. (2009). Emotion words, regardless of polarity, have a processing advantage over neutral words. *Cognition*, *112*(3), 473–481. http://doi.org/10.1016/j.cognition.2009.06.007

Kranz, F., & Ishai, A. (2006). *Face Perception Is Modulated by Sexual Preference*. *Current Biology* (Vol. 16).

Krebs, R. M., Fias, W., Achten, E., & Boehler, C. N. (2013). Picture novelty attenuates semantic interference and modulates concomitant neural activity in the anterior cingulate cortex and the locus coeruleus. *NeuroImage*, *74*, 179–187. http://doi.org/10.1016/j.neuroimage.2013.02.027

Kukkonen, T. M. (2015). Devices and methods to measure female sexual arousal. *Sexual Medicine Reviews*, *3*(4), 225–244. http://doi.org/10.1002/smrj.58

Kukkonen, T. M., Binik, Y. M., Amsel, R., & Carrier, S. (2007). Thermography as a Physiological Measure of Sexual Arousal in Both Men and Women. *The Journal of Sexual Medicine*, *4*(1), 93–105. http://doi.org/10.1111/j.1743-6109.2006.00399.x

Kukkonen, T. M., Binik, Y. M., Amsel, R., & Carrier, S. (2010). An Evaluation of the Validity of Thermography as a Physiological Measure of Sexual Arousal in a Non-University Adult Sample. *Archives of Sexual Behavior*, *39*(4), 861–873. http://doi.org/10.1007/s10508-009-9496-4

Laan, E., & Everaerd, W. (1995). Habituation of female sexual arousal to slides and film. *Archives of Sexual Behavior*, *24*(5), 517–541. http://doi.org/10.1007/BF01541832

Laan, E., Everaerd, W., & Evers, A. (1995). Assessment of female sexual arousal: response specificity and construct validity. *Psychophysiology*, *32*(5), 476–85.

Lai, Y., & Hynie, M. (2011). A Tale of Two Standards: An Examination of Young Adults' Endorsement of Gendered and Ageist Sexual Double Standards. *Sex Roles*, *64*(5–6), 360–

371. http://doi.org/10.1007/s11199-010-9896-x

Lalumiere, M. L., Quinsey, V. L., Harris, G. T., Rice, M. E., & Trautimas, C. (2006). Are Rapists Differentially Aroused by Coercive Sex in Phallometric Assessments? *Annals of the New York Academy of Sciences*, *989*(1), 211–224. http://doi.org/10.1111/j.1749-6632.2003.tb07307.x

Lang, P.J., Bradley, M.M., & Cuthbert, B. N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8. University of Florida, Gainesville, FL.

Lang, P. J. (1980). Behavioral treatment and bio-behavioral assessment: Computer applications. In J. B. Sidowksi, J. H. Johnson, & T. A. Williams (Eds.), *Technology in mental health care delivery systems* (pp. 119–137). Norwood, NJ: Ablex.

Lang, P. J., & Bradley, M. M. (2010). Emotion and the motivational brain. *Biological Psychology*, *84*(3), 437–450. http://doi.org/10.1016/j.biopsycho.2009.10.007

Larsen, J. T., & McGraw, A. P. (2011). Further evidence for mixed emotions. *Journal of Personality and Social Psychology*, *100*(6), 1095–1110. http://doi.org/10.1037/a0021846

Lasaitis, C., Ribeiro, R. L., & Bueno, O. F. A. (2008). Brazilian norms for the International Affective Picture System (IAPS): comparison of the affective ratings for new stimuli between Brazilian and North-American subjects. *Jornal Brasileiro de Psiquiatria*, *57*(4), 270–275. http://doi.org/10.1590/S0047-20852008000400008

Laumann, E. O., Nicolosi, A., Glasser, D. B., Paik, A., Gingell, C., Moreira, E., … GSSAB Investigators' Group. (2005). Sexual problems among women and men aged 40?80?y: prevalence and correlates identified in the Global Study of Sexual Attitudes and Behaviors. *International Journal of Impotence Research*, *17*(1), 39–57. http://doi.org/10.1038/sj.ijir.3901250

Laumann, E. O., Paik, A., & Rosen, R. C. (1999). Sexual dysfunction in the United States: prevalence and predictors. *JAMA*, *281*(6), 537–44.

Laws, D. R., & Gress, C. L. Z. (2004). Seeing things differently: The viewing time alternative to penile plethysmography. *Legal and Criminological Psychology*, *9*(2), 183–196. http://doi.org/10.1348/1355325041719338

Libkuman, T. M., Otani, H., Kern, R., Viger, S. G., & Novak, N. (2007). Multidimensional normative ratings for the International Affective Picture System. *Behavior Research*

Methods, *39*(2), 326–34.

Liu, G., Xin, Z., & Lin, C. (2014). Lax decision criteria lead to negativity bias: evidence from the emotional stroop task. *Psychological Reports*, *114*(3), 896–912. http://doi.org/10.2466/28.04.PR0.114k29w0

Logothetis, N. K., Pauls, J., Augath, M., Trinath, T., & Oeltermann, A. (2001). Neurophysiological investigation of the basis of the fMRI signal. *Nature*, *412*(6843), 150–157. http://doi.org/10.1038/35084005

Lykins, A. D., Meana, M., & Strauss, G. P. (2008). Sex differences in visual attention to erotic and non-erotic stimuli. *Archives of Sexual Behavior*, *37*(2), 219–28. http://doi.org/10.1007/s10508-007-9208-x

Mama, Y., Ben-Haim, M. S., & Algom, D. (2013). When emotion does and does not impair performance: a Garner theory of the emotional Stroop effect. *Cognition & Emotion*, *27*(4), 589–602. http://doi.org/10.1080/02699931.2012.726212

Maravilla, K. R., & Yang, C. C. (2007). Sex and the brain: the role of fMRI for assessment of sexual function and response. *International Journal of Impotence Research*, *19*(1), 25–9. http://doi.org/10.1038/sj.ijir.3901493

Marchewka, A., Zurawski, Ł., Jednoróg, K., & Grabowska, A. (2014). The Nencki Affective Picture System (NAPS): introduction to a novel, standardized, wide-range, high-quality, realistic picture database. *Behavior Research Methods*, *46*(2), 596–610. http://doi.org/10.3758/s13428-013-0379-1

Masters, W. H. and Johnson, V. E. (1970). *Human Sexual Inadequacy*. Toronto: Bantam Books.

Masters, W., & Johnson, V. (1966). Human sexual response.

Mauss, I. B., & Robinson, M. D. (2009). Measures of emotion: A review. *Cognition & Emotion*, *23*(2), 209–237. http://doi.org/10.1080/02699930802204677

Mavissakalian, M., Blanchard, E. B., Abel, G. C., & Barlow, D. H. (1975). Responses to complex erotic stimuli in homosexual and heterosexual males. *British Journal of Psychiatry*, *126*(3), 252–257.

McCallum, E. B., & Peterson, Z. D. (2012). Investigating the Impact of Inquiry Mode on Self-Reported Sexual Behavior: Theoretical Considerations and Review of the Literature. *Journal of Sex Research*, *49*(2–3), 212–226. http://doi.org/10.1080/00224499.2012.658923

McKenna, F. P., & Sharma, D. (2004). Reversing the emotional Stroop effect reveals that it is

not what it seems: the role of fast and slow components. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *30*(2), 382–92. http://doi.org/10.1037/0278-7393.30.2.382

Mercer, C. H., Fenton, K. A., Johnson, A. M., Wellings, K., Macdowall, W., McManus, S., … Erens, B. (2003). Sexual function problems and help seeking behaviour in Britain: national probability sample survey. *BMJ*, *327*(7412), 426–427. http://doi.org/10.1136/bmj.327.7412.426

Meston, C. M., Heiman, J. R., Trapnell, P. D., & Paulhus, D. L. (1998). Socially desirable responding and sexuality self-reports. *Journal of Sex Research*, *35*(2), 148–157. http://doi.org/10.1080/00224499809551928

Meston, C. M., Rellini, A. H., McCall, K., Kukkonen, T. M., Binik, Y. M., Amsel, R., … Janssen, E. (2010). The sensitivity of continuous laboratory measures of physiological and subjective sexual arousal for diagnosing women with sexual arousal disorder. *The Journal of Sexual Medicine*, *7*(2 Pt 2), 938–50. http://doi.org/10.1111/j.1743-6109.2009.01548.x

Mineka, S., & Sutton, S. K. (1992). COGNITIVE BIASES AND THE EMOTIONAL DISORDERS. *Psychological Science*, *3*(1), 65–69. http://doi.org/10.1111/j.1467-9280.1992.tb00260.x

Mokros, A., Dombert, B., Osterheider, M., Zappalà, A., & Santtila, P. (2010). Assessment of pedophilic sexual interest with an attentional choice reaction time task. *Archives of Sexual Behavior*, *39*(5), 1081–90. http://doi.org/10.1007/s10508-009-9530-6

Mokros, A., Gebhard, M., Heinz, V., Marschall, R. W., Nitschke, J., Glasgow, D. V, … Laws, D. R. (2013). Computerized assessment of pedophilic sexual interest through self-report and viewing time: reliability, validity, and classification accuracy of the affinity program. *Sexual Abuse : A Journal of Research and Treatment*, *25*(3), 230–58. http://doi.org/10.1177/1079063212454550

Murnen, S. K., & Stockton, M. (1997). Gender and Self-Reported Sexual Arousal in Response to Sexual Stimuli: A Meta-Analytic Review. *Sex Roles*, *37*(3/4), 135–153. http://doi.org/10.1023/A:1025639609402

Nowosielski, K., Wróbel, B., & Kowalczyk, R. (2016). Women's Endorsement of Models of Sexual Response: Correlates and Predictors. *Archives of Sexual Behavior*, *45*(2), 291–302. http://doi.org/10.1007/s10508-015-0611-4

Nummenmaa, L., Hietanen, J. K., Santtila, P., & Hyönä, J. (2012). Gender and visibility of sexual cues influence eye movements while viewing faces and bodies. *Archives of Sexual Behavior*, *41*(6), 1439–1451. http://doi.org/10.1007/s10508-012-9911-0

Ó Ciardha, C. (2010). The Use of Implicit Cognitive Measures in the Assessment of Sexual Offenders. *Doctoral Dissertation, Trinity College Dublin*.

Ó Ciardha, C., & Gormley, M. (2013). Measuring sexual interest using a pictorial modified Stroop task, a pictorial Implicit Association Test and a Choice Reaction Time task. *Journal of Sexual Aggression*, *19*(2), 158–170. http://doi.org/10.1080/13552600.2012.677486

Payne, K. A., & Binik, Y. M. (2006). Reviving the Labial Thermistor Clip. *Archives of Sexual Behavior*, *35*(2), 111–113. http://doi.org/10.1007/s10508-005-9017-z

Peterson, Z. D., & Janssen, E. (2007). Ambivalent affect and sexual response: the impact of co-occurring positive and negative emotions on subjective and physiological sexual responses to erotic stimuli. *Archives of Sexual Behavior*, *36*(6), 793–807. http://doi.org/10.1007/s10508-006-9145-0

Pfaus, J. G. (2009). Pathways of sexual desire. *The Journal of Sexual Medicine*, *6*(6), 1506–33. http://doi.org/10.1111/j.1743-6109.2009.01309.x

Pfaus, J. G., Kippin, T. E., & Coria-Avila, G. (2003). What can animal models tell us about human sexual response? *Annual Review of Sex Research*, *14*, 1–63.

Poels, S., Bloemers, J., van Rooij, K., Goldstein, I., Gerritsen, J., van Ham, D., … Tuiten, A. (2013a). Toward Personalized Sexual Medicine (Part 2): Testosterone Combined with a PDE5 Inhibitor Increases Sexual Satisfaction in Women with HSDD and FSAD, and a Low Sensitive System for Sexual Cues. *The Journal of Sexual Medicine*, *10*(3), 810–823. http://doi.org/10.1111/j.1743-6109.2012.02983.x

Poels, S., Bloemers, J., van Rooij, K., Goldstein, I., Gerritsen, J., van Ham, D., … Tuiten, A. (2013b). Toward Personalized Sexual Medicine (Part 2): Testosterone Combined with a PDE5 Inhibitor Increases Sexual Satisfaction in Women with HSDD and FSAD, and a Low Sensitive System for Sexual Cues. *The Journal of Sexual Medicine*, *10*(3), 810–823. http://doi.org/10.1111/j.1743-6109.2012.02983.x

Poels, S., Bloemers, J., van Rooij, K., Koppeschaar, H., Olivier, B., & Tuiten, A. (2014). Two novel combined drug treatments for women with hypoactive sexual desire disorder. *Pharmacology Biochemistry and Behavior*, *121*, 71–79.

http://doi.org/10.1016/j.pbb.2014.02.002

Poeppl, T. B., Nitschke, J., Dombert, B., Santtila, P., Greenlee, M. W., Osterheider, M., & Mokros, A. (2011). Functional cortical and subcortical abnormalities in pedophilia: a combined study using a choice reaction time task and fMRI. *The Journal of Sexual Medicine*, *8*(6), 1660–74. http://doi.org/10.1111/j.1743-6109.2011.02248.x

Ponseti, J., & Bosinski, H. A. G. (2010). Subliminal sexual stimuli facilitate genital response in women. *Archives of Sexual Behavior*, *39*(5), 1073–9. http://doi.org/10.1007/s10508-009-9587-2

Prause, N., Janssen, E., & Hetrick, W. P. (2008). Attention and emotional responses to sexual stimuli and their relationship to sexual desire. *Archives of Sexual Behavior*, *37*(6), 934–49. http://doi.org/10.1007/s10508-007-9236-6

Prause, N., Moholy, M., & Staley, C. (2014). Biases for Affective Versus Sexual Content in Multidimensional Scaling Analysis : An Individual Difference Perspective, 463–472. http://doi.org/10.1007/s10508-013-0128-7

Prause, N., Steele, V. R., Staley, C., Sabatinelli, D., & Proudfit, G. H. (2015). Modulation of late positive potentials by sexual images in problem users and controls inconsistent with "porn addiction." *Biological Psychology*, *109*, 192–199. http://doi.org/10.1016/j.biopsycho.2015.06.005

Price, S. A., Beech, A. R., Mitchell, I., & Humphreys, G. W. (2013). Measuring Deviant Sexual Interest Using the Emotional Stroop Task. *Criminal Justice and Behavior*, *40*(9), 970–987. http://doi.org/10.1177/0093854813476264

Price, S. a., Beech, a. R., Mitchell, I., & Humphreys, G. W. (2013a). Measuring Deviant Sexual Interest Using the Emotional Stroop Task. *Criminal Justice and Behavior*, *40*(9), 970–987. http://doi.org/10.1177/0093854813476264

Price, S. a., Beech, a. R., Mitchell, I., & Humphreys, G. W. (2013b). Measuring Deviant Sexual Interest Using the Emotional Stroop Task. *Criminal Justice and Behavior*, *40*(9), 970–987. http://doi.org/10.1177/0093854813476264

Pulverman, C. S., Hixon, J. G., & Meston, C. M. (2015). Uncovering category specificity of genital sexual arousal in women: The critical role of analytic technique. *Psychophysiology*, *52*(10). http://doi.org/10.1111/psyp.12467

Redouté, J., Stoléru, S., Grégoire, M. C., Costes, N., Cinotti, L., Lavenne, F., … Pujol, J. F.

(2000). Brain processing of visual sexual stimuli in human males. *Human Brain Mapping*, *11*(3), 162–177. http://doi.org/10.1002/1097-0193(200011)11:3<162::AID-HBM30>3.0.CO;2-A

Rieger, G., Cash, B. M., Merrill, S. M., Jones-Rounds, J., Dharmavaram, S. M., & Savin-Williams, R. C. (2015). Sexual arousal: The correspondence of eyes and genitals. *Biological Psychology*, *104*(2015), 56–64. http://doi.org/10.1016/j.biopsycho.2014.11.009

Rieger, G., & Savin-Williams, R. C. (2012). The eyes have it: sex and sexual orientation differences in pupil dilation patterns. *PloS One*, *7*(8), e40256. http://doi.org/10.1371/journal.pone.0040256

Rowland, D., Van Diest, S., Incrocci, L., & Slob, A. K. (2005). Psychosexual Factors That Differentiate Men with Inhibited Ejaculation from Men with No Dysfunction or Another Sexual Dysfunction. *The Journal of Sexual Medicine*, *2*(3), 383–389. http://doi.org/10.1111/j.1743-6109.2005.20352.x

Rupp, H. A., James, T. W., Ketterson, E. D., Sengelaub, D. R., Ditzen, B., & Heiman, J. R. (2013). Lower sexual interest in postpartum women: relationship to amygdala activation and intranasal oxytocin. *Hormones and Behavior*, *63*(1), 114–21. http://doi.org/10.1016/j.yhbeh.2012.10.007

Rupp, H. A., & Wallen, Æ. K. (2009a). Sex-Specific Content Preferences for Visual Sexual Stimuli, 417–426. http://doi.org/10.1007/s10508-008-9402-5

Rupp, H. A., & Wallen, K. (2007). Sex differences in viewing sexual stimuli: an eye-tracking study in men and women. *Hormones and Behavior*, *51*(4), 524–33. http://doi.org/10.1016/j.yhbeh.2007.01.008

Rupp, H. A., & Wallen, K. (2009b). Sex-Specific content preferences for visual sexual stimuli. *Archives of Sexual Behavior*, *38*(3), 417–426. http://doi.org/10.1007/s10508-008-9402-5

Rupp, H. a, & Wallen, K. (2009). Sex-specific content preferences for visual sexual stimuli. *Archives of Sexual Behavior*, *38*(3), 417–26. http://doi.org/10.1007/s10508-008-9402-5

Sabatinelli, D., Flaisch, T., Bradley, M. M., Fitzsimmons, J. R., & Lang, P. J. (2004). Affective picture perception: gender differences in visual cortex? *Neuroreport*, *15*(7), 1109–12.

Safron, A., Barch, B., Bailey, J. M., Gitelman, D. R., Parrish, T. B., & Reber, P. J. (2007). Neural correlates of sexual arousal in homosexual and heterosexual men. *Behavioral Neuroscience*, *121*(2), 237–248. http://doi.org/10.1037/0735-7044.121.2.237

Sakheim, D. K., Barlow, D. H., Beck, J. G., & Abrahamson, D. J. (1985). A comparison of male heterosexual and male homosexual patterns of sexual arousal. *Journal of Sex Research*.

Samson, L., & Janssen, E. (2014). Sexual and affective responses to same- and opposite-sex stimuli in heterosexual and homosexual men: assessment and manipulation of visual attention. *Archives of Sexual Behavior*, *43*(5), 917–30. http://doi.org/10.1007/s10508-013-0221-y

Sand, M., & Fisher, W. A. (2011). Women's Endorsement of Models of Female Sexual Response: The Nurses' Sexuality Study. *The Journal of Sexual Medicine*, *4*(3), 708–719. http://doi.org/10.1111/j.1743-6109.2007.00496.x

Savic, I., Berglund, H., & Lindström, P. (2005). Brain response to putative pheromones in homosexual men. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(20), 7356–61. http://doi.org/10.1073/pnas.0407998102

Schimmack, U. (2005). Attentional Interference Effects of Emotional Pictures: Threat, Negativity, or Arousal? *Emotion*, *5*(1), 55–66. http://doi.org/10.1037/1528-3542.5.1.55

Schimmack, U., & Derryberry, D. (2005). Attentional interference effects of emotional pictures: threat, negativity, or arousal? *Emotion (Washington, D.C.)*, *5*(1), 55–66. http://doi.org/10.1037/1528-3542.5.1.55

Seabrook, R. C., Ward, L. M., Cortina, L. M., Giaccardi, S., & Lippman, J. R. (2016). Girl Power or Powerless Girl? Television, Sexual Scripts, and Sexual Agency in Sexually Active Young Women. *Psychology of Women Quarterly*, *41*(2), 240–253. http://doi.org/10.1177/0361684316677028

Silva, J. R. (2011). International Affective Picture System (IAPS) in Chile : A cross- cultural adaptation and validation study. *Terapia Psicológica*, *29*(56), 251–258. http://doi.org/10.4067/S0718-48082011000200012

Simons, J. S., & Carey, M. P. (2001). Prevalence of sexual dysfunctions: results from a decade of research. *Archives of Sexual Behavior*, *30*(2), 177–219.

Smith, P., & Waterman, M. (2004). Processing Bias for Sexual Material: The Emotional Stroop and Sexual Offenders. *Sexual Abuse: A Journal of Research and Treatment*, *16*(2), 163–171. http://doi.org/10.1177/107906320401600206

Snowden, R. J., Curl, C., Jobbins, K., Lavington, C., & Gray, N. S. (2016a). Automatic Direction of Spatial Attention to Male Versus Female Stimuli: A Comparison of Heterosexual Men

and Women. *Archives of Sexual Behavior*, *45*(4), 843–853. http://doi.org/10.1007/s10508-015-0678-y

Snowden, R. J., Curl, C., Jobbins, K., Lavington, C., & Gray, N. S. (2016b). Automatic Direction of Spatial Attention to Male Versus Female Stimuli: A Comparison of Heterosexual Men and Women. *Archives of Sexual Behavior*, *45*(4), 843–853. http://doi.org/10.1007/s10508-015-0678-y

Snowden, R. J., Wichter, J., & Gray, N. S. (2008). Implicit and explicit measurements of sexual preference in gay and heterosexual men: A comparison of priming techniques and the Implicit Association Task. *Archives of Sexual Behavior*, *37*(4), 558–565. http://doi.org/10.1007/s10508-006-9138-z

Spada, A. H., & Jeglic, E. L. (2015). A cognitive-based indicator of deviant sexual interest: Concurrent validation of the Stroop task. *Journal of Sexual Aggression*, *2600*(September), 1–17. http://doi.org/10.1080/13552600.2015.1078000

Spape, J. (2011). The role of prepotent sexual features in female nonspecific sexual response. *ProQuest Dissertations and Theses*, (September 2011), 92.

Spape, J., Timmers, A. D., Yoon, S., Ponseti, J., & Chivers, M. L. (2014). Gender-specific genital and subjective sexual arousal to prepotent sexual features in heterosexual women and men. *Biological Psychology*, *102C*, 1–9. http://doi.org/10.1016/j.biopsycho.2014.07.008

Spiering, M., & Everaerd, W. (2007). The Sexual Unconscious. In E. Janssen (Ed.), *The psychophysiology of sex* (pp. 166–183). Bloomington: Indian University Press.

Spiering, M., Everaerd, W., & Laan, E. (2004). Conscious processing of sexual information: mechanisms of appraisal. *Archives of Sexual Behavior*, *33*(4), 369–80. http://doi.org/10.1023/B:ASEB.0000028890.08687.94

Staley, C., & Prause, N. (2013). Erotica viewing effects on intimate relationships and self/partner evaluations. *Archives of Sexual Behavior*, *42*(4), 615–624. http://doi.org/10.1007/s10508-012-0034-4

Stoléru, S., Fonteille, V., Cornélis, C., Joyal, C., & Moulier, V. (2012). Functional neuroimaging studies of sexual arousal and orgasm in healthy men and women: A review and meta-analysis. *Neuroscience and Biobehavioral Reviews*, *36*(6), 1481–1509. http://doi.org/10.1016/j.neubiorev.2012.03.006

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, *18*(6), 643–662. http://doi.org/10.1037/h0054651

Suschinsky, K. D., & Lalumière, M. L. (2012). Is Sexual Concordance Related to Awareness of Physiological States? *Archives of Sexual Behavior*, *41*(1), 199–208. http://doi.org/10.1007/s10508-012-9931-9

Suschinsky, K. D., Lalumière, M. L., & Chivers, M. L. (2009a). Sex differences in patterns of genital sexual arousal: measurement artifacts or true phenomena? *Archives of Sexual Behavior*, *38*(4), 559–73. http://doi.org/10.1007/s10508-008-9339-8

Suschinsky, K. D., Lalumière, M. L., & Chivers, M. L. (2009b). Sex Differences in Patterns of Genital Sexual Arousal: Measurement Artifacts or True Phenomena? *Archives of Sexual Behavior*, *38*(4), 559–573. http://doi.org/10.1007/s10508-008-9339-8

Sylva, D., Safron, A., Rosenthal, A. M., Reber, P. J., Parrish, T. B., & Bailey, J. M. (2013a). Neural correlates of sexual arousal in heterosexual and homosexual women and men. *Hormones and Behavior*, *64*(4), 673–684. http://doi.org/10.1016/j.yhbeh.2013.08.003

Sylva, D., Safron, A., Rosenthal, A. M., Reber, P. J., Parrish, T. B., & Bailey, J. M. (2013b). Neural correlates of sexual arousal in heterosexual and homosexual women and men ☆. *Hormones and Behavior*, *64*, 673–684. http://doi.org/10.1016/j.yhbeh.2013.08.003

Tsujimura, A., Miyagawa, Y., Takada, S., Matsuoka, Y., Takao, T., Hirai, T., … Okuyama, A. (2009). Sex Differences in Visual Attention to Sexually Explicit Videos: A Preliminary Study. *The Journal of Sexual Medicine*, *6*(4), 1011–1017. http://doi.org/10.1111/j.1743-6109.2008.01031.x

Van der Elst, W., Boxtel, M. P. J. Van, Breukelen, G. J. P. Van, & Jolles, J. (2006). The Stroop Color-Word Test: Influence of Age, Sex, and Education; and Normative Data for a Large Sample Across the Adult Age Range. *Assessment*, *13*(1), 62–79. http://doi.org/10.1177/1073191105283427

van der Made, F., Bloemers, J., van Ham, D., El Yassem, W., Kleiverda, G., Everaerd, W., … Tuiten, A. (2009). Childhood sexual abuse, selective attention for sexual cues and the effects of testosterone with or without vardenafil on physiological sexual arousal in women with sexual dysfunction: A pilot study. *Journal of Sexual Medicine*, *6*(2), 429–439. http://doi.org/10.1111/j.1743-6109.2008.01103.x

Van Der Made, F., Bloemers, J., Yassem, W. E., Kleiverda, G., Everaerd, W., Van Ham, D., …

Tuiten, A. (2009). The influence of testosterone combined with a PDE5-inhibitor on cognitive, affective, and physiological sexual functioning in women suffering from sexual dysfunction. *Journal of Sexual Medicine*, *6*(3), 777–790. http://doi.org/10.1111/j.1743-6109.2008.01142.x

van Rooij, K., Poels, S., Bloemers, J., Goldstein, I., Gerritsen, J., van Ham, D., … Tuiten, A. (2013). Toward Personalized Sexual Medicine (Part 3): Testosterone Combined with a Serotonin1A Receptor Agonist Increases Sexual Satisfaction in Women with HSDD and FSAD, and Dysfunctional Activation of Sexual Inhibitory Mechanisms. *The Journal of Sexual Medicine*, *10*(3), 824–837. http://doi.org/10.1111/j.1743-6109.2012.02982.x

Wallen, K., & Rupp, H. A. (2010). Women's interest in visual sexual stimuli varies with menstrual cycle phase at first exposure and predicts later interest. *Hormones and Behavior*, *57*(2), 263–8. http://doi.org/10.1016/j.yhbeh.2009.12.005

Walter, M., Bermpohl, F., Mouras, H., Schiltz, K., Tempelmann, C., Rotte, M., … Northoff, G. (2008). Distinguishing specific sexual and general emotional effects in fMRI-subcortical and cortical arousal during erotic picture viewing. *NeuroImage*, *40*(4), 1482–94. http://doi.org/10.1016/j.neuroimage.2008.01.040

Waters, A. J., & Feyerabend, C. (2000). Determinants and effects of attentional bias in smokers. *Psychology of Addictive Behaviors*, *14*(2), 111–120. http://doi.org/10.1037/0893-164X.14.2.111

Wilson, C., & Wallis, D. J. (2012). Attentional Bias and Slowed Disengagement from Food and Threat Stimuli in Restrained Eaters Using a Modified Stroop Task. http://doi.org/10.1007/s10608-012-9451-x

Wilson, C., & Wallis, D. J. (2013). Attentional bias and slowed disengagement from food and threat stimuli in restrained eaters using a modified stroop task. *Cognitive Therapy and Research*, *37*(1), 127–138. http://doi.org/10.1007/s10608-012-9451-x

Wincze, J. P., Venditti, E., Barlow, D., & Mavissakalian, M. (1980). The effects of a subjective monitoring task in the physiological measure of genital response to erotic stimulation. *Archives of Sexual Behavior*, *9*(6), 533–45.

Woodard, T. L., & Diamond, M. P. (2009). Physiologic measures of sexual function in women: a review. *Fertility and Sterility*, *92*(1), 19–34. http://doi.org/10.1016/j.fertnstert.2008.04.041

Wrase, J., Klein, S., Gruesser, S. M., Hermann, D., Flor, H., Mann, K., … Heinz, A. (2003).

Gender differences in the processing of standardized emotional visual stimuli in humans: a functional magnetic resonance imaging study. *Neuroscience Letters*, *348*(1), 41–45. http://doi.org/10.1016/S0304-3940(03)00565-2

Zappalà, A., Antfolk, J., Bäckström, A., Dombert, B., Mokros, A., & Santtila, P. (2013). Using a Dual-Target Rapid Serial Visual Presentation Task (RSVP) as an Attention-Based Measurement Procedure of Sexual Preference: Is it Possible to Fake? *Psychiatry, Psychology and Law*, *20*(1), 73–90. http://doi.org/10.1080/13218719.2011.619642

Zou, G. Y. (2007). Toward using confidence intervals to compare correlations. *Psychological Methods*, *12*(4), 399–413. http://doi.org/10.1037/1082-989X.12.4.399

Zuckerman, M. (1971). Physiological measures of sexual arousal in the human. *Psychological Bulletin*, *75*(5), 297–329.

SUPPLEMENTAL MATERIALS

APPENDIX 1
Supplemental Material Chapter 2

PFAUS LAB, DEPARTMENT OF PSYCHOLOGY
CONSENT FORM TO PARTICIPATE IN RESEARCH

This is to state that I agree to participate in a research project being conducted by Julie Shilhan and (516-848-2424 ext. 2241, m_shilha@live.concordia.ca) and Maria Santaguida (514-848-2424 ext. 2241, mari_sa@live.concordia.ca) under the supervision of Dr. Jim Pfaus of the Department of Psychology at Concordia University (514-848-2424 ext. 2189, jim.pfaus@concordia.ca).

A. PURPOSE
I have been informed that the purpose of this study is to investigate the relation between responses to sexual word stimuli and sexual desire.

B. PROCEDURES
I understand that I have been asked to complete a color-naming task that includes words that will vary in sexual explicitness. I have been informed that the objective of the task is to respond with only the tint of the words (i.e., red, blue, green, yellow) as quickly and accurately as possible, using response keys. After I complete the task, I will be asked to complete a questionnaire that includes questions on my sexuality, mental health, and religion. I am aware that the completion of this study will take approximately 60 minutes.

C. RISKS AND BENEFITS
There are minimal risks associated with participation in this study. However, some of the questions I am about to answer may temporarily cause slight discomfort. I understand that participation in this study has no personal benefits. As a Concordia student taking part in the Psychology Participant Pool, I am entitled to receive one (1) credit per hour of participation.

D. CONDITIONS OF PARTICIPATION
I understand that participation is voluntary and I am free to withdraw my consent and discontinue my participation at any time without negative consequences. I further understand that my participation in this study is anonymous (i.e., no identifying information will be attached to my responses). I understand that the data from this study may be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

Name: _____

Signature: _____ Date: _____

Witness / Experimenter signature: _____ Date: _____

For further information about this study, please feel free to contact the principal investigator, Dr. Jim Pfaus, at 514-848-2424 ext. 2189 (jim.pfaus@concordia.ca). If you any have questions about your rights as a research participant, please contact the Research Ethics and Compliance Advisor, Concordia University, at 514-848-2424 ext. 7481 or by email at ethics@alcor.concordia.ca.

Chapter 2: Modified Word Stroop-Verbal Stimuli

Table A1

Verbal stimuli included in the sex Stroop task: "positively-valenced sexual", "negatively-valenced sexual", and "neutral" word categories

Positively-Valenced Sexual	**Negatively-Valenced Sexual**	**Neutral**
Naked	Pubes	Person
Kinky	Whore	Twin
Horny	Anal	Friend
Erotic	Rape	Bench
Sex	Hooker	Cash
Orgasm	Cunt	Clouds
Condom	Skank	Diploma
Penis	Slut	Joke
Vibrator	Foreskin	Applause
Clit	Molest	Lady
Intercourse	Orgy	Alert
	Pimp	
	Pervert	

Chapter 2 – Sexual Desire Inventory-II

This questionnaire asks about your level of sexual desire. By desire, we mean interest in or wish for sexual activity. For reach item, please circle the number that best shows your thoughts and feelings. Your answers will be private and anonymous.

1. During this last month, how often would you have liked to engage in sexual activity with a partner (for example, touching each other's genitals, giving or receiving oral stimulation, intercourse, etc.)?

0) Not at all
1) Once a month
2) Once every two weeks
3) Once a week
4) Twice a week
5) 3 to 4 times a week
6) Once a day
7) More than once a day

1. During this last month, how often have you had sexual thoughts involving a partner?

0) Not at all
1) Once a month
2) Once every two weeks
3) Once a week
4) Twice a week
5) 3 to 4 times a week
6) Once a day
7) More than once a day

3. When you have sexual thoughts how strong is your desire to engage in sexual behavior with a partner?

0 1 2 3 4 5 6 7 8
No desire Strong desire

4. When you first see an attractive person, how strong is your sexual desire?

0 1 2 3 4 5 6 7 8
No desire Strong desire

5. When you spend time with an attractive person (for example, at work or school), how strong is your sexual desire?

0 1 2 3 4 5 6 7 8
No desire Strong desire

6. When you are in romantic situations (such as a candle-lit dinner, a walk on the beach, etc.) how

0 1 2 3 4 5 6 7 8
No desire Strong desire

7. How important is it for you to fulfill your sexual desire though activity with a partner?

0 1 2 3 4 5 6 7 8
Not at all important Extremely important

8. Compare to other people of your age and sex, how would you rate your desire to behave sexually with a partner?

0 1 2 3 4 5 6 7 8

Much less desire Much more desire

9. During this last month, how often would you have liked to behave sexually by yourself (for example, masturbating, touching you genitals, etc.)?

0) Not at all
1) Once a month
2) Once every two weeks
3) Once a week
4) Twice a week
5) 3 to 4 times a week
6) Once a day
7) More than once a day

10. How strong is your desire to engage in sexual behavior by yourself?

0 1 2 3 4 5 6 7 8

No desire Strong desire

11. How important is it for you to fulfill your desires to behave sexually by yourself?

0 1 2 3 4 5 6 7 8

Not at all important Extremely important

12. Compared to other people your age and sex, how would you rate your desire to behave sexually by yourself?

0 1 2 3 4 5 6 7 8

Much less desire Much more desire

13. How long could you go comfortably without having sexual activity of some kind?

0) Forever
1) A year or two
2) Several months
3) A month
4) A few weeks
5) A week
6) A few days
7) One day
8) Less than one day

"The Sexual Desire Inventory: Development, Factor, Structure, and Evidence of Reliability," by I. P. Spector, M. P. Carey, and L. Steinberg. 1996, Journal of Sex & Marital Therapy, 22, 175-190.

Appendix 2
Supplemental Material Chapter 3

Concordia Sexual Information Survey

Please fill in this part of the questionnaire as accurately as you can. All information you provide will remain strictly confidential

1. Gender: Male___ Female___Other (please specify)_____
2. Age_____
3. Ethnic background_____
4. What is the religion you were brought up in? Choose one:

Catholocism ____ Protestanism____ Judaism _____ Islam_____Hinduism_____
Other (Please specify)_____ No religion_____

Are you taking some form of oral contraceptive (i.e. birth control pill)? Yes____ No____

Are you currently menstruating Yes____ No_____
If No: When was last day of your last menstrual cycle? _____

Relationship status (Y or N)
Single_____
In a relationship_____
Are you married/commonlaw _____
Widowed_____ Divorced_____

If you answered that you were in a relationship, select the item that corresponds with the duration of the relationship
1 month_____ 3 months_____ 6 months_____ 1year_____
2 years_____ 2-4 years_____ 4-6 years_____ 6-10 years_____
Over 10 years_____

Rate your sexual orientation:

0	1	2	3	4	5	6
Exclusively Heterosexual	Mostly Heterosexual		Equally Heterosexual and Homosexual		Mostly Homosexual	Exclusively Homosexual

Or

Asexual _____

On average how many times a week do you have sexual intercourse

Anal:

0____ 1-4_____ 5-8_____ 9 or more_____

Genital (Penile-Vaginal):

0____ 1-4_____ 5-8_____ 9 or more_____

Oral:

0____ 1-4_____ 5-8_____ 9 or more_____

On average how many days a week do you engage in other forms of sex play (e.g. dildo, fingering, hand job)

0____ 1-4_____ 5-8_____ 9 or more_____

On average how many times a week do you think about sex

0___ 1-5_____ 6-10_____ 11-15_____ 15 or more_____

Do you experience any difficulty engaging in sexual activity

0	1	2	3	4	5
Never		Sometimes		Often	Always

Over the past 4 weeks, how would you rate your level (degree) of sexual desire or interest?

1	2	3	4	5
very low none at all	Low	Moderate	High	Very high

Over the past 4 weeks, how often did you feel sexually aroused ("turned on") during sexual activity or intercourse?

0	1	2	3	4	5
No Sexual Activity	Almost never or never	A few times (less than ½ the time)	Sometimes (about ½ the time)	Most times (more than half the time)	Almost always or always

Over the past 4 weeks, when you had sexual stimulation or intercourse, how often did you reach orgasm (climax)?

0	1	2	3	4	5
No Sexual Activity	Almost never or never	A few times (less than ½ the time)	Sometimes (about ½ the time)	Most times (more than half the time)	Almost always or always

If you identify as female:
Over the past 4 weeks, how often did you experience discomfort or pain during or following vaginal penetration?

0	1	2	3	4	5
Did not attempt intercourse	Almost never or never	A few times (less than ½ the time)	Sometimes (about ½ the time)	Most times (more than half the time)	Almost always or always

Appendix 3
Supplemental Material Chapter 4

CONSENT TO PARTICIPATE IN THE SEXUAL IMAGE STROOP TASK

I understand that I have been asked to participate in a program of research being conducted by Marie-Eve Leclerc (514-824-0552, marie.eve.leclerc27@gmail.com) under the supervision of Dr. Johnson (514-848-2424 ext. 2241, aaron.johnson@concordia.ca) of the department of Psychology of Concordia University.

A. PURPOSE

I have been informed that the purpose of this study is to investigate the sexual interest of males and females in response to images of sexual content.

B. PROCEDURES

I understand that I have been asked to complete a response task, a rating task and two questionnaires. I have been informed that the objective of the response time task is to respond to sexual content images tinted in one of the four colors of the Stroop Task (i.e.; green, blue, yellow and red) as quickly as possible without compromising accuracy, using the response keys. I am aware that the completion of this study will take approximately forty minutes.

C. RISKS AND BENEFITS

There are minimal risks associated with participation in this study. I understand that participation in this study has no personal benefits. As a Concordia student taking part in the Psychology Participant Pool, I am entitled to receive one credit per hour of participation in this experiment.

D. CONDITIONS OF PARTICIPATION

I understand that participation is voluntary and I am free to withdraw my consent and discontinue my participation at any time without negative consequences. I further understand that my participation in this study is confidential (i.e., the researcher will know, but will not disclose my identity and no identifying information will be attached to my responses). I understand that the data from this study may be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT.
I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

Name: _____

Signature: _____ Date: _____

Witness / Experimenter signature: _____Date: _____

Chapter 4-Modified Pictorial Stroop Task: Sample Pictorial Stimuli

Image Type: Naked Women

Image Type: Naked Man

Image Type: Low Arousal-Clothed Couples Cuddling