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Eye-tracking in sex research: Comparing genders on processing of erotic stimuLi

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EYE-TRACKING IN SEX RESEARCH: COMPARING GENDERS ON PROCESSING OF EROTIC STIMULI

by

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ABSTRACT

Eye-tracking in Sex Research: Comparing Genders on Processing of Erotic Stimuli

by

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The fact that sexual experiences, comprising cognitive, affective, and behavioral components, are private and socio-culturally laden has limited the types of methodology useful in exploring their characteristics. Eye-tracking methodology has the capacity to overcome some methodological difficulties We presented men and women with erotic and non-erotic pictures to examine the oft-published gender difference in self-reported attentional focus to erotica (i.e., men are most interested in body parts, and women are most interested in romantic context). After adjusting for scene region size, we found no gender differences in the amount of time that men and women looked at different aspects of an erotic image. Both men and women focused more on faces than on bodies or contextual cues. Significant differences were also found in attention to erotic and non-erotic pictures, providing support for eye-tracking's usefulness in sexuality research. Results are interpreted using the Information Processing Approach, and future directions are suggested.

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CHAPTER 1

INTRODUCTION

Sexual experiences, comprised of cognitive, affective, and behavioral aspects, are some of the most private, yet socio-culturally laden, of human experiences. This poses particular dilemmas to research, with implications not just for our understanding of human sexuality, but for the proper conceptualization and treatment of sexual dysfunctions. Although no methodology is without problems, the more information we can bring to bear on this topic and the resulting convergent validity we attain, the more confident we can be about the meaning of our results.

Unlike many other topics of scientific interest, research on human sexuality has, to date, been uniquely limited in the types of methodology used to explore its characteristics. The vast majority of past research conducted on sexuality has employed some variant of self-report (e.g. self-administered questionnaire, interview, behavior sampling or monitoring), or physiological data gathering. The problems affecting the validity of self-reporting (e.g. difficulty with recall, unwillingness to disclose, over- or under-reporting) are not specific to sexuality research, and are lamented in other disciplines as well. However, because the nature of a person's sexuality is so very personal, private, and vulnerable to value judgments, self-report data about sexual matters may be particularly confounded by the aforementioned factors. Physiological experiments have typically assessed both men and women's sexual arousal to an erotic

stimulus in the laboratory setting. While many consider this method of data collection to be the objective measure that counter-balances the subjectivity of self-report, physiological studies are not without their own inherent problems. Among these drawbacks to physiological research are the consistently low correlation between subjective and physiological arousal for women, and the question of whether the artifice of the lab environment can produce the same results in participants as would be found in a real-world sexual encounter.

The call to introduce more sound research methods into sexuality research has been made by several prominent researchers in the field (Abramson, 1990; Bancroft, 1999; Catania, 1999). However, progress toward achieving this goal has been slow at best, as a generation of sex researchers is being challenged to approach a familiar terrain using unfamiliar techniques. I propose to introduce a method of cognitive psychology research (e.g. eye-tracking) into sexuality research, and attempt to validate a common finding regarding gender differences in preference for sexual stimuli using this objective measure of cognitive and visual attention.

CHAPTER 2

LITERATURE REVIEW

In the following section, literature relevant to the current proposal is reviewed. These sections include: 1) Retrospective Self-Report, 2) Sampling/Monitoring Studies, 3) Physiological Assessment, 4) Experimental Manipulations, 5) Application of Eye-Tracking Methodology to the Study of Erotic Attentional Focus.

Retrospective Self-Report

The vast majority of data regarding sexual behavior in humans has been collected via self-report methods (e.g. questionnaires, interviews). The advent of serious inquiry into human sexuality began with the thousands of interviews conducted by Alfred Kinsey and his colleagues. Much of the current information regarding sexuality and sexual behavior continues to emanate from large-scale surveys. However, as self-report methods have historically had problems, it is possible that much of what is public knowledge regarding sexuality may contain significant degrees of inaccuracy.

There are many reasons for the prevalence of self-report methodology both within the area of human sexuality as well as outside of it. Self-report measures can be developed quickly and used economically, it is typically very simple to write self-report items that target the behaviors or concepts of interest, and it is often the case that self-reporting is the only way to obtain the desired information. It has also been argued that

self-report may be more accurate than other methods because people have access to a great deal of information about themselves and are usually able to retrieve that information quickly. Self-report methods are also very useful when there is little known about a construct and the goal is to gather more information about it, particularly in the early stages of research and hypothesis formation (Baker & Brandon, 1990).

Despite the positive aspects of self-report, there are many drawbacks that call for serious caution when interpreting results. Elements of recall (e.g. vividness and complexity of behavior), self-presentation bias (e.g. the degree to which the content of questions elicit fear or approval seeking), motivational issues, and the method of data collection have all been identified as factors that affect the quality and validity of a participant's responses in regard to their sexual behavior (Catania et al., 1990; Croyle & Loftus, 1993). Such inconsistencies between self-reported and actual sexual behavior have no way of being sorted out, as sex research lacks a gold standard for validating self-reported sexual behavior. These problems with reporting contribute to measurement error, which in turn biases results. Measurement error associated with respondent variables may occur in one or more of several ways: (1) respondents may refuse to answer a question, (2) respondents may underreport their behavior, either by underestimating the frequency with which behaviors occur or denying engaging in a behavior when they in fact have, and (3) respondents may overreport behaviors that either they have never performed or have not performed with as high an estimated frequency (Catania et al., 1995; Catania et al., 1990).

Understanding how memory relates to the recall of past sexual events is one of the least understood areas of sex research. The availability heuristic would suggest that

sexual encounters that have high personal salience (e.g. first coitus) are more likely to be remembered than those with lower personal salience. Also, less frequent acts may be remembered more easily than activities that occur with high frequency. It has been shown that in general, humans may have little or no direct access to higher order cognitive processes. Nisbett and Wilson (1977) reviewed studies conducted on a variety of topics, primarily in social psychology, and concluded that people tend to base reports of their own behavior on a priori, implicit causal theories, or judgments about the extent to which a particular stimulus is a plausible cause of a given response. While the majority of research on memory and recall has been conducted in the domain of cognitive psychology, several attempts have been made to understand how recall problems affect the validity of self-reported sexual behavior. These investigations have typically been methodological in nature, such that researchers have attempted to determine which methods of data collection are most and least affected by difficulty with recall. The majority of research has shown higher correlations between previously reported sexual behavior and later recall of that behavior for interviews than for diaries (McLaws, Oldenburg, Ross, & Cooper, 1990; Ramjee, Weber, Morar, 1999; Reading, 1983). Other attempts to validate recall have involved both partners reporting on sexual encounters and computing correlations (Clark & Wallin, 1964; Pfeiffer, Verwoerdt, & Wang, 1968; Van Duynhoven, Nagelkerke, Van de Laar, 1999). However, these concordance rates have been found to be variable, and therefore not reliable. As it seems likely that we are poor judges of our own behavior, and tend to forget non-memorable experiences, future studies should more specifically examine the interplay between memory and reporting of

sexual behavior in order to have a better understanding of what and how events are being reported.

Self-presentation bias is another major issue affecting responding to self-report items, particularly in sex research. Self-presentation bias may result in under-or overreporting behaviors depending on the social value of said behaviors. Bragging may lead to overreporting of sexual behavior, and it is thought that machismo might also lead to overreporting, as sexual potency is valued in cultures with strong machismo values (Catania et al., 1990). Intentional underreporting may occur due to embarrassment, issues with disclosing private information, or simply lying. It has been found that participants felt significantly less comfortable filling out a sexuality scale than either a biographical/career scale or a sociopolitical scale, and were significantly less truthful on the sexuality scale than on the biographical/career scale (Nicholas, Durrheim, & Tredoux, 1994). The authors did not query participants as to why they were more likely to lie on the sexuality scale, but it certainly is of interest to sex researchers to consider this information when interpreting the results of self-report studies. Several studies have shown that discomfort with disclosing sexual information may be responsible for people's refusal to answer questions (Bradburn, Sudman, Blair, & Stocking, 1978; Catania, McDermott, & Pollack, 1986). Meston, Heiman, Trapnell, and Paulhus (1998) conducted a study to examine two different types of socially desirable responding, self-deceptive enhancement and impression management, on sexuality self-reports. It was found that after personality and conservatism were partialed out, associations between self-deceptive enhancement and sexuality variables were eliminated, but associations between impression management and sexuality measures remained significant. Potential

gender differences in self-reporting of sexual attitudes and behavior has also been examined, as it is typically believed that women have more social pressures to conform to non-sexual or committed-relationship-sex-only standards than men, for whom casual sex and masturbation are quite acceptable. Recent research comparing responses of participants led to believe that untruthful responses could be detected versus those of participants led to believe that they could not be detected indicated that women are more affected than are men by this manipulation (i.e. women's responses show more variability, evidencing a stronger inclination to respond according to social norms when lying cannot be detected) (Alexander & Fisher, 2003). It is clear the relationship between self-presentation bias and reporting on sexual behaviors depends on many factors, and this line of inquiry deserves more attention in order to clarify these relationships.

One other aspect that has been shown to influence self-report data and measurement error is the mode in which the data are being collected. The most frequently employed methods of self-report are self-administered questionnaires and phone surveys; face-to-face interviews are still used but not often as they are both time-consuming and costly. Each of these methods has its own advantages and unique problems with regard to measurement error.

Self-administered questionnaires (SAQs) may enhance privacy under appropriate conditions, and they are often inexpensive to administer, as one person can supervise the administration of more than one person at a given time. It has been shown that participants feel less threatened by SAQs (Catania et al., 1986), and other research has supported the idea that enhancing respondents' privacy reduces social embarrassment and

increases honest reporting (Millstein & Irwin, 1983). However, the use of SAQs has not always resulted in higher levels of reporting (DeLamater & MacCorquodale, 1975; Zelnik, Kantner, & Ford, 1981). Many sexuality questionnaires do not have built-in lie scales, so it is often not possible to distinguish between truthfulness and dishonesty. In addition, SAQs typically do not address the aforementioned problems of recall and self-presentation.

Telephone interviews have been employed in research in an attempt to gather large numbers of a variety of different people. New technology has enabled researchers to access random sampling via random digit dialing, as well as access the use of purely automated interviewers in an effort to increase feelings of privacy and subsequent disclosure. Conflicting evidence regarding this issue has been found. Some studies have found that randomized phone interviews with a non-human interviewer reduced response bias (Gribble, Miller, Rogers, and Turner, 1999); however, it has also been found that participants are no more likely to admit to certain types of behaviors during a telephone interview than during a face-to-face interview (Czaja, 1987). It is also questionable how random samples are when using telephone interviewing techniques, as people who either have no phone or refuse to participate may be systematically different than those who do participate.

Refusal rates are the most frequently reported index of measurement error in sexuality surveys (Catania et al., 1990; Catania et al., 1995). Average refusal rates range from 6% to 19% depending upon the type of activity that is being asked about (Bradburn et al., 1978; Catania et al., 1986; Johnson & DeLamater, 1976; Michael, Laumann, Gagnon, & Smith, 1988), and it has been found that nonresponders tend to be older, less

educated, and have a lower reading ability than responders (Johnson & DeLamater, 1976). However, to date there has not been any type of meta-analysis across studies to examine refusal rates for questions involving different questions, so it is not known if questions regarding certain behaviors are more likely to be refused than others. Clearly all of these self-report methods can also be impacted by motivational factors, another potentially important source of measurement error. Highly motivated respondents may take more time and effort to understand the questions being asked, whereas less motivated participants may skip items or give less thoughtful responses.

The advantages of utilizing self-report methodology are many, but questions about the validity of such data are fraught with error potential. This drawback is particularly problematic in the area of human sexuality, as self-report methods have gathered the vast majority of what we know about topics such as sexual behavior, sexual orientation, and sexual dysfunction, and it has been shown that participants are even more inclined to respond inaccurately to questions of such a private nature. It is for these reasons that researchers in human sexuality have explored other types of research methodology that may reduce validity and subsequent interpretation difficulties.

Sampling/Monitoring Studies

Behavioral sampling and monitoring methodology has been employed in all types of research to circumvent primarily the problem of faulty recall innate to the average questionnaire or interview study; sex research is no exception. The daily diary has been used in a variety of studies by different researchers in efforts to extract a more reliable and valid assessment of a person's sexual being, and has primarily been applied to recent

research examining sexual risk-taking behaviors associated with HIV transmission (e.g. McLaws, Oldenburg, Ross, & Cooper, 1990; Morrison, Leigh, & Gillmore, 1999). The daily diary has notable advantages over its methodological counterparts, however, the extent to which it can ameliorate the drawbacks of typical self-report methods (e.g. questionnaire, interview) is questionable.

The daily diary does have various advantages over conventional research methods. In contrast to structured questionnaires and interviews, the open format of the daily diary offers the participant more freedom with regard to recalling information, usage of a person's natural language, and description for nebulous concepts such as sex and love (Okami, 2002). Although the information is still elicited retrospectively, the period of recall can be much shorter than for other types of self-report, thereby lessening the effects of forgetting, telescoping, or other cognitive errors. It has also been shown that participants seem to prefer the diary method over standard recall measures (McLaws et al., 1990).

Despite the apparent benefits of the daily diary over its sister self-report methodology, behavioral monitoring in general introduces new concerns while not entirely escaping old ones common to other types of self-report. One significant disadvantage of the diary method is the required continued compliance on the part of the participant. Rather than completing one session and being finished, the diary necessitates intensive time and effort commitments over a preset period of time. It is likely that participants sufficiently motivated and detail-oriented to complete such a task in the prescribed manner may be systematically different than nonparticipants in ways that might affect the subsequent data collected, calling into question the representativeness of

the sample (Leigh, Gillmore, & Morrison, 1998). In addition, as there is no experimenter present to ensure the participant is following the directions in the manner he/she has been trained, the subject is essentially free to complete the diary at his time of choice. This clearly reinstates the drawback of recall problems as found in other self-report methodology, and therefore potentially decreases the validity of the data gathered. Also, there are typically no validity checks to assess the truthfulness of the behaviors reported, so that the participant may be filling out entries incorrectly and over- or under-reporting behaviors, as well as purposefully responding untruthfully (Okami, 2002).

There are also problems with potential behavioral reactivity to monitoring one's own behavior. Behavioral monitoring, particularly sexual behavior, could easily affect the likelihood that a certain behavior will or will not occur. Knowing that one must report sexual activity may effect changes in sexual activity because of the individual's increased consciousness of it. This could result in both increases and decreases in the behavior, in part depending on whether the behavior is perceived as desirable or as risky and stigmatized.

In an effort to gain a more complete understanding of the aforementioned problems, a pilot study compared three different variations of daily diaries to evaluate which method encouraged the greatest compliance and disclosure (Morrison, Leigh, & Gillmore, 1999). The three methods compared were written daily diaries, daily telephone interviews the participants initiated, or daily telephone interviews initiated by project staff. It was found that respondent-initiated telephone calls resulted in more missing days than either of the other two methods, and the authors strongly cautioned against this technique. Self-administered written diaries resulted in the fewest missing days, but the

highest number of missing items per day. The project-initiated phone calls method resulted in more missing days as compared to the written diaries, but fewer missing items per day. The authors recommend that higher frequency behaviors should be assessed more actively, via telephone interviews initiated by project staff, to ensure greater recall. For behaviors that occur with less frequency, it may not matter as much if the behaviors are recorded daily, and the written diary method may help increase disclosure for sensitive items because of the greater feeling of anonymity associated with this method.

Clearly, behavioral monitoring methodology has some serious validity problems that necessitate strong caution in the interpretation of results. The daily diary technique demands a great degree of compliance and effort on the part of the participant, and a leap of faith on the part of the researcher in trusting that the participants are accurately reporting events precisely as instructed. Beyond even that, one must wonder about the representativeness of a sample of people who complete their diary entries honestly and in a timely manner. In addition, monitoring one's own behavior may affect the very behavior itself. Though the daily diary method has been used with the goal of alleviating the problems with recall in more common types of self-report methodology, it also risks introducing new confounds.

Experimental Manipulation

Considering the problems of self-report, it is understandable that researchers have turned to their laboratories. The artifice of the laboratory environment is a clear challenge to external validity and so is the experimental operationalization of certain sexuality-related variables. The issue of whether experimental manipulations utilized in these labs

have real world equivalents, and in turn, implications is a serious one in sex research. Many studies have examined constructs such as cognitive distraction, performance demand, and mood on sexual arousal, but the manner in which these experiences have been manipulated begs the question as to whether the true experience of cognitive distraction, performance demands, and variations in mood during true sexual encounters was adequately captured.

A variety of techniques to induce cognitive distraction during sexual arousal have been used in research. Farkas, Sine, and Evans (1979) introduced two different tones of sound through headphones as the participant was viewing erotic material. Participants were instructed to tally each of the types of tones they heard during erotic stimulus presentation in order to distract them from the erotica. Adams, Haynes, and Brayer (1985) had participants engage in an adding task (i.e. a series of three digits appeared on the television screen and the participant had to total them and report the answer aloud) as they listened to audio erotic stimuli. Abrahamson (1985) had participants listen to a taped recording of a popular novel while viewing arousing films, and were told that they would be tested regarding the content of the novel after the session to ensure they had been paying attention. Elliott and O'Donohue (1997) introduced a dichotic listening paradigm in which participants heard an erotic audiotape in one ear and non-related sentences in the other ear. Distraction was manipulated by having the participant either repeat the sentence forward, or repeat the sentence both forward and in reverse.

In the previously reviewed studies, it was often found that cognitive distraction did affect sexual arousal to varying degrees. However, one must question the operationalization of the construct of cognitive distraction. All of the aforementioned

studies used different methods to manipulate distraction, and it does not seem as if there has been any consensus on the manner in which to create distraction, nor the degree to which distraction should be induced. In addition, it is unlikely that the cognitive distraction probable during a real sexual encounter has any significant similarities with the computation of arithmetic problems, tallying tones, or being forced to listen to someone reading from a novel.

Performance demand, or the expectation that one will perform sexually, is another construct that has been studied fairly extensively in laboratory research. The aforementioned study by Farkas, Sine, and Evans (1979) also had participants placed into a high or low performance demand group. The high performance demand group was told that previous participants found the film highly arousing, and the low performance demand group was told that previous participants found the film to not be very arousing at all. Lange, Wincze, Zwick, Feldman, and Hughes (1981) asked participants to achieve an erection as quickly, as fully, and for as long as possible while viewing an erotic tape. A similar study had participants listen to audiotaped erotica and instructed them to become as sexually aroused as possible while continually monitoring and maintaining sexual arousal (Heiman & Rowland, 1983). Several studies have actually threatened shock to participants if they did not achieve the degree of arousal that the "average" participant achieved (Barlow, Sakheim, & Beck, 1983; Beck & Barlow, 1986; Hale & Strassberg, 1990). While few plausible alternatives may exist, it remains questionable whether real-world correlates of experimental manipulation for performance demand exist. Even if the manipulations do cause an adequate demand for the sexual performance of the participant, the methods that have been used to create performance

demand are arguably a far cry from anything that would ever occur outside of the laboratory environment.

Several studies have also attempted to manipulate the mood states of participants and examine subsequent effects on arousal. Anxiety has most often been induced by threat of shock (Barlow, Sakheim, & Beck, 1983; Beck & Barlow, 1986; Hale & Strassberg, 1990), though one study (Elliot & O'Donohue, 1997) attempted to induce anxiety by telling participants that they would be videotaped during the experimental session. Palace and Gorzalka (1990) induced anxiety by first showing participants a film clip depicting threatened amputation and then showing the erotic stimulus. Meisler and Carey (1991) induced positive and negative mood by presenting participants with audiotaped mood induction statements adapted from the Velten Mood Induction Procedure (Velten, 1968). Participants heard statements such as "I feel great," and were asked to try to feel the mood in the statement. Laan, Everaerd, Von Berlo, and Rijs (1995) used a musical mood induction (jazzy sax music) technique to elevate participants' mood. Mitchell, DiBartolo, Brown, and Barlow (1998) also used music to induce different types of mood (Eine Kleine Nachtmusik and Divertmento by Mozart for positive mood, and Albinoni's Adagio and Barber's Adagio Pour Courdes were used for negative mood). Some studies involving mood inductions in more general research have used various movie clips to induce different types of mood, though this has not been used often in sex research as of yet.

The induction of mood has long been studied in other areas of research, and much debate has occurred as to which methods produce the greatest degree of change in mood in the intended direction. Most researchers believe that movie clips have the utmost

ability to change mood states, though which film clips for which specific moods is still disputed (Gerrards-Hesse, A., Spies, K., & Hesse, F.W., 1994; Gross & Levenson, 1995). Also unclear is the degree to which intense emotions such as elation, sadness, and anger can actually be produced by simple self-statements or movie scenes.

Experiences such as cognitive distraction, performance demand, and different mood states have been induced in experiments to explore their effects on human sexuality. While these studies have taught us much regarding consequences on sexual response, it is difficult to determine what has been learned about people in real sexual encounters. Because the manner in which these experiences have been manipulated often has no comparable event outside of the lab, the degree to which one can extrapolate real-world responses from the results of these studies is questionable.

Physiological Assessment

Scientists in the field of human sexuality have employed another type of methodology with some frequency: physiological assessment of sexual arousal and response. This methodology is typically regarded as an objective measure of a person's sexual response, as studies are free of self-report, and are normally conducted in an experimental setting, offering the researcher more control over the experience of the participant (e.g. stimuli, presentation of stimuli, situational characteristics, etc.). The idea that a person's sexuality involves a physiological component that could potentially be captured and measured dates back to the beginning of the 20th century; efforts to assess physiological response began in 1963 with Freund's development of the first instrument to continuously measure male genital response (Janssen, 2002). Since then, sexual

psychophysiology has been used to examine phenomena such as the activation and inhibition of sexual arousal; the psychophysiology of sexual motivation, orgasm, and ejaculation; the effects of aging, mood, and hormones on sexual responsivity; the association between sexual orientation/preferences and sexual arousal; and the effects of erotica on sexual attitudes and behavior (Janssen, 2002).

The most commonly used instrument to measure genital sexual response in men is the Rigiscan. The Rigiscan was developed in 1985 and is designed to continuously measure penile circumference and rigidity (Bradley, Timm, Gallagher, & Johnson, 1985). The device has two loops; one is placed at the base of the penis and the other is placed around the shaft directly behind the glans. Within each loop is a cable that is tightened at discrete time intervals. Circumference is measured every 15 seconds, and rigidity is measured every 30 seconds after a 20% increase in circumference is detected.

Although the Rigiscan is widely used in research and clinical settings, several important questions regarding its validity and reliability have yet to be answered or even addressed in research. There are currently no data available on its test-retest reliability (Janssen, 2002). Another problem with the Rigiscan is that it has been found that individual Rigiscan devices may differ in measures of rigidity as compared to other Rigiscan machines and other physiological measures of penile tumescence (Munoz, Bancroft, & Marshall, 1993), calling into question the generalizability of data. It also may underestimate rigidity and circumference, particularly at lower levels of tumescence (Munoz, Bancroft, & Marshall, 1993). A fourth significant drawback is that there are no data regarding the potential reactivity of the measurement (Janssen, 2002). Finally, the degree to which the tightening of the loops during circumference and rigidity

measurement, either in the absence of or in interaction with experimental manipulations, has not yet been assessed.

The most commonly used method to measure female genital response is vaginal photoplethysmography. This technique involves the use of a photometer (Sintchak & Geer, 1975; Hoon, Wincze, & Hoon, 1976), which is made of clear plastic and is shaped like a tampon. The device is designed so that it can be easily inserted into the vagina by the participant, and a shield is typically placed on the attached cable so that the depth of insertion and orientation of the photoreceptive surface are known and held reasonably constant (Laan, Everaerd, & Evers, 1995). The photoplethysmograph measures the amount of light that is reflected back from the vaginal wall, which is termed "back-scattered light." It is assumed that a greater back-scattered signal reflects increased blood volume in the vaginal blood vessels (Levin, 1992), and therefore greater physiological sexual arousal. The photometer records two signals: vaginal blood volume (VBV) and vaginal pulse amplitude (VPA). VBV is thought to provide an index of the total amount of blood in the vaginal wall (Hatch, 1979). The VPA signal records the vaginal pulse wave and reflects changes in the vascular walls dependent on pressure changes within the vessels (Jennings, Tahmoush, & Redmont, 1980).

Although vaginal photoplethysmography is widely used to assess physiological arousal in women and both the VBV and VPA signals have been found in response to erotic stimuli, the precise source and nature of these two measures is as of yet unknown. The lack of a theoretical framework and of a calibration method for this device leaves much of the interpretation of data to the researcher. Movement artifacts are a common problem with the vaginal probe, and to date, no studies have specifically examined

potential fluctuations in readings during menses (Janssen, 2002). Due to the lack of a standard calibration method, changes in vaginal blood flow are relative. It is also not known the extent to which factors related to individual variations in anatomy and physiological characteristics (e.g. resting levels of vaginal muscular tone and moistness) affect the amplitude of the signal (Geer & Janssen, 2000).

One common and problematic finding with regard to psychophysiological research is that the correlation between subjective and physiological sexual response is consistently lower for women than for men (Dekker & Everaerd, 1988; Heiman, 1977; Laan & Everaerd, 1995; Rowland, 1999; Steinman, Wincze, Sakheim, Barlow, & Mavissakalian, 1981;Wincze, Vendetti, Barlow, & Mavissakalian, 1980). It has been suggested that for sexually dysfunctional men, mental arousal is more closely related to subjective arousal than physical arousal; sexually functional men tend to rely more on physical arousal to define their subjective arousal (Rowland & Heiman, 1991). It is possible that women also define subjective arousal by their mental arousal, thereby following the pattern of the sexually dysfunctional men and resulting in a lower correlation between subjective and physical arousal. This disparity has been observed since the advent of sexual psychophysiology (Geer, Morokoff, & Greenwood, 1974; Hoon, Wincze, & Hoon, 1976; Osborn & Pollack, 1977; Wincze, Hoon, & Hoon, 1977) and continues to occur even today (Meston & Heiman, 1998; Meston & Gorzalka, 1996a; Meston & Gorzalka, 1996b). These nonsignificant correlations are most often observable when the participant is reporting no subjective sexual response, yet an increase in VBV and VPA is recorded (Heiman, 1976; Laan & Everaerd, 1995; Laan, Everaerd, Van Der Velde, & Geer, 1995).

Heiman (1976) found that in her sample of sexually functional college-aged women, over 40% of women who registered the largest VBV increases reported no physical arousal, whereas about 12% of women who experienced the greatest VPA increase reported no physical arousal. Although Heiman (1976) makes the case for assessing genital arousal primarily by the vaginal pulse amplitude signal, there is clearly a subset of women for whom this does not work either.

Laan and Everaerd (1995) reviewed the determinants of female sexual arousal, and spent a substantial portion of the review examining the discord between women's subjective reports and physiological measurements of sexual arousal. Several explanations have been put forth for this discrepancy. One is that the lack of a consistent pattern of correlations may be attributable to the various ways in which subjective sexual arousal was assessed. Second, low correlations have been thought to be the result of measurement error of the vaginal photoplethysmograph. As stated before, a third possibility is that at lower levels of arousal, women may rely more on external cues to interpret subjective experience, which are often not available in the laboratory environment. More recently it has been argued that, as opposed to women experiencing levels of arousal that are consistently lower than men in general, the evidence suggests that external stimulus information (e.g. relationships, sexual scenarios) may play a more important role in assessing feelings of sexual desire than do internal physiological cues at all levels of arousal (Meston, 2000). A last possible explanation is that women, if not instructed to do so, typically do not attend to physiological cues of arousal (Korff & Geer, 1983). Laan and Everaerd (1995) conducted a meta-analysis to examine determinants of female sexual arousal and found that the seven best predictors of genital

physiological arousal were fairly similar to those for subjective arousal; however, those predictors only accounted for 9% of the variance for genital arousal, whereas 26% of the variance in subjective sexual arousal was explained. It is also possible, as Rosen and Beck (1988) proposed, that only subjective measures of sexual arousal may be associated with subject variables, whereas genital changes may be a more precise gauge of arousal to stimulus characteristics.

When reviewing the history of difficulty correlating subjective and genital sexual response in women, one is left to wonder: what exactly is being measured, and what does it mean that these discordant patterns exist? Unfortunately, due to the lack of theoretical grounding for the interpretation of female physiological data, combined with no standardized calibration methods for the photoplethysmograph, these questions have not been answered. However, even if physiological assessment were perfected, both theoretically and technically, it remains likely that the female discordance between physiological and subjective measures of arousal would persist. That leaves us with questions about the meaning and purpose of the discrepancy, as well as with the ways in which the discrepancy between physiological and subjective arousal plays out behaviorally outside of the laboratory.

Another major issue with sexual physiological research in general is the question of how generalizable the results from these studies are to the population as a whole. Though much research is confronted with the predicament of potential and essential differences between those who participate and those who do not, the potential for volunteer bias is particularly glaring in research examining physiological aspects of human sexuality (Plaud, Gaither, Hegsted, Rowan, & Devitt, 1999; Strassberg & Lowe,

1995; Wiederman, 1999; Wolchik, Braver, & Jensen, 1985). Studies have shown differences between volunteers and nonvolunteers across a variety of variables including sexual experience, frequencies of sexual activity, sex guilt, exposure to erotic materials, and sexual attitudes. In physiological research, the differences are likely to be multiplied, as it has been shown that potential participants are increasingly less likely to volunteer for studies involving increasing intrusiveness (Strassberg & Lowe, 1995; Plaud et al., 1999; Wolchik, Braver, & Jensen, 1985). Though it has not been determined whether these differences between volunteers and nonvolunteers create systematic variations in physiological research, it is certainly appropriate to interpret results from studies employing physiological methodology with caution.

Although physiological genital recording is generally considered to be an objective measure of sexual arousal, this is clearly not the case. Many basic questions about the measurement devices remain unanswered, even though this methodology has been and continues to be used in many labs across the globe. Also unclear is how generalizable the results found in the unnatural laboratory setting are to real-life sexual encounters, and whether those people willing to undergo these studies are representative of non-participants in ways that may affect the data collected.

Application of Eye-tracking Methodology to the Study of Erotic Attentional Focus

Having reviewed the various problems with the methodologies most frequently used in sex research, it is apparent that new techniques are needed to provide a more accurate and unbiased perspective of human sexuality. Hence, I have turned to methodologies of other sub-disciplines in psychology in order to examine techniques that

would potentially be relevant to questions in human sexuality. To this end, I have chosen eye-tracking methodology to bring a new perspective on a common finding in sex research.

Tracking eye movements is a technique employed primarily in cognitive psychology and used to capture and measure visual attention. It has most often been applied to research on reading, but a substantial literature exists on scene perception as well. I have chosen eye-tracking because it avoids problems inherent to self-report (e.g. recall, self-presentation), as well as the drawbacks of physiological research (i.e. making the discord between subjective and physiological arousal irrelevant). Eye-tracking is an online measure of visual attention, bypassing some of the disadvantages of the most frequently employed methodologies in human sexuality research, although there will undoubtedly be interesting questions raised in the interpretation of the results.

It has been repeatedly found, mostly in self-report studies, that in situations with sexual connotations, men tend to focus on physical and genital aspects, and women focus more on the emotional or contextual cues of the sexual scenario. I have chosen this finding as my test case to pilot the use of eye-tracking methodology in sex research for the following reasons: 1) the literature on gender differences for the preference of erotic stimuli is very consistent—men report themselves to be drawn to body parts and women report themselves to be drawn to sexy situations or contexts; 2) the bulk of this literature is based on self-report, thus begging for some more objective convergent validity; 3) although eye-tracking necessitates a lab environment, the external validity of viewing erotic stimuli seems high as the visual is so significant a component of most sexual encounters; 4) despite concerns about self-representation, eye movements are not easily

controllable at this micro level of analysis (tracking the extent to which the eyes fixate on face or breasts or the contextual background details) (Henderson & Hollingsworth, 1998). In the following sections, I will first review the literature regarding the gender difference in attentional focus. Then, I will go into further detail regarding eye-tracking and scene perception, and make the case for why applying eye-tracking methodology in sexuality research is both feasible and promising.

Gender Differences in Self-Reported Attentional Focus for Erotica and Fantasies

Throughout the decades of previous research examining different aspects of human sexuality, there has been one fairly stable finding that has come from a variety of studies employing different methodologies: when a real or imagined situation has sexual connotations, men tend to focus primarily on the genital or anatomical/physical aspects, whereas the context and emotional tones of the situation tend to have greater salience for women (Ellis & Symons, 1990; Follingstad & Kimbrell, 1986; Geer & McGlone, 1990; Gold & Chick, 1988; Hardin & Gold, 1988-1989; Hicks & Leitenberg, 2001; Hsu, Kling, Kessler, Knapke, Diefenbach, & Elias, 1994; Janssen, Carpenter, & Graham, 2003; Laan, Everaerd, van Bullen, & Hanewald, 1994; Leitenberg & Henning, 1995; Loren & Weeks, 1986; Mednick, 1977; Mosher & MacIan, 1994; Person, Terestman, Myers, Goldberg, & Salvadori, 1989; Plaud & Bigwood, 1997; Wilson, 1997; Wilson & Lang, 1981). The vast majority of this research has been conducted on sexual fantasy. Because of this, and due to the inherently private nature of fantasy, most previous studies have employed self-report methodology.

Leitenberg and Henning (1995) conducted a review of several hundred studies that examined a variety of facets involved in sexual fantasy. Several main gender differences were found with regard to the content of fantasy. Men's fantasies seemed to focus more on the woman's body and what he wants to do with it, as opposed to women's fantasies, which focus more on men's interest in their (the women's) bodies. It was also concluded that men's sexual fantasies focus more on explicit sexual acts, nude bodies, and physical gratification, whereas emotional context and romance are more often found in women's sexual fantasies.

Most studies examining the content of sexual fantasy have involved the use of some form of questionnaire to gather information from participants. Many of these questionnaires come in the form of checklists, which give the participant a set of sexual activities or situations and instruct the participant to indicate how often he or she fantasizes about the specific topic. Plaud and Bigwood (1997) administered the Wilson Sex Fantasy Questionnaire to 116 male participants to explore common themes of college-aged men in comparison to women and older men. It was found that the men had significantly more exploratory (e.g. group sex), intimate (e.g. heterosexual behaviors), and impersonal fantasies (e.g. sex with strangers) than the female sample (Plaud & Bigwood, 1997).

Wilson and Lang (1981) also conducted a factor analysis with regard to sexual fantasy content. Ninety individuals completed a mail-in questionnaire, and the factor analysis revealed four basic types of fantasies: (1) exploratory (e.g. group sex), (2) intimate (e.g. kissing), (3) impersonal (e.g. fetishism), and (4) sadomasochistic (e.g. whipping, spanking). All types of fantasies were more commonly reported by men, but

women were almost as high on the intimate factor. It was also found that women were more likely to report being passive or receptive in their fantasies, and men were more likely to report being active or pursuing sexual activity; this result has been found in several other studies as well (Mednick, 1977; Leitenberg & Henning, 1995). It is important to note that although men and women reported similar frequencies of engaging in intimate sexual fantasy, the fact that men are reporting the same frequency of intimate fantasies may be a ceiling effect, as men are more likely to engage in sexual fantasy than women overall.

Several other studies have explored gender differences in sexual fantasy content more directly using checklists. Hsu, Kling, Kessler, Knapke, Diefenbach, and Elias (1994) asked participants to categorize their experience with 55 different fantasies. Significant gender differences were found for 19 of the items. Men reported more experience with fantasies involving anal intercourse, having two or more lovers, sex with a virgin, making love with the possibility of being discovered, and whipping/beating partner more than women. Loren and Weeks (1986) conducted a similar study to compare men and women in frequency of differentially-themed fantasies. They found that men reported having fantasies involving anal sex, group sex, forcing someone else into sex, observing others having sex, and imagining the sexual anatomy of a partner significantly more often than women. Women reported fantasizing about giving in to having sex with someone after initially resisting more often than men did.

Some studies have focused specifically on expected gender differences in sexual fantasies about specific partners (e.g. stable partner, anonymous partner, group sex). Hicks and Leitenberg (2001) found that significantly more men reported fantasizing

about extradyadic partners than did women. Men also reported a higher percentage of their fantasies involving someone other than their current partner, while women were more likely to fantasize about their current partner than about someone else (Hicks & Leitenberg, 2001). Person, Terestman, Myers, Goldberg, and Salvadori (1989) also found that men reported a higher interest in partner variation in sexual fantasy as compared to women. Wilson (1997) hypothesized that differences in mating strategies would lead to differences in sexual fantasy content, with men being more likely to fantasize about anonymous and multiple partners than women, and women having fantasies involving close-bonded and famous partners more than men. As expected, men reported a significantly higher percentage of fantasy involving group sex than women, and while the other gender differences were small, women did report a higher prevalence of fantasies involving same-sex or famous partners than did men. Sex with strangers was a more common theme for men than for women.

Ellis and Symons (1990) surveyed over 300 students using a questionnaire designed to investigate gender differences in sexual fantasy. It was found that male fantasies focused on visual images (e.g. genital details, partner attractiveness), more than on contextual images (e.g. tactile stimulation, emotional reactions of self or partner); in women, this pattern was reversed, resulting in a greater degree of focus on contextual images as compared to visual images. Again, this pattern of gender differences is evident.

Some research investigating sexual fantasy content has collected data by having participants actually write their own fantasies, rather than having a checklist that is limited by the creator's imagination. Gold and Chick (1988) had 134 undergraduates

record three of their sexual fantasies and answer several questions about them. Each of the fantasies was scored for explicitness, length, and emotionality. Men were found to have more explicit fantasies and females recorded more emotional ones, and no difference was found on the length of the fantasies. Consistent with most previous research, the men in the sample tended to write more about sex acts and body parts, whereas women tended to focus more on the emotional aspects of fantasies. Follingstad and Kimbrell (1986) also had 210 college-aged participants write fantasies and were interested in length, explicitness, and variety in content. They found that males wrote longer, more explicit, and more varied (with respect to content) fantasies than females. It was again found that the males included more specific sex acts and sex organs than the female participants, providing further evidence for the body-centered, physical focus of men in sexual fantasy. Hardin and Gold (1988-1889) also had participants write three sexual fantasies which were then rated on a fantasy checklist. The male fantasies were found to be more explicit and mention group sex more often than female fantasies. The females mentioned themes of love and commitment significantly more often than the males.

Recent efforts in the erotica and pornography industry have focused more attention on attracting a greater number of female consumers. Candida Royalle, a former pornography actress, has become a prominent director and producer of female-oriented erotica, which is made to focus predominantly on aspects of sexual encounters that women typically report as more sexually arousing (e.g. emotions, romance, foreplay). One study compared both the psychophysiological genital response and subjective experience of women to male- and female-produced erotica (Laan, Everaerd, van Bullen,

& Hanewald, 1994). They found that while subjective arousal was higher for the female-produced film, genital response did not differ significantly between the two types of film excerpts (though response was substantial for both). Because of this difference, correlations between subjective and genital arousal were found to be nonsignificant. The disparity between self-reported arousal and genital response, while common, is particularly interesting in this case, as the subjective appraisal of arousal follows the conventional wisdom about what women attend to in sexual situations, but the lack of difference in genital response between the two types of films indicate they are essentially equally arousing, physiologically.

Several other studies have compared sexual arousal in men and women in relatively similar ways, finding similar results. One study presented men and women with both male- and female-oriented erotica and had participants self-report their levels of sexual arousal. While men showed similar responsiveness to both videos that were intended for men and women, women were far less responsive to conventional X-rated videos intended for men but relatively more responsive to videos intended for women (Mosher & MacIan, 1994). Another more recent study found similar differences using comparable methodology (i.e. male- versus female-oriented erotic film clips). Male and female research assistants each selected ten film clips that they rated as the most arousing, and then these twenty film clips were shown to participants, who rated them on a variety of factors including how arousing they found the film clips to be (Janssen, Carpenter, & Graham, 2003). It was found that women rated the female-selected clips as more arousing than the male-selected clips, and men rated the male-selected clips as more highly arousing than the female-selected clips, even though the clips had been

standardized for the sexual activities depicted, the amount of time devoted to foreplay, oral stimulation and intercourse, and the number and gender of actors participating in each of those activities. This finding further supports common gender differences established in this area of research.

One very notable exception to the wealth of self-report studies in this area is a study investigating gender differences in memory for erotica employing cognitive psychology methodology (Geer & McGlone, 1990). Geer and McGlone (1990) had 20 males and 20 females read a story describing a heterosexual encounter. The story contained romantic, erotic, and neutral elements. Memory was then tested using a recognition test. It was found that women were better and faster at identifying the romantic sentences, whereas men were better and faster at identifying erotic sentences (there was no difference in responding to neutral sentences). This study represents one of the few deviations from subjective self-report and physiological research in human sexuality, in that it applied purely cognitive methodology to a question in sexuality research. It is important to note that results similar to those found using different methodology were attained, providing support for expanding our base of techniques in the realm of human sexuality research.

These oft-reported gender differences in attentional focus of erotic stimuli have been explained by at least three theoretical positions: socio-evolutionary theory, social constructionism, and recent theorizing on the difference between male and female sexual desire. Ellis and Symons (1990), invoking socio-evolutionary principles, hypothesized that this disparity may be evolutionarily adaptive. For women, the value of a mate is based upon his ability to provide resources to both a woman and her offspring, which

would suggest that contextual cues such as expression of emotion and indications of social status and health may be important foci for sexual desire. Men determine a mate's value more based on physiological and psychological characteristics indicative of reproductive fitness, suggesting that anatomy and physical characteristics would be more sexually arousing than contextual cues.

It has also been theorized that this gender difference may be learned via messages regarding sexual relationships in childhood and adolescence (DeLamater, 1987). Socialization may prompt men to develop a recreational or body-centered orientation to sexual relationships, with the goal of sexual behavior as recreation and pleasure; women would be more likely to develop a relational or person-centered orientation, so that the goal of sexual behavior is to reinforce psychological and emotional intimacy. Whether the origin of these reported differences can be found in our biology or socialization (and most likely it is both), the robustness of this gender difference is clear evidence that differences in determinants of sexual desire will remain fairly constant throughout society and time.

Rosemary Basson has recently become a prominent theorist in the field of human sexuality. Her new perspective on the female sexual response cycle, which places an emphasis not on the physiological rewards of intercourse (e.g., physical stimulation, orgasm) but rather intimacy and emotion, has garnering increased interest in relevant literature (Basson, 2000; Basson, 2001). Basson argues that women's sexual satisfaction, in contrast to the more physically-oriented rewards of male sexual satisfaction, depends upon experiences and feelings such as intimacy, trust, communication, affection, bonding, sensual touching, and commitment (Basson, 2000; Basson, 2001). Although

much of Basson's ideas have been generated from clinical reports and not empirical research, this new perspective on the female sexual response cycle may help to explain the consistent gender differences in self-reported interest in sexual stimuli and fantasy. If women's sexual response is truly more driven by intimacy and commitment, then it is logical to believe women would be more attuned to cues of intimacy, such as physical closeness, facial emotional expressions, and contextual circumstances under which a sexual encounter may occur.

While it is often the case that women tend to report more emotion and context focused fantasies as opposed to men, who tend to focus more on naked bodies and physical acts, this finding does not always hold true. Schmidt, Siguisch, and Schafer (1973) instructed 120 female and 120 male participants read one of two stories that described a sexual experience of a young couple; one story included affectional components and the other did not. Physiological sexual responses (e.g. erection, vaginal lubrication, tingling in breasts) were recorded and emotional reactions were attained via self-report. They found that there was no significant interaction between sex and type of story, suggesting that overall differences in emotional reactions were not influenced by the fact that stories did or did not contain affectional components (Schmidt, Siguisch, & Schafer, 1973). It was also found that for both men and women, the sexual-physiological reactions while reading the story without affection were as great as they were while reading the story with affectional components. The authors noted that the overwhelming majority of participants registered physical correlates of sexual arousal while reading the stories. This study is clearly affected by the aforementioned weaknesses of self-reporting, but the fact that women reported no physical or emotional differences between

the stories with and without affection is fairly counterintuitive to what most research would suggest as the outcome.

Another study utilizing somewhat different methodology generated similar results. Tokatilidis and Over (1995) had 119 women rate on a Likert scale how sexually aroused they felt when employing nominated themes (sensual, genital, or sexual power) during sexual fantasy. It was found that, contrary to what might be expected, sensual themes evoked the least amount of sexual arousal, followed by sexual power themes, and genital themes as the most sexually arousing. This contrast is interesting as it seems that in general, past research suggests that women more often focus on contextual cues in fantasy, whereas this study suggests that genital cues may actually be more arousing to them.

Smith and Over (1991) investigated male sexual fantasy using the Male Sexual Fantasy Questionnaire developed by the authors. Factor analysis yielded five subscales: sensual, genital, public sex, sexual dominance-submission, and sexual aggression fantasies. Genital fantasies were rated as the most frequently employed fantasy, followed by sensual, public sex, sexual dominance-submission, and sexual aggression fantasies. Self-reported ratings of sexual arousal were also recorded, and a somewhat different pattern emerged. Genital fantasies were rated the most arousing, followed by public sex, sensual, sexual dominance, and sexual aggression fantasies. Meuwissen and Over (1991) developed a female version of this questionnaire to examine sexual fantasy patterns in women. Five dimensions of sexual fantasy were assessed, including genital, sensual, sexual power, forbidden sexual activity, and sexual suffering fantasies. Women reported genital fantasies were used with the highest frequency, followed by sensual, sexual

power, forbidden sexual activity, and sexual suffering fantasies. Genital fantasies were rated as the most arousing, followed by sensual, sexual power, forbidden sexual activity, and sexual suffering fantasies. It is difficult to make cross-gender comparisons from these two studies, as the individual factor analyses did not result in the same fantasy themes, but it appears that genital fantasies were rated as both the most commonly used and the most arousing for both men and women. This finding is somewhat surprising, as most research would suggest that women would be more inclined to use sensual fantasies than genital fantasies.

Several studies examining gender differences in response to male- or female-oriented erotica have also not found these typical gender differences. One study presented men and women with one scene of a sexual encounter that was prefaced with instructional sets that established either a lust or a love scene (Fisher & Byrne, 1978). No significant gender differences were found between the lust and love instructional sets for the same scene. In a different experiment, a casual sex theme was added to the lust and love scenes, and it was found that both men and women reported more sexual arousal to the casual sex theme than by those involving love or lust (Fisher & Byrne, 1978). A more recent study presented college-aged men and women one of four videos that manipulated the expression of love and affection (high or low), as well as sexual explicitness (high or low) (Quackenbush, Strassberg, & Turner, 1995). Results indicated that both male and female participants rated the high explicit/high romantic video as significantly more arousing than the high explicit/low romantic video, indicating that romantic aspects of sexual encounters (e.g. kissing, nongenital touching) are important for sexual arousal in both men and women (Quackenbush, Strassberg, & Turner, 1995).

Here it is seen again that while these gender differences may be very prominent in sexual fantasy, these gendered preferences may not always be found when actually viewing erotic materials.

Regardless of the origin, the hypothesis that men are more genitally/physically oriented and women focus more on contextual cues and emotion in sexual situations has generally been supported. The few studies that did not find this gender difference make it even more interesting as a topic of study, as new methodologies have the potential to extract previously untapped information with regard to phenomena and add to our collective understanding of human sexuality. It is for this reason that eye-tracking, a cognitive measure of visual attention and processing, has been chosen to further examine these gender differences.

Eye-tracking and Scene Perception

Eye-tracking is a cognitive technique used in hundreds of labs across the world. While the specific eye-trackers used may vary in brand and acuity, the idea across all of the equipment is the same: the eye-tracker measures and records eye movements as the participant is presented with different types of visual stimuli. Stimuli used in studies have varied greatly, from literature to investigate reading patterns, to famous works of art in order to glean a better understanding of visual perception and cognitive processes such as attention and memory. For the purposes of applying this methodology to questions of sexuality, I will focus primarily on eye movements during scene viewing.

Henderson and Hollingworth (1998) reviewed the eye movement literature with regard to scene perception, and provided three reasons as to why it is important to

understand eye movements during scene perception. First, eye movements are critical for the efficient and timely acquisition of visual information during visual-cognitive tasks, and the manner in which eye movements are controlled to assist information acquisition is a question of much importance. Second, information about how the visual environment is acquired, represented, and stored is a critical question in the areas of perception and cognition. Third, eye movement data provide an unobtrusive, continuous measure of visual and cognitive information processing. Applying these to the processing of erotic stimuli, eye-tracking methodology has the potential to inform us in an objective and continuous way about what and how individuals attend to when exposed to visually erotic situations. For example, do their viewing patterns confirm self-report data about gender differences in focus on bodies versus contextual cues?

Eye movements during scene viewing typically have been divided into two distinct temporal phases: fixations and saccades. Fixations have been defined as "periods of time when the point of regard is relatively (though not perfectly) still", and saccades have been defined as "periods of time when the eyes are rotating at a relatively rapid rate to reorient the point of regard from one spatial position to another" (Henderson & Hollingworth, 1998). Visual attention has been defined as the "selective use of information from one region of the visual field at the expense of other regions in the visual field (Henderson, 1992), and a scene is typically defined as "a semantically coherent (and often nameable) view of a real-world environment comprising background elements and multiple discrete objects arranged in a spatially licensed manner" (Henderson & Hollingworth, 1999). For the purposes of this study, the following will focus on the fixation aspects of scene viewing.

Much research has been conducted to examine the intricacies of scene perception, often revealing very interesting patterns that provide a glimpse of cognitive perception. Henderson (1993) concluded that landing position distributions indicate that the preferred fixation location on an object is the center of the object. This finding is consistent with other research on the topic (Rayner, 1979). Biederman, Mezzanotte, and Rabinowitz (1982) presented participants with pictures that included some sort of violation (e.g. floating fire hydrant, a fire hydrant on top of a mailbox, a fire hydrant in a kitchen). Response times were measured with regard to how fast the participant could correctly detect the violation. It was found that violations of semantic relations were detected more accurately than violations of interposition (e.g. background appears to pass through the object), and at least as accurately as violations of support (e.g. floating objects that should not float). The semantic violations were at least as disruptive and detectable as the other violations, leading the authors to conclude that semantic relations appear to be accessed at least as quickly as relations which can be defined by physical parameters. If this pattern were to be examined in a sexual scene, one would hypothesize that semantic violations (e.g. a tractor in a bedroom where two people are engaging in intercourse) would be identified more accurately than other violations (e.g. the bed appearing to pass through the figures in the scenes). It would also be of interest to see if women could detect these violations more quickly, as self-report data suggests they tend to be more contextually focused and may spend more time looking at the contextual aspects of erotic images.

There has been extensive research conducted to examine where people look in scenes and why certain patterns tend to emerge. One such constant pattern is the greater

fixation density and overall time of fixations on "informative" objects in scenes. An early study researching scene viewing concluded that fixation positions were highly regular and were related to the informativeness of regions in the pictures (Buswell, 1935). He stated that "eye movements are unconscious adjustments to the demands of attention during a visual experience. The underlying assumption in this study is that in a visual experience the center of fixation of the eyes is the center of attention at a given time" (Buswell, 1935).

This finding has been replicated repeatedly throughout the course of history of eye movement research across a multitude of different tasks and experiments, leading Henderson and Hollingworth (1998) to conclude that the positions of independent fixations in a scene are determined in part by the informativeness of scene regions, with more fixations being directed to more informative regions. Mackworth and Morandi (1967) conducted a study to examine the idea of informativeness of scene regions. They had one set of 20 participants view one of two pictures for 20 seconds, and after the scenes had each been divided into 64 squares, a different set of 20 participants rated each square for its recognizability. Both measures gave high readings for the same areas, i.e. the areas that were rated as the most informative were also the areas that had the highest fixation densities in the first set of participants.

Antes (1974) also found a similar pattern in scene-viewing using a similar technique. Twenty subjects were presented with 10 pictures for 20 seconds each. The informativeness of certain regions of the pictures had been determined independently by 20 different subjects; in this study, several pictures from the Thematic Apperception Test were used, and the informative regions were typically the faces of figures in the pictures

and other identifying features. A strong relationship was found between rated informativeness and fixation density. He concluded that fixations on informative areas were concentrated toward the initial few seconds of viewing, and that less informative detail received a greater proportion of the fixations later in viewing. The studies reviewed above would clearly suggest that areas that are more informative in sexual scenes will be fixated longer than those that are not as informative. What is of particular interest to the current study is if these "informative" areas differ between the genders.

Loftus and Mackworth (1978) conducted a study to delineate the underlying psychological mechanisms that cause one area of a picture to be both rated as more informative and fixated more often than others. They presented participants with scenes that contained either an uninformative object (i.e. a tractor in a farm scene), or an informative object (i.e. an octopus in a farm scene). It was found that observers fixate earlier, more often, and with longer durations on objects that have a low probability of appearing in a scene (informative), as compared to objects that have a high probability of being in the scene (uninformative) (Loftus & Mackworth, 1978). They concluded that this finding shows that considerably more processing is being allotted to informative objects. Several researchers have criticized the findings of this study (DeGraef, Christiaens, & d'Ydewalle, 1990; Rayner & Pollatsek, 1992), questioning whether the results may have been due to visual factors (e.g. lines, contours), rather than semantic inconsistency. However, it is likely these differences would have affected only first gaze duration (and not total fixation duration), as results similar to those of Loftus and Mackworth (1978) have been replicated. Again, this would suggest that if women are more contextually focused than men, they should allot more time to the semantically

informative regions or objects than men, and potentially even fixate on them more quickly than men.

Several prominent researchers in the field of eye-tracking have developed theories to explain these common findings (e.g. attentional focus to informative regions of scenes). Henderson and Hollingworth (1998) proposed a model of control in scene viewing that is meant to account for fixation placement and fixation duration for those fixations that are directed in the service of visual analysis and cognitive processing. They theorize that initially, a region's salience is determined by visual factors (e.g. luminance, contrast, texture, color), as this is the only information that is available about each region. The saliency map framework suggests that the visual information acquisition system follows two rules: (1) visual-spatial attention is allocated to the scene region with the highest saliency weight (Koch & Ullman, 1985), and (2) the eyes attempt to stay fixated on the attended scene region (Henderson, 1992; Henderson & Ferreira, 1990; Henderson & Ferreira, 1993). When the eyes are fixated, the amount of time they stay fixated will be determined by the amount of time needed to complete perceptual and cognitive analyses of that region. Once processing is complete, the saliency weight for that region is reduced and attention is relocated to the region that now has the highest saliency weight. Within this model, Henderson and Hollingworth (1998) assume that the source of the saliency weight for a given scene region will change from primarily visual to primarily cognitive interest as regions are fixated and understood. This change eventually leads to a greater fixation density and total fixation time on semantically interesting objects and scene regions (Henderson & Hollingworth, 1998), as has been found in many studies (Antes, 1974; Buswell, 1935; Loftus & Mackworth, 1978;

Mackworth & Morandi, 1967). This theory would propose that past the first fixation, men and women will tend to spend greater fixation time and density on the informative regions. From the self-reporting of attentional focus, I anticipate gender differences in these patterns such that women will spend greater fixation time and density on contextual aspects of erotic images, and men will spend greater fixation time and density on the physical and genital portions of sexual pictures.

It often been stated that the brain is the most important sexual organ (Zilbergeld, 1992), however little research as of yet has directly tested or explored this idea. Important reasons associated with employing a methodology from cognitive psychology to human sexuality research include the avoidance of biases associated with self-report and physiological research, as well as the ability to examine sexuality and sexual behavior from where it is derived—the brain. Eye-tracking is a particularly relevant measure of such cognitions, as external visual stimuli comprise an important part of the phenomenology of sexual experience. The current study intends to address these previous issues of bias from other methodologies, and concurrently examine gender differences in attentional focus of erotica in greater detail than has ever been done before.

Aims of the Study

My first aim of this study was to pilot a methodology from cognitive psychology (eye-tracking) to questions of human sexuality. I was interested in testing the feasibility of using this methodology to examine aspects of human sexuality and sexual behavior. A second aim was to validate the gender difference found in self-reported erotic stimuli preferences. To this end, I showed images of both sexual and nonsexual content to men

and women, and measured their eye movements as they looked at these scenes on a computer screen. Based on the results of this study, the results that have been found in self-report regarding gender differences in attentional focus would be either supported or not.

Hypotheses

1. Women will have longer fixation durations on the faces of the figures in the images than the rest of the bodies.
2. Men will have longer fixation durations on the bodies of the figures in the images than the faces.
3. Women will have longer fixation durations than men on facial aspects of the stimuli.
4. Men will have longer fixation durations than women on body parts.
5. Women will have longer fixation durations than men on contextual aspects (non-human) of the stimuli.
6. These patterns will exist independently of normal viewing patterns of non-erotic images.

CHAPTER 3

METHODOLOGY

Participants

Twenty male and 20 female undergraduate students participated in the study. All were 21 years of age or older, and they had normal or corrected to normal vision. Participants were compensated by receiving research credit as part of requirements for an introductory psychology course. They remained naïve with respect to the purpose of the study until debriefing. Data was removed from analyses for any participants who evidenced grossly anomalous viewing patterns. The University of Nevada Las Vegas Institutional Review Board (IRB) approved this study in June of 2003 before any participants were run.

Materials and Design

The images for this experiment consisted of 30 three-dimensional digital color scenes, 15 of which are erotic and 15 which are non-erotic. Of the 15 scenes in each of the aforementioned categories, 5 are of individual men, 5 are of individual women, and the remaining 5 are images of couples (i.e. a man and a woman). The erotic scenes of individuals consisted of men and women in various states of undress positioned provocatively. The matched non-erotic scenes consisted of men and women in the same poses and similar situations as those in the erotic scenes but devoid of the erotic content

(e.g. the person in the erotic image is nude and the individual in the non-erotic image is clothed). The erotic pictures of couples consisted of one man and one woman engaged in erotic foreplay in various states of undress. The matched non-erotic pictures were men and women in similar positions and similar situations but lacking the erotic content. Scenes were viewed at a distance of 82cm. There were two phases of the experiment for each participant; the first phase was a practice session, in which the individual was shown images of people in various non-erotic situations, in order to obtain a potential baseline of the participant's typical viewing patterns of pictures that include people should one be needed. The second phase was the test phase, in which the participant was shown the erotic and non-erotic images chosen for this study.

Apparatus

The stimuli was displayed at a resolution of 1024 x 786 pixels x 256 colors on a True Color monitor using a Radon VE ATI Graphics card operating at a refresh rate of 85 Hz.

Eye movements were recorded by an SMI Eyelink headband-mounted eye-tracker, which is carefully balanced to be comfortable even with extended use. The system uses infra-red (940nm) video-based technology to simultaneously track the eyes and head position composition. Eye positions were sampled at 250 Hz. Viewing was binocular, although only the position of the right eye was tracked.

Procedure

The participants began the experiment by reading the informed consent and answering questions regarding their vision. The experimenter orally described the eye-tracking equipment as he or she positioned the helmet on the participant's head. Participants were encouraged to ask questions at any time, but they were instructed to try to remain still once the eye-tracker has been placed on his or her head. Once all questions had been answered, the eye-tracker was calibrated. Calibration consisted of having the participant fixate nine markers on the display area, and the calibration was checked by having the participant perform the same task again. The Eyelink system was calibrated to each individual until the average error in gaze position is 0.5°. Once the eye-tracker was successfully calibrated, the practice session began.

The practice session consisted of the presentation of three images of people in non-erotic situations to examine the participants' normal viewing patterns of scenes that include people. After the practice session was completed, the experimenter again asked the participant if he or she had any questions, and continued with the experimental session once all questions had been answered. In the experimental session each participant was presented with 20 scenes: 10 images of individuals (5 erotic and 5 non-erotic) and 10 images of couples (5 erotic and 5 non-erotic). Due to the experimenter's concerns of comfort for participants, male participants were only shown individual images of women, and female participants were only shown individual images of men. Both male and female participants were shown the 10 couples pictures. Participants were presented with the images of the individuals first, followed by the couples images. The presentation of erotic and non-erotic image sets (individual vs. couple) was

counterbalanced across all subjects, so that an equal number of participants saw erotic images first versus non-erotic images first.

Upon completion of the eye-tracking portion of the study, participants completed a short questionnaire (see Appendix). The questionnaire consisted primarily of questions regarding demographic variables (e.g. age, ethnicity, sexual orientation, handedness, religious affiliation). There were also be several questions regarding potential prior exposure to images and individuals in those images used in the study. Additionally, in order to ensure that the manipulation of erotic vs. non-erotic pictures was successful, we asked participants to rate how arousing they found each set of pictures. Participants checked one of five boxes; 1 indicated the set of images was "very unarousing", 2 indicated "somewhat unarousing", 3 indicated "neither arousing nor unarousing", 4 indicated "somewhat arousing", and 5 indicated "very arousing". The experiment lasted approximately 30 minutes.

Data Analyses

Descriptive analyses were completed for participant variables. Analyses were computed for both subjects and items (F1 and F2) at the .05 level. The three dependent measures of interest were total number of fixations, first gaze duration, and total time. These three eye-tracking measures are the most commonly reported dependent variables in cognitive literature, and it is often theorized that total number of fixations is a measure of drawing attention, and first gaze duration and total time are indicative of an object in the image maintaining attention (Henderson, 2004). ANOVAs were used to examine mean differences in total number of fixations, first gaze duration times, and total times

for the different scene regions within each gender. Gender X scene region comparisons for number of fixations, first gaze duration times, and total times were examined using F-tests. Analyses were completed for the non-erotic and erotic images both within each gender and between men and women (for the couples pictures).

Due to the concern that participants may have spent longer amounts of time in the regions that comprised larger amounts of space in the picture (i.e., if participants looked more at the body than the face because the body is bigger than the face), the raw data of the three dependent variables was transformed into ratio scores. Ratio scores were computed by dividing the dependent variable for a particular scene region (e.g., total number of fixations) by the percentage of space the scene region comprised. All analyses were computed on these transformed data to control for the impact of scene region size on viewing measures.

CHAPTER 4

RESULTS

Overview of Analyses

First, descriptive analyses were conducted on the participants' sociodemographic characteristics. Second, we examined whether these socio-demographic characteristics, the order of presentation of images, or specific images covaried in any significant way with the dependent measures. Third, we examined the effectiveness of the experimental manipulation by comparing the self-reported arousal value of erotic and non-erotic images in women viewing individual images of men, men viewing individual images of women, and both men and women viewing the images of couples. Fourth, we analyzed the viewing patterns of women shown images of individual men, looking for differences in attention to two different scene regions (face and body) and condition (i.e., erotic or non-erotic). Fifth, we repeated this analysis on men shown individual images of women. Sixth, we examined gender differences in the viewing patterns of men and women when shown images of couples, in regard to three different scene regions (face, body, and context).

Sample Description

A total of 49 individuals participated in the study. One individual was excluded because his eye-tracking patterns were more than two standard deviations above or below

the mean participants' gender on fixation measures. The last eight consecutive participants run were also excluded in order to maintain even numbers of individuals in each group for the Latin Square design. The final sample consisted of 40 individuals, 20 men and 20 women. The men in the sample were somewhat older than the women (M = 23.9, SD = 2.99 and M = 23.0, SD = 2.35 respectively), although this difference was not significant. All participants were right-handed, and all identified as heterosexual. Ethnic and religious distributions are summarized in Table 1. Results indicated comparable ethnic distributions, but the male sample was more diverse with regard to religious identification, and more likely to report a religious affiliation.

Covariation

Several analyses were performed to determine whether covariates in the data existed. First, regression analyses were conducted on each dependent variable (e.g., total number of fixations, total time, first gaze duration), for each scene region (e.g., face, body, context) in each condition (erotic vs. non-erotic). Three socio-demographic variables were regressed onto each of these measures, and these were age, ethnicity (Caucasian vs. non-Caucasian), and religion (religious vs. non-religious). Sexual orientation and handedness were not used in the regression analyses because all 40 participants identified as heterosexual and right-handed. No significant pattern of relationships between the predictors and dependent variables was found. Additionally, to determine whether the order of presentation contributed to participants' viewing patterns, I regressed the order of presentation onto each of the aforementioned dependent variables. Again, no significant pattern of relationships emerged.

In order to ensure that no single picture in each set of the images (e.g., individual females, individual males, couples) was contributing significantly to the results, one-way ANOVAs were performed on each dependent variable with the images as the independent variable (5 levels, one for each image in each set of pictures). The results showed no significant patterns, thus providing support that the images were sufficiently similar to one another.

Because there are large differences in the sizes of regions in the scenes (i.e., bodies account for a larger proportion of the total image than do the faces), it was essential to control for region size. This was accomplished by transforming all raw data into ratio scores. The ratio score was computed by dividing the raw data by the percentage of the image accounted for by the scene region in question.

Viewing Patterns of Women Gazing at Male Images

The 20 women in this sample were presented with 5 erotic images of individual men and 5 matched non-erotic images of men in similar situations. One a scale of one to five, the women rated the erotic images as somewhat arousing (M = 3.4, SD = .68), and the non-erotic images as generally somewhat unarousing (M = 2.4, SD = 1.05). A within-groups ANOVA comparing these two means revealed that the erotic images were rated as significantly more arousing than the non-erotic images ($F(1,19) = 17.27$, $p < .01$), providing evidence for the successful manipulation of eroticism.

The first hypothesis was that women would look longer at the faces in the images than at the bodies. Means and standard deviations for the raw data and region size-adjusted transformation are reported in Table 2. 2-way repeated measures ANOVAs

were conducted to determine within-subjects differences in scene region and condition type for the three dependent variables (e.g., total number of fixations, first gaze duration, total time).

For total number of fixations, a significant main effect was found for condition ($F(1, 19) = 39.08, p < .001$) and scene region ($F(1, 19) = 129.51, p < .001$), as well as a significant scene region X condition interaction ($F(1, 19) = 30.09, p < .001$) (see Table 3). The main effect for condition indicated that the face had significantly more fixations than the body; the scene region X condition interaction showed that while women had significantly more fixations on the face than the body in both conditions, the difference was larger in the non-erotic condition.

With regard to first gaze duration, a significant main effect was found for condition ($F(1, 19) = 28.85, p < .001$), scene region ($F(1, 19) = 43.52, p < .001$), and a significant condition X scene region interaction was also observed ($F(1, 19) = 20.75, p < .001$) (see Table 4). First gaze durations were longer on faces than bodies, and there was also a significant interaction, while women had longer first gaze durations on the faces than the bodies in both conditions, this difference was significantly longer in the non-erotic condition.

For total time analyses, a significant main effect was found for condition ($F(1, 19) = 42.19, p < .001$), scene region ($F(1, 19) = 143.45, p < .001$), and a significant scene region X condition interaction was also found ($F(1, 19) = 35.2, p < .001$) (see Table 5). Women spent significantly more time on the faces than bodies, and this difference was significantly larger in the non-erotic condition than the erotic condition.

Thus, the first hypothesis was supported on all three dependent variables, providing support for the idea that women are more interested in faces than bodies when looking at images of men, regardless of erotic content. Additionally, there were significant differences between the two conditions, such that women looked longer at the faces than the bodies in this pictures regardless of the condition, but this differences was significantly larger in the non-erotic condition as compared to the erotic condition.

Viewing Patterns of Men Gazing at Female Images

The 20 male participants were presented with 5 erotic images of individual women and 5 non-erotic matched pictures of women in similar situations without the erotic content. Men rated the erotic pictures as somewhat arousing (M = 3.95, SD = .39), and the non-erotic pictures as neither arousing nor unarousing (M = 2.8, SD = .83). A within-subjects ANOVA comparing these two conditions revealed that the erotic pictures were rated as significantly more arousing than the non-erotic images ($F(1,19) = 40.04$, $p < .001$), suggesting that the manipulation of erotic vs. non-erotic content was successful.

The second hypothesis was that men would look longer at the bodies in the images than the faces. Means and standard deviations for the raw data and region size-adjusted transformation are reported in Table 6. 2-way repeated measures ANOVAs were conducted for each of the dependent variables.

For total number of fixations, a significant main effect was found for condition ($F(1, 19) = 73.55$, $p < .001$), scene region ($F(1, 19) = 68.36$, $p < .001$), and a significant scene region X condition interaction was found ($F(1, 19) = 59.94$, $p < .001$) (see Table

7). Men looked more at the face than the body in both conditions, although this difference was much larger in the non-erotic condition than the erotic condition.

Next, analyses were conducted on the dependent variable of first gaze duration (see Table 8). A significant main effect was found for condition ($F(1, 19) = 25.91, p < .001$), scene region ($F(1, 19) = 34.36, p < .001$), and a condition X scene region interaction was also found ($F(1, 19) = 17.57, p < .001$). First gaze durations were significantly longer on the faces than the bodies, and this difference was significantly larger for the non-erotic pictures than the erotic pictures.

Finally, analyses on total time durations were conducted (see Table 9). Significant main effects were found for condition ($F(1, 19) = 63.60, p < .001$), scene region ($F(1, 19) = 72.01, p < .001$) and a significant scene region X condition interaction was also found ($F(1, 19) = 26.02, p < .001$). Men looked significantly longer at the faces than the bodies in the images in general, and the interaction indicated that this difference was significantly larger in the non-erotic pictures than the erotic pictures.

Thus, the second hypothesis was not supported for any of the three dependent variables. The results provided evidence for the idea that men are more interested in faces than bodies when looking at images of women, regardless of erotic content. Additionally, there were significant differences between the two conditions, such that men looked at the faces longer than the bodies in both conditions, but this difference was significantly larger in the non-erotic condition than the erotic condition.

Viewing Patterns of Men and Women When Gazing at Couples Images

Both men and women were shown the same 5 images of heterosexual couples in erotic situations and 5 matched pictures of couples in similar situations but without the erotic content. A mixed design 2-way ANOVA with gender as the between-groups variable and condition as the within-groups variable showed that overall, both men and women rated the erotic pictures as significantly more arousing than the non-erotic pictures ($F(1, 38) = 54.18, p < .001$). There was no main effect for gender and no gender X condition interaction, suggesting that men and women did not differ significantly as to how arousing they rated the images.

Means and standard deviations for the raw data and region size-adjusted transformation are reported in Table 10 for women and Table 11 for men. There were three hypotheses in regard to the couples images. Hypothesis three stated that women would have longer fixation durations than men on facial aspects of the stimuli. The fourth hypothesis stated that men would have longer fixation durations than women on body parts. Finally, the fifth hypothesis was that women would have longer fixation durations than men on contextual aspects of the stimuli.

Hypothesis three stated that women would have longer fixation durations than men on facial aspects of the stimuli; this hypothesis was not supported for total number of fixations (see Table 12), first gaze duration (see Table 13), or total time (see Table 14). 3-way mixed design ANOVAs on all three dependent measures failed to reveal any main effects for or interactions with gender as the between-groups variable. Posthoc tests of simple effects also failed to show any significant findings for gender differences.

Hypothesis four stated that men would spend a greater amount of time looking at the bodies of the figures in the pictures than the women. This hypothesis was also not supported for either total number of fixations (see Table 12), first gaze duration (see Table 13), or total time (see Table 14). Again, 3-way ANOVAs on the three dependent variables revealed no significant main effects or interactions involving gender. Similarly, posthoc tests of simple effects also found no significant results for gender.

Finally, the fifth hypothesis stated that women would spend more time looking at the contextual aspects of the scene than men. This hypothesis was also not supported for total number of fixations (see Table 12), first gaze duration (see Table 13), or total time (see Table 14). Both the 3-way ANOVAs and subsequent tests of simple effects failed to show any significant findings for gender.

Although the predictions of gender differences were not supported, several significant results were found. Because sphericity was found to be violated for all three dependent measures, Greenhouse-Geiser results are reported. With regard to the dependent variable of total number of fixations (see Table 12), main effects for condition ($F(1, 38) = 5.25, p < .05$) and scene region ($F(1, 38) = 266.34, p < .001$) were found; additionally, a condition X scene region interaction was observed ($F(1, 38) = 16.17, p < .001$). Subsequent tests of simple effects showed that the participants had significantly more fixations on the face than the body ($F(1, 38) = 156.90, p < .001$) and context ($F(1, 38) = 356.76, p < .001$). Additionally, this difference was even more pronounced in the non-erotic pictures than the erotic pictures ($F(1, 38) = 15.64, p < .001$).

Significant differences were also found in the first gaze duration analyses (see Table 13). A significant main effect for scene region was found ($F(1, 38) = 426.70, p <$

.001). Tests of simple effects revealed that participants looked longer at faces than both bodies ($F(1, 38) = 334.80, p < .001$) and the context of the scene ($F(1, 38) = 495.39, p < .001$).

Results of total time analyses are reported in Table 14. A significant main effect was found for scene region ($F(1, 38) = 254.71, p < .001$), and a significant condition X scene region interaction was observed ($F(1, 38) = 4.54, p < .05$). Subsequent tests of simple effects revealed again that participants looked longer at the faces than both the bodies ($F(1, 38) = 188.80, p < .001$) and the context of the scene ($F(1, 38) = 311.21, p < .001$).

The overall results of the analyses on the couples pictures showed some very interesting patterns. The hypotheses were based upon very consistent findings in human sexuality research, and those based on the couples images were not supported. There were no gender effects for any of the dependent measures, suggesting that gender does not have an effect on the viewing patterns of visual erotic stimuli. However, there were significant differences found with regard to condition and scene region, such that erotic and non-erotic pictures had significantly different eye-tracking patterns, and that the participants looked at the different scene regions statistically different amounts of time (i.e., both men and women looked at faces longer than both bodies and context). The condition X scene region interactions observed showed that while both men and women looked at faces more than bodies, this difference was again larger in the non-erotic pictures than the erotic pictures.

CHAPTER 5

DISCUSSION

The one hypothesis that was tested by all analyses in this study (women looking at men, men looking at women, men and women looking at couples) was that eye-tracking methodology would capture differences in the way people attend to erotic versus non-erotic visual stimuli. This hypothesis was strongly confirmed throughout. Although faces enjoyed longer fixation durations than bodies and context in erotic images, the difference was significantly larger in the non-erotic stimuli. From the basis of this methodological hypothesis, the study then tested five hypotheses emanating from the literature on gender differences in largely self-reported attentional focus in sexual situations. These hypotheses were that 1) women would have longer fixation durations on the faces of the men in the images than on their bodies; 2) men would have longer fixation durations on the bodies of the women in the images than on their faces; 3) women would have longer fixation durations than would men on faces of the couples in the images; 4) men would have longer fixation durations than would women on the bodies of the couples in the images; and 5) women would have longer fixation durations than would men on contextual aspects (the scenario) of the images. The only one these hypotheses for which support was found was the first one. Women did indeed look longer at faces than atbodies, but so did men, and there were no gender differences to speak of. The meaning of these results will now be examined in the order presented.

The fact that eye-tracking in this study was able to capture differences in the way people look at erotic versus non-erotic stimuli is encouraging in that it opens up sex research to this new methodology and all of its potential. As a continuous, online measure of visual attention, eye-tracking bypasses many of the disadvantages that plague the most frequently employed methodologies in human sexuality research. The discipline has heretofore been quite limited in its ability to access an objective record of people's inner experiences. Retrospective self-report, the most common method used by researchers in sex research, is riddled with potential confounds (as reviewed by Catania et al., 1990 and Catania et al., 1995), such as those possibly introduced by self-presentation bias, recall errors, motivational differences, method of data collection, and problems with potential over- or under-reporting of less socially acceptable behaviors. All of these factors present potential threats to the quality and validity of data obtained from studies based on retrospective self-report. Even sampling or monitoring methodology is not without its own problems, primarily regarding questions of the representativeness of samples and the accuracy of the data obtained (Leigh, Gillmore, & Morrison, 1998). Experimental manipulations of experiences, such as mood and cognitive distraction, tend to lack external validity, and psychophysiological research continues to be compromised by consistently low correlations between physiologic and subjective ratings of arousal for women (Dekker & Everaerd, 1988; Heiman, 1977; Laan & Everaerd, 1995; Rowland, 1999; Steinman, Wincze, Sakheim, Barlow, & Mavissakalian, 1981;Wincze, Vendetti, Barlow, & Mavissakalian, 1980), as well as questions of test-retest reliability and potential reactivity of physiological measurement in men (Janssen, 2002).

When dealing with a topic as sensitive and private as sexuality, it is clearly difficult to design the "perfect" study, and researchers have used the methods available to them as best they could. However, many in the field have noted a need for new methods that can provide reliable, objective data from which to draw solid conclusions (Abramson, 1990; Bancroft, 1999; Catania, 1999). Eye-tracking methodology may be a promising one in its ability to tap into aspects of attention and arousal. There is significant research in scene perception supporting the idea that people spend the greatest amount of time looking at objects that are of most interest to them (Antes, 1974; Buswell, 1935; Henderson & Hollingworth, 1999; Henderson & Hollingworth, 1998; Loftus & Mackworth, 1978; Mackworth & Morandi, 1967). Whether further investigations into sexual questions using eye-tracking methodology find a direct link between fixations times and arousal remains to be tested, but it seems intuitive to posit such a hypothesis in sexually functional individuals. Furthermore, testing with sexually dysfunctional individuals may reveal a different relationship between attention and arousal. They may be more distractable or maybe even focus more on that which makes them anxious, rather than aroused. Whatever the case may be, there are many potential applications of eye-tracking methodology to sexuality research and this study basically provides support, at the very least, for its applicability.

The fact that participants in this study processed sexual information in a significantly different manner than they did non-sexual information provides further support for a growing body of literature asserting the same (Geer, 1996). A number of researchers are promoting the use of an information processing approach (IPA) to the study of sexuality (Geer, 1996). They believe it is useful to conceptualize people as

working organisms who are constantly flooded with incoming information. This information can come either internally (i.e., from within the system or body), or externally (i.e., from the environment) and it is either given access or rejected, processed if taken in, and used for subsequent responses and decision making. Massaro and Cowan (1993) stated that, "The basic notion of IP (Information Processing) is that one must trace the progress of information through the system from stimuli to response." That progress has thus far been researched at the levels of attention, memory and the organization of sexual information. Past research (Geer & Ballard, 1996) has shown that both men and women respond more slowly in identifying a stimulus when an erotic element is present than when there is no erotic element (sexual content induced delay). Significant gender differences have been found in memory for sexual information (Castille & Geer, 1993; Geer, Judice, & Jackson, 1994; Geer & McGlone, 1990) as well as in the organization of sexual information in semantic networks (Geer, 1996; Manguno-Mire & Geer, 1998). All of these studies support the contention that the brain is doing something differently when presented with sexual stimuli.

The present study adds to this body of research by investigating the very first step in the progress from stimulus to response—visual attentional capture. Whatever meaning we attach to what people first look at or spend the longest time looking at, it is, at the very least, evidence of attentional capture and the most elemental step in visual information processing. What this study tells us is that there is a significant difference in the way that visual sexual information is processed when compared to visual non-sexual information. This study represents the first visual test of this cognitive processing difference.

Having established that this study supports a difference in the way sexual versus non-sexual information is processed, let us now turn our attention to what the current study found no support for – gender differences in the processing of sexual stimuli.

The most commonly self-reported gender difference in sexual attentional focus, both in real life and in fantasy has been that men focus more on the physical or genital aspects of a sexual stimulus, and that women focus more on the emotional or contextual cues of a sexual stimulus or scenario. This supposed gender difference has been reported in a wealth of studies examining sexual fantasy (see review by Leitenberg & Henning, 1995), psychophysiological response to different types of erotica (Lann, Everaerd, van Bullen, & Hanewald, 1994; Mosher & MacIan, 1994), and memory for different aspects of a written sexual story (Geer & McGlone, 1990). The replication of this difference using eye-tracking would have added convergent validity to this largely self-report literature. The fact that eye-tracking in this study did not confirm the gender differences could have one of two implications, at the very least. Either the results in the literature are invalidated by their reliance on self-report or, alternately, eye-tracking and self-report are accessing different aspects of the same experience. A more detailed review of the results for each hypothesis would be helpful here.

Female participants evidenced longer fixation duration for the faces in the images than for the bodies across both erotic and non-erotic conditions. The difference, however, was even larger in the non-erotic image set, indicating that women spent more time on other aspects of the picture (i.e., the bodies) in the erotic image. Male participants also had longer fixation durations on the faces of the women in the images than on their bodies across both erotic and non-erotic conditions. As in the case of the female

participants, there was a significant interaction between condition and scene region, such that while men looked longer at the faces than the bodies in both conditions, this disparity was even larger in the non-erotic condition. The third, fourth, and fifth hypotheses tested the oft-reported gender differences in attentional focus to erotic stimuli, and these were tested on the pictures of couples in both erotic and non-erotic conditions. Both men and women were presented with the same pictures, allowing for valid cross-gender comparisons on these sets of images. The third hypothesis predicting that women would have longer fixation durations than men on facial aspects of the stimuli was not supported. Men and women looked for similar amounts of time at the faces of the individuals in the images. The fourth hypothesis predicting that men would have longer fixation durations than women on body parts was also not supported. Men and women were similarly interested in the bodies of the individuals in the images. The fifth hypothesis predicting that women would have longer fixation durations than men on contextual aspects (non-human) of the stimuli also went unsupported. Men and women did not significantly differ on the amount of time each spent on contextual aspects of the images.

Thus, it can be concluded that eye-tracking methodology in this study found evidence contrary to that of most studies examining gender differences in sexual attentional focus. Specifically, this study found no difference in the amount of attention men and women devote to different components of an erotic stimulus. Both are most interested in faces, similarly interested in bodies, and least of all, but similarly interested in the contextual aspects of visual erotic stimuli.

The results found in this study are quite interesting, insofar as the majority of the predictions were formulated based on the preponderance of previous research and were largely unsupported. Because the common gender difference in attentional focus of erotic stimuli was not found, we are left to wonder what to infer from these results. First of all, not all studies have found a gender difference in preferences for different aspects of sexual stimuli. A number of studies found that stories, fantasies, or videos that focused more heavily on lust or genitalia were rated as more highly arousing by both men and women than those depicting sensuality and romance (Fisher & Byrne, 1978; Meuwissen & Over, 1991; Quackenbush, Strassberg, & Turner, 1995; Schmidt, Siguisch, & Schafer, 1973; Smith & Over, 1991; Tokatilidis & Over, 1995). It is possible that studies investigating this issue have potentially confounded preference with arousal. Sigusch, Schmidt, Reinfeld, and Wiedemann-Sutor (1970) found that both men and women rated sexual scenes as more arousing than affectionate scenes; however, women rated the sexual scenes less positively than men, and less favorably than the affectionate scenes. Geer and Bellard (1996) had men and women rate romantic and sexual words, and found that women rated the romantic words more positively than the sexual words, and the men rated the sexual words as more positive than the romantic words. That does not mean, however, that men and women would not have both found the sexual ones more arousing. We certainly know from the literature on subjective preferences and physiological arousal that women show arousal to stimuli they express no preference for (Chivers, in press). Thus, if liking something and finding it arousing are not highly positively correlated and they don't appear to be, the confounding of these two variables may help to explain the discrepancy of the findings in previous research. It does not, however,

explain the findings in our study. It is not surprising that women looked more at faces than at bodies but it is somewhat surprising that men did, considering their reports of being most interested in the more supposedly sexual aspects of a stimulus such as body parts.

We found that both men and women are primarily interested in the faces of the people in the pictures as opposed to any other region, and these scene differences in fixation times were very large. Clearly faces are important, and much of the literature in perception and some past research in attention support this finding. It has been hypothesized that humans are genetically programmed to be most interested in faces, as faces give us a wealth of information, unlike any other part of the body (Farah, 1996). Facial recognition studies have found that face perception is "special", such that we use different processes to recognize faces than we do anything else (Farah, 1996). Farah (1996) found that we recognize faces on a holistic or Gestalt type basis, such that the overall quality of the face transcends its individual elements. Most people's faces have the same basic elements (i.e., two eyes, one nose, one mouth) and these elements occur, more or less, in the same position on everyone's face, which should make it difficult to recognize individual people. However, this holistic perception of faces is distinctly different, making us better able to discern identity from one person to the next. Neuroscientific research has also examined this issue, and found that in primates, there are specific cells in the visual cortex that are responsible for perceiving faces (Rolls & Tovee, 1995). Due to the similarity of human brains and primate brains, it seems likely that comparable results would be found in humans. The human face also can give the onlooker much information, including mood, emotional state, and even cues of age,

health, and beauty. Therefore, it is not unlikely that we would have found people's attention being drawn to the faces more than other regions of the picture, even though the face comprises a much smaller area of the total image. Faces are clearly of special interest to people, and the differences in number of fixations and fixation times clearly support the idea that the faces of the people in the pictures were of primary interest, even when they were totally naked, very attractive and in suggestive poses.

One avenue toward understanding why men showed more interest in the faces than expected may be in a line of research in emotional perception that has found that, on average, women's faces are more emotionally expressive than men's faces (Kring & Gordon, 1998). The women in the erotic stimulus set used in this study are typically smiling in a sexy "come hither" expression, indicating that they are sexually interested in whoever might be looking at them. If faces are of primary interest to begin with, and women are better at expressing sexual interest with their faces than are men, it may be possible that men were getting the sexual information they desired from the faces more than they would have from the bodies anyway. This might explain the disproportionate amount of fixation time on the women's faces in comparison to their bodies. Ekman, a prominent emotion researcher, developed a stimulus set of faces expressing reliably different emotions (Matsumoto & Ekman, 1988) that has been used in many studies; however, no faces indicating sexual interest were included. It would be interesting to determine whether individuals can detect sexual interest in facial expressions as reliably as they can detect happiness, sadness, worry, or anger. Additionally, it would be germane to investigate whether there are gender differences in both facial expressiveness and detection of sexual interest when looking at someone's face.

Applying the IPA model, it is important to understand how our results relate to two different types of cognition: molar and molecular. Molar refers to the more high-level type of information processing, such as schemas, whereas molecular refers to more low-level processing, such as perception and initial attentional capture. Molecular processing happens at a very basic level; the point at which the information enters the organism to be later processed at the molar level. Perception and attention are very low-level, molecular cognitive processes, which stand in direct contrast to high-level, schema type processing which is found in self-report. Eye-tracking is accessing scene perception and attention, and at this low level of cognitive processing, there were no gender differences found in attention to visual erotic stimuli. Men and women did not attend to these pictures in a different manner, even though much of the self-report evidence in the sexuality literature suggested they would. Maybe, both eye-tracking and self report are correct in their very different assertions as to what men and women prefer in an erotic stimulus. Maybe they are simply accessing different levels of cognitive processing.

What we cannot access in this study are the higher-level processes that are going on in the participants' head. Co-occurring molar cognitive processes may in fact support the gender difference of interest in sexual situations, such that the inner narratives of the participants may have been different even while attending to the same scene regions. When men were looking at the faces they may have been thinking about the face in the image expressing "I want to have sex with you", whereas the women may have been looking at the faces and interpreting them to be expressing something like "I love you and you are special to me which is why I would like to be intimate with you." Since we did not ask the participants what they were interested in or what they were thinking about

while they looked at the pictures, we do not know whether these gender differences in high-level cognitive processes existed in this study. What we can say with some degree of certainty is that when testing the most basic, entry-level cognitive processes of perception and attention, men and women do not differ. This is an important point: cognition in sexuality starts out the same way for both men and women; it may be later in the molar cognitive processes where the differences start to occur and reveal themselves in self-report.

We also do not know how arousal relates to either the molar or molecular processes of attention and perception in this study because we did not directly test it. Although we cannot assert that attention is as related to arousal as it is to interest, we can assert that for an object or body part to be appreciated as arousing, one must first notice it and attend to it; the information must get into the system. Thus, although there currently is no direct link between attention and arousal, it seems likely that a strong relationship may be borne out of future studies. If it is, the results of this study suggest that the face is perhaps the most arousing aspect of a sexual partner for both men and women, given that the person's face is average to very attractive (as generally seemed the case with the stimuli in this study, although no attractiveness ratings were gathered). On the other hand, it has been found that people may attend most to objects that propagate fear or revulsion, objects that are most related to their concerns (Williams, Watts, McLeod, & Mathews, 1988). While this is an interesting idea that has been found in past research on anxiety and phobias, it does not seem to be pertinent to this study. It is not reasonable to postulate that anyone looked more at the faces because they were scared of them or because they were concerned about them than they were of the bodies. If anything, with

rates of body dysmorphic disorder and cosmetic surgery increasing, one would think that the scene regions that would have been of most concern to the participants would have been the bodies rather than the faces, and this was clearly not the case.

There are some potential limitations to this study that should be addressed in future research. The first is the question of face validity. The people in the erotic pictures were all very attractive and youthful looking and hardly the average person one sees everyday in normal situations or is even partnered with. We are left to wonder whether the results would be similar if the people in the pictures were not quite as attractive. We also do not know how these eye-tracking patterns translate into real-world situations. Seeing an erotic image on a computer screen is hardly equivalent to being confronted with a sexual partner who is disrobing. On the other hand, online tracking of viewing patterns when individuals are exposed to images of other individuals in provocative states of undress arguably has more face validity than asking people to retrospectively report what they have attended to in sexual episodes that may be one week to one year old. Another limitation in this study relates to the fact that although all of the erotic pictures clearly had erotic content that distinguished them from the non-erotic matched pictures, none of the erotic pictures had full frontal nudity nor people actually engaging in sex (intercourse or otherwise). It would be interesting to determine whether more revealing images would have attracted more attention to body parts, had they been more visible.

A second limitation of this study is that only attention, a low-level cognitive process, was measured. Human sexuality researchers are typically most interested in subjective sexual arousal, which conceptually requires high-level processing for a person

to not only notice something erotic, but to label it as so. Although there is an arguably strong relationship between attention/interest and arousal, and although we know from the participants' ratings that they found the erotic images more arousing than the non-erotic ones, there was no direct measure of arousal in this study. Future research should examine the relationship between eye-tracked attention and arousal in order to further understand how they relate to each other.

Finally, a third limitation relates simply to the fact that this is the first study in human sexuality research to use eye-tracking methodology. While it is a precise measure that is well-validated in other fields of psychology, it has never been used to test hypotheses related to sexuality. It would be useful to know what correlates, if any, exist for eye-tracked attention in sexuality such as subjective preferences, subjective arousal, physiological arousal and even sexual behavior. More convergent validity is needed to assess the usefulness of applying eye-tracking methodology to human sexuality research.

This study raises many issues regarding the applicability of eye-tracking methodology to future sex research. Considering that the most prominent finding was that faces were of primary interest for both men and women, one is left to wonder what the eye-tracking patterns would have been had the faces been removed or blurred so that the participant could not look at them. Would there have been gender differences then as to what parts of the body men and women focused on? It is also possible that the scene context would have attracted more attention. Another interesting issue to examine would be the difference between a sexy facial expression and a neutral or other emotional facial expression. What if the women in the pictures had not had seductive facial expressions, and were rather expressing anger, fear, or even no emotion? It is possible that the faces

in those cases would attract even more attention because they would be discordant with the rest of the scene, but it is also possible that the men would have been less interested in the faces because they were not being seduced by them. It would be interesting to test the differences between a seductive, sexy facial expression and the facial expressions of other basic emotions in order to discern what parts of the face denote sexuality. These differences have been found between the basic emotions, but the verdict is still out as to whether sexual interest is an emotion or not. This issue has not been directly tested. This line of research would also be of substantial relevance to the research on sex offenders. Is their sexual arousal unaffected by facial expressions of fear or displeasure, in contrast to non-sex-offending men?

Another potential line of research relates to the effect of appearance variance on attentional capture. Ethnicity, weight, body size, general levels of attractiveness, and even body position are all variables that may change people's eye-tracking patterns. As of yet, we do not know how these variables may affect attention, but it would certainly be of interest to vary levels of these characteristics and see if the eye-tracking patterns would be different.

Cognitive distraction is another area ripe for the use of eye-tracking methodology. Considering the already established link between distraction and arousal deficits (Barlow, 1986; Beck & Barlow, 1986; Beck, Barlow, Sakheim, & Abrahamson, 1987), eye-tracking seems perfectly positioned to test the differences in visual distractibility between sexually functional and dysfunctional individuals. In research on scene perception, results suggest that incongruent objects (i.e., an object that does not belong in a scene, such as a squirrel in a bathtub) attract more attention than other objects in the scene that

do conceptually belong there (i.e., a bar of soap in a bathtub). If one were to insert distracting elements into a sexual scene, would we find differences in the extent to which sexually functional and dysfunctional individuals would attend to the incongruent object? Would there be simple gender differences in distractability, even in the absence of dysfunction? One of the drawbacks of this study was that we only tested low-level molecular processing; there was no measure of high-level molar processing that undoubtedly occurs when looking at a sexual scene. So although we know where the participants attended to in the scene, we do not know why, nor do we know what they were thinking while they were looking at the different scene regions. It would be interesting to add this higher level cognitive processing level to future studies, such that we might ask participants what they are thinking about while looking at the pictures, or even what they liked or did not like about the pictures after having looked at them. It may even be worthwhile to direct participants to a specific scene region and ask them what their thoughts are in relation to what is occurring in that region. Although self-report data is inherently problematic, it does give us insight as to how the person is processing the information in the scene and would clearly be of importance to understand in the context of their eye-tracking data.

The importance of examining cognitive variables in human sexuality-related research efforts cannot be overstated. Cognition is an important part of sexuality and we need to further understand in the inner experience of individuals when presented with sexual situations. Employing cognitive techniques, such as eye-tracking methodology, will access these private experiences in ways previously inaccessible to us, thereby yielding more reliable and valid data. Because methodological problems have been so

prevalent in human sexuality research, it is worthwhile to search for new ways of testing our theories and ideas. We believe eye-tracking has the potential to answer some of the questions and problems that have been plaguing sex research to date. This study's preliminary test of a commonly reported gender difference in preference for components of a sexual stimulus yielded very different results from the self-report literature. Only more research will determine the true meaning of our discrepant findings, but this methodology holds great promise as 1) another source of convergent validity (or not) for popular assumptions about sexuality and 2) a new tool to investigate as yet unanswered questions about the processing of sexual stimuli.

REFERENCES

Abrahamson, D.J. (1985). Effects of distraction on sexual responding in functional and dysfunctional men. *Behavior Therapy, 16,* 503-515.

Abramson, P. R. (1990). Sexual science: Emerging discipline or oxymoron? *The Journal of Sex Research, 27,* 147-165.

Adams, A.W., Haynes, S.N., & Brayer, M.A. (1985). Cognitive distraction in female sexual arousal. *Psychophysiology, 22,* 689-696.

Alexander, M.G., & Fisher, T.D. (2003). Truth and consequences: Using the Bogus Pipeline to examine sex differences in self-reported sexuality. *The Journal of Sex Research, 40,* 27-35.

Antes, J.R. (1974). The time course of picture viewing. *Journal of Experimental Psychology, 103,* 62-70.

Baker, T.B., & Brandon, T.H. (1990). Validity of self-reports in basic research. *Behavioral Assessment, 12,* 33-51.

Bancroft, J. (1999). Sexual science in the 21st century: Where are we going? A personal note. *The Journal of Sex Research, 36,* 226-229.

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

Barlow, D.H., Sakheim, D.K., & Beck, J.G. (1983). Anxiety increases sexual arousal. *Journal of Abnormal Psychology, 92,* 49-54Basson, R. (2000). The female sexual response: A different model. *Journal of Sex and Marital Therapy, 26,* 51-65.

Basson, R. (2001). Human sex-response cycles. *Journal of Sex and Marital Therapy, 27,* 33-43.

Beck, J.G., & Barlow, D.H. (1986). The effects of anxiety and attentional focus on sexual responding—I. Physiological patterns in erectile dysfunction. *Behaviour Research and Therapy, 24,* 9-17.

Beck, J. G., Barlow, D. H., Sakheim, D. K., & Abrahamson, D. J. (1987). Shock threat and sexual arousal: The role of selective attention, thought content, and affective states. *Psychophysiology, 24,* 165-172.

Biederman, I., Mezzanotte, R.J., & Rabinowitz, J.C. (1982). Scene perception: Detecting and judging objects undergoing relational violations. *Cognitive Psychology, 14,* 143-177.

Bradburn, N., Sudman, S., Blair, E., & Stocking, C. (1978). Question threat and response bias. *Public Opinion Quarterly, 42,* 221-234.

Bradley, W., Timm, G., Gallagher, J., & Johnson, B. (1985). New method for continuous measurement of nocturnal penile tumescence and rigidity. *Urology, 26,* 4-9.

Buswell, G.T. (1935). *How people look at pictures.* Chicago: University of Chicago Press.

Castille, C. O., & Geer, J. H. (1993). Ambiguous stimuli: Sex is in the eye of the beholder. *Archives of Sexual Behavior, 22,* 131-143.

Catania, J.A. (1999). A comment on advancing the frontiers of sexological methods. *The Journal of Sex Research, 36,* 1-2.

Catania, J.A., Binson, D., Van Der Straten, A., & Stone, V. (1995). Methodological research on sexual behavior in the AIDS era. *Annual Review of Sex Research, 6,* 77-125.

Catania, J.A., Gibson, D.R., Chitwood, D.D., & Coates, T.J. (1990). Methodological problems in AIDS behavioral research: Influences on measurement error and participation bias in studies of sexual behavior. *Psychological Bulletin, 108,* 339-362.

Catania, J., McDermott, L., & Pollack, L. (1986). Questionnaire response bias and face-to-face interview sample bias in sexuality research. *The Journal of Sex Research, 22,* 52-72.

Chivers, M. L., Reiger, G., Latty, E., & Bailey, J. M. (in press). A sex difference in the specificity of sexual arousal. *Psychological Science.*

Clark, A., & Wallin, P. (1964). The accuracy of husbands' and wives' reports of frequency of marital coitus. *Population Studies, 18,* 165-173.

Croyle, R.T., & Loftus, E.F. (1993). Recollection in the kingdom of AIDS. In D.G. Ostrow & R.C. Kessler (Eds.). *Methodological issues in AIDS behavior research.* (163-180). New York: Plenum Press.

Czaja, R. (1987-1988). Asking sensitive behavioral questions in telephone interviews. *International Quarterly of Community Health Education, 8,* 23-32.

DeGraef, P., Christiaens, D., & d'Ydewalle, G. (1990). Perceptual effects of scene context on object identification. *Psychological Research, 52,* 317-329.

DeLamater, J. (1987). Gender differences in sexual scenarios. In K. Kelley (Ed.) *Females, males, and sexuality: Theories in research.* (pp. 127-139). Albany, NY: State University of New York Press.

DeLamater, J., & MacCorquodale, P. (1975). The effects of interview schedule variations on reported sexual behavior. *Sociological Methods and Research, 4,* 215-236.

Dekker, J., & Everaerd, W. (1988). Psychological determinants of sexual arousal: A review. *Behaviour Research and Therapy, 27,* 353-364.

Elliott, A.N., & O'Donohue, W.T. (1997). The effects of anxiety and distraction on sexual arousal in a nonclinical sample of heterosexual women. *Archives of Sexual Behavior, 26,* 607-624.

Ellis, B.J., & Symons, D. (1990). Sex differences in sexual fantasy: An evolutionary psychological approach. *The Journal of Sex Research, 27,* 527-555.

Farah, M. J. (1996). Is face recognition special? Evidence from neuropsychology. *Behavioural Brain Research, 76,* 181-189.

Farkas, G.M., Sine, L.F., & Evans, I.M. (1979). The effects of distraction, performance demand, stimulus explicitness and personality on objective and subjective measures of male sexual arousal. *Behaviour Research & Therapy, 17,* 25-32.

Fisher, W.A., & Byrne, D. (1978). Sex differences in response to erotica? Love versus lust. *Journal of Personality and Social Psychology, 36,* 117-125.

Follingstad, D.R., & Kimbrell, C.D. (1986). Sex fantasies revisited: An expansion and further clarification of variables affected sex fantasy production. *Archives of Sexual Behavior, 15,* 475-486.

Geer, J. H. (1996). Gender differences in the organization of sexual information. *Archives of Sexual Behavior, 25,* 91-107.

Geer, J. H., & Bellard, H. (1996). Sexual content induced delays in lexical decisions: Gender and context effects. *Archives of Sexual Behavior, 25,* 379-395.

Geer, J. H., & Manguno-Mire, G. M. (1996). Gender differences in cognitive processes in sexuality. *Annual Review of Sex Research, 7,* 90-124.

Geer, J.H., & Janssen, E. (2000). The sexual response system. In J.T. Cacioppo, L.G. Tassinary, & G.G. Berntson (Eds.) *Handbook of psychophysiology.* (pp. 315-341). New York: Cambridge University Press.

Geer, J.H., & McGlone, M.S. (1990). Sex differences in memory for erotica. *Cognition and Emotion, 4,* 71-78.

Geer, J. H., Judice, S., & Jackson, S. (1994). Reading times for erotic material: The pause to reflect. *The Journal of General Psychology, 121,* 345-352.

Geer, J.H., Morokoff, P., & Greenwood, P. (1974). Sexual arousal in women: The development of a measurement device for vaginal blood volume. *Archives of Sexual Behavior, 3,* 559-564.

Gerrards-Hesse, A., Spies, K., & Hesse, F.W. (1994). Experimental inductions of emotional states and their effectiveness: A review. *British Journal of Psychology, 85,* 55-78.

Gold, S.R., & Chick, D.A. (1988). Sexual fantasy patterns as related to sexual attitude, experience, guilt and sex. *Journal of Sex Education and Therapy, 14,* 18-23.

Gribble, J.N., Miller, H.G., Rogers, S.M., & Turner, C.F. (1999). Interview mode and measurement of sexual behaviors: Methodological issues. *The Journal of Sex Research, 36,* 16-24.

Gross, J.J., & Levenson, R.W. (1995). Emotion elicitation using films. *Cognition and Emotion, 9,* 87-108.

Hale, V.E., & Strassberg, D.S. (1990). The role of anxiety on sexual arousal. *Archives of Sexual Behavior, 19,* 569-581.

Hardin, K.N., & Gold, S.R. (1988-1989). Relationship of sex, sex guilt, and experience to written sexual fantasies. *Imagination, Cognition and Personality, 8,* 155-163.

Hatch, J.P. (1979). Vaginal photoplethysmography: Methodological considerations. *Archives of Sexual Behavior, 8,* 357-374.

Heiman, J.R. (1977). A psychophysiological exploration of sexual arousal patterns in females and males. *Psychophysiology, 14,* 266-274.

Heiman, J.R. (1976). Issues in the use of psychophysiology to assess female sexual dysfunction. *Journal of Sex and Marital Therapy, 2,* 197-204.

Heiman, J.R., & Rowland, D.L. (1983). Affective and physiological sexual response patterns: The effects of instructions on sexually functional and dysfunctional men. *Journal of Psychosomatic Research, 27,* 105-116.

Henderson, H. M. (personal communication, August 16, 2004).

Henderson, J.M. (1993). Eye movement control during visual object processing: Effects of initial fixation position and semantic constraint. *Canadian Journal of Experimental Psychology, 47,* 79-98.

Henderson, J.M. (1992). Visual attention and eye movement control during reading and picture viewing. In K. Rayner (Ed.) *Eye movements and visual cognition: Scene perception and reading.* (pp. 260-283). New York: Springer-Verlag.

Henderson, J.M., & Hollingworth, A. (1999). High-level scene perception. *Annual Review of Psychology, 50,* 243-271.

Henderson, J.M., & Hollingworth, A. (1998). Eye movements during scene viewing: An overview. In G. Underwood. (Ed.) *Eye guidance in reading and scene perception (pp. 269-293).* Oxford, England: Elsevier Science Ltd.

Henderson, J.M., & Ferreira, F. (1993). Eye movement control in reading: Fixation measures reflect foveal but not parafoveal processing difficulty. *Canadian Journal of Experimental Psychology, 47 (Special Issue),* 201-221.

Henderson, J.M., & Ferreira, F. (1990). Effects of foveal processing difficulty on the perceptual span in reading: Implications for attention and eye movement control. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 16,* 417-429.

Hicks, T.V., & Leitenberg, H. (2001). Sexual fantasies about one's partner versus someone else: Gender differences in incidence and frequency. *The Journal of Sex Research, 38,* 43-50.

Hoon, P.W., Wincze, J.P., & Hoon, E.F. (1976). Physiological assessment of sexual arousal in women. *Psychophysiology, 13,* 196-204.

Hsu, B., Kling, A., Kessler, C., Knapke, K., Diefenbach, P., & Elias, J.E. (1994). Gender differences in sexual fantasy and behavior in a college population: A ten-year replication. *Journal of Sex and Marital Therapy, 20,* 103-117.

Janssen, E. (2002). Psyhophysiological measurement of sexual arousal. In M. Wiederman & B. Whitley (Eds.) *Handbook for Conducting Research on Human Sexuality* (pp. 139-171). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Janssen, E., Carpenter, D., & Graham, C.A. (2003). Selecting films for sex research: Gender differences in erotic film preference. *Archives of Sexual Behavior, 32,* 243-251.

Jennings, J.R., Tahmoush, A.J., & Redmont, D.P. (1980). Non-invasive measurement of peripheral vascular activity. In I.R. Martin & P.H. Venables (Eds.) *Techniques in psychophysiology* (pp. 70-131). New York: Wiley.

Johnson, W., & DeLamater, J. (1976). Response effects in sex surveys. *Public Opinion Quarterly, 40,* 165-181.

Koch, C., & Ullman, S. (1985). Shifts in selective visual attention: Towards the underlying neural circuitry. *Human Neurobiology, 4,* 219-227.

Korff, J., & Geer, J.H. (1983). The relationship between sexual arousal experience and genital response. *Psychophysiology, 20,* 121-127.

Kring, A. M., & Gordon, A. H. (1998). Sex differences in emotion: Expression, experience, and physiology. *Journal of Personality and Social Psychology, 74,* 686-703.

Laan, E., & Everaerd, W. (1995). Determinants of female sexual arousal: Psychophysiological theory and data. *Annual Review of Sex Research, 6,* 32-76.

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

Laan, E., Everaerd, W., Van Der Velde, J., & Geer, J.H. (1995). Determinants of subjective experience of sexual arousal in women: Feedback from genital arousal and erotic stimulus content. *Psychophysiology, 32,* 444-451.

Laan, E., Everaerd, W., Van Berlo, R., & Rijs, L. (1995). Mood and sexual arousal in women. *Behaviour Research and Therapy, 33,* 441-443.

Laan, E., Everaerd, W., van Bellen, G., & Hanewald, G. (1994). Women's sexual and emotional responses to male- and female-produced erotica. *Archives of Sexual Behavior, 23,* 153-169.

Lange, J.D., Wincze, J.P., Zwick, W., Feldman, S., & Hughes, K. (1981). Effects for performance, self-monitoring of arousal, and increased sympathetic nervous system activity on male erectile response. *Archives of Sexual Behavior, 10,* 443-464.

Leigh, B.C., Gillmore, M.R., & Morrison, D.M. (1998). Comparison of diary and retrospective measures for recording alcohol consumption and sexual activity. *Journal of Clinical Epidemiology, 51,* 119-127.

Leitenberg, H., & Henning, K. (1995). Sexual fantasy. *Psychological Bulletin, 117,* 469-496.

Levin, J.R. (1992). The mechanisms of human female sexual arousal. *Annual Review of Sex Research, 3,* 1-48.

Loftus, G.R., & Mackworth, N.H. (1978). Cognitive determinants of fixation location during picture viewing. *Journal of Experimental Psychology: Human Perception and Performance, 4,* 565-572.

Loren, R.E.A., & Weeks, G.R. (1986). Sexual fantasies of undergraduates and their perceptions of the sexual fantasies of the opposite sex. *Journal of Sex Education and Therapy, 12,* 31-36.

Mackworth, N.H., & Morandi, A.J. (1967). The gaze selects informative details within pictures. *Perception and Psychophysics, 2,* 547-552.

Manguno-Mire, G. M., & Geer, J. H. (1998). Network knowledge organization: Do knowledge structures for sexual and emotional information reflect gender or sexual orientation? *Sex Roles, 39,* 705-729.

Massaro, D. W., & Cowan, N. (1993). Information processing models: Microscopes of the mind. *Annual Review of Psychology, 44,* 383-425.

Matsumoto, D., & Ekman, P. (1988). *Japanese and Caucasian facial expressions of emotion (JACFEE)* [CD-ROM]. Available from: Neural Research Laboratory, Department of Psychology, San Francisco State University, 1600 Halloway Avenue, San Francisco, CA, 94132.

McLaws, M.L., Oldenburg, B., Ross, M.W., & Cooper, D.A. (1990). Sexual behavior in AIDS-related research: Reliability and validity of recall and diary measures. *The Journal of Sex Research, 27,* 365-281.

Mednick, R.A. (1977). Gender-specific variances in sexual fantasy. *Journal of Personality Assessment, 41,* 248-254.

Meisler, A.W., & Carey, M.P. (1991). Depressed affect and male sexual arousal. *Archives of Sexual Behavior, 20,* 541-554.

Meston, C.M. (2000). The psychophysiological assessment of female sexual function. *Journal of Sex Education and Therapy, 25,* 6-16.

Meston, C., & Heiman, J. (1998). Ephedrine-activated physiological sexual arousal in women. *Archives of General Psychiatry, 55,* 652-656.

Meston, C.M., Heiman, J.R., Trapnell, P.D., & Paulhus, D.L. (1998). Socially desirable responding and sexuality self-reports. *The Journal of Sex Research, 35,* 148-157.

Meston, C.M., & Gorzalka, B.B. (1996a). Differential effects of sympathetic activation on sexual arousal in sexually dysfunctional and functional women. *Journal of Abnormal Psychology, 105,* 582-591.

Meston, C.M., & Gorzalka, B.B. (1996b). The effects of immediate, delayed, and residual sympathetic activation on sexual arousal in women. *Behaviour Research and Therapy, 34,* 143-148.

Michael, R., Laumann, E., Gagnon, J., & Smith, T. (1988, September 23). Number of sex partners and potential risk of sexual exposure to HIV. *Morbidity and Mortality Weekly Report, 37,* 565-568.

Meuwissen, I., & Over, R. (1991). Multidimensionality of the content of female sexual fantasy. *Behaviour Research & Therapy, 29,* 179-189.

Millstein, S., & Irwin, C. (1983). Acceptability of computer-acquired sexual histories in adolescent girls. *Journal of Pediatrics, 103,* 815-819.

Mitchell, W.B., DiBartolo, P.M., Brown, T.A., & Barlow, D.H. (1998). Effects of positive and negative mood on sexual arousal in sexually functional males. *Archives of Sexual Behavior, 27,* 197-207.

Mosher, D.L., & MacIan, P. (1994). College men and women respond to X-rated videos intended for male or female audiences: Gender and sexual scripts. *The Journal of Sex Research, 31,* 99-113.

Morrison, D.M., Leigh, B.C., & Gillmore, M.R. (1999). Daily data collection: A comparison of three methods. *The Journal of Sex Research, 36,* 76-81.

Munoz, M.M., Bancroft, J., & Marshall, I. (1993). The performance of the Rigiscan in the measurement of penile tumescence and rigidity. *International Journal of Impotence Research, 5,* 69-76.

Nicholas, L.J., Durrheim, K., & Tredoux, C.G. (1994). Lying as a factor in research on sexuality. *Psychological Reports, 75,* 839-842.

Nisbett, R.E., & DeCamp Wilson, T. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84,* 231-259.

Okami, P. (2002). Dear diary: A useful but imperfect method. In M. Wiederman & B. Whitley (Eds.) *Handbook for Conducting Research on Human Sexuality* (pp. 195-207). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Osborn, C.A., & Pollack, R.H. (1977). The effects of two types of erotic literature on physiological and verbal measures of female sexual arousal. *Journal of Sex Research, 13,* 250-256.

Palace, E.M., & Gorzalka, B.B. (1990). The enhancing effects of anxiety on arousal in sexually dysfunctional and functional women. *Journal of Abnormal Psychology, 99,* 403-411.

Person, E.S., Terestman, N., Myers, W.A., Goldberg, E.L., & Salvadori, C. (1989). Gender differences in sexual behaviors and fantasies in a college population. *Journal of Sex & Marital Therapy, 15,* 187-198.

Pfeiffer, E., Verwoerdt, A., & Wang, H.S. (1968). Sexual behavior in aged men and women. *Archives of General Psychiatry, 19,* 753-758.

Plaud, J.J., Gaither, G.A., Hegstad, H.J., Rowan, L., & Devitt, M.K. (1999). Volunteer bias in human psychophysiological sexual arousal research: To whom do our research results apply? *The Journal of Sex Research, 36,* 171-179.

Plaud, J.J., & Bigwood, S.J. (1997). A multivariate analysis of the sexual fantasy themes of college men. *Journal of Sex & Marital Therapy, 23,* 221-230.

Quackenbush, D.M., Strassberg, D.S., & Turner, C.W. (1995). Gender effects of romantic themes in erotica. *Archives of Sexual Behavior, 24,* 21-35.

Ramjee, G., Weber, A.E., & Morar, N. (1999). Recording sexual behavior: Comparison of recall questionnaires with a coital diary. *Sexually Transmitted Diseases, 26,* 374-380.

Rayner, K. (1979). Eye guidance in reading: Fixation locations within words. *Perception, 8,* 21-30.

Rayner, K., & Pollatsek, A. (1992). Eye movements and scene perception. *Canadian Journal of Psychology, 46,* 342-376.

Reading, A.E. (1983). A comparison of the accuracy and reactivity of methods of monitoring male sexual behavior. *Journal of Behavioral Assessment, 5,* 11-23.

Rolls, E.T., & Tovee, M. J. (1995). Sparseness of the neuronal representation of stimuli in the primate temporal visual cortex. *Journal of Neurophysiology, 73,* 713-726.

Rosen, R.C., & Beck, J.G. (1988). *Patterns of sexual arousal: Psychophysiological processes and clinical applications.* New York: The Guilford Press.

Rowland, D.L. (1999). Issues in the laboratory study of human sexual response: A synthesis for the nontechnical sexologist. *The Journal of Sex Research, 36,* 3-15.

Rowland, D.L., & Heiman, J.R. (1991). Self-reported and genital arousal changes in sexually dysfunctional men following a sex therapy program. *Journal of Psychosomatic Research, 35,* 1-11.

Schmidt, G., Sigusch, V., & Schafer, S. (1973). Responses to reading erotic stories: Male-female differences. *Archives of Sexual Behavior, 2,* 181-199.

Sigusch, V., Schmidt, G., Reinfeld, A., & Wiedemann Sutor, I. W. (1970). Psychosexual stimulation: Sex differences. *The Journal of Sex Research, 6,* 10-24.

Sintchak, G., & Geer, J.H. (1975). A vaginal photoplethysmograph system. *Psychophysiology, 12,* 113-115.

Smith, D., & Over, R. (1991). Male sexual fantasy: Multidimensionality in content. *Behaviour Research and Therapy, 29,* 267-275.

Steinman, D.L., Wincze, J.P., Sakheim, B.A., Barlow, D.H., & Mavissakalian, M. (1981). A comparison of male and female patterns of sexual arousal. *Archives of Sexual Behavior, 10,* 529-547.

Strassberg, D.S., & Lowe, K. (1995). Volunteer bias in sexuality research. *Archives of Sexual Behavior, 24,* 369-382.

Tokatlidis, O., & Over, R. (1995). Imagery, fantasy, and female sexual arousal. *Australian Journal of Psychology, 47,* 81-85.

Van Duynhoven, Y., Nagelkerke, N., & Van de Laar, M. (1999). Reliability of self-reported sexual histories: Test-retest and interpartner comparison in a sexually transmitted diseases clinic. *Sexually Transmitted Diseases, 26,* 33-42.

Velten, E. (1968). A laboratory task for induction of mood states. *Behavior Research and Therapy, 6,* 473-482.

Wiederman, M.W. (1999). Volunteer bias in sexuality research using college student participants. *The Journal of Sex Research, 36,* 59-66.

Williams, J. M. G., Watts, F. N., McLeod, C., & Mathews, A. (1988). Cognitive psychology and emotional disorders. New York: John Wiley & Sons.

Wilson, G.D. (1997). Gender differences in sexual fantasy: An evolutionary analysis. *Personality and Individual Differences, 22,* 27-31.

Wilson, G.D., & Lang, R.J. (1981). Sex differences in sexual fantasy patterns. *Personality & Individual Differences, 2,* 343-346.

Wincze, J.P., Venditti, F., Barlow, D.H., & 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,* 533-545.

Wincze, J.P., Hoon, P., & Hoon, E.F. (1977). Sexual arousal in women: A comparison of cognitive and physiological responses by continuous measurement. *Archives of Sexual Behavior, 6,* 121-133.

Wolchik, S.A., Braver, S.L., & Jensen, K. (1985). Volunteer bias in erotica research: Effects of intrusiveness of measure and sexual background. *Archives of Sexual Behavior, 14,* 93-107.

Zelnik, M., Kantner, J., & Ford, K. (1981). *Sex and pregnancy in adolescence.* Beverly Hills, CA: Sage.

Zilbergeld, B. (1992). The new male sexuality. New York: Bantam Books.

APPENDIX I

TABLES

Table 1

Demographic Characteristics of Sample (N = 40)

	Women		Men	
Characteristic	n	%	n	%
Ethnicity				
African American	1	5	2	10
Asian	4	20	3	15
Caucasian	11	55	10	50
Hispanic	2	10	1	5
Pacific Islander	1	5	2	10
Other	1	5	2	10
Religion				
Buddhist	1	5	1	5
Catholic	5	25	4	20
Christian	1	5	7	35
Muslim	1	5	1	5
None	12	60	7	35

Table 2

Means and Standard Deviations of Raw and Size-adjusted Transformed Number of Fixations, First Gaze Duration, and Total Time for Female Participants Gazing at Male Images

	Erotic Images			Non-Erotic Images		
	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)
Raw Data						
Face	11.10(3.32)	1043.84(808.08)	4636.84(1423.90)	12.39(3.46)	1259.80(556.33)	5425.84(1481.90)
Body	19.90(5.62)	1114.72(540.65)	6464.32(1771.88)	14.79(4.02)	1024.36(335.34)	4690.84(1627.06)
Transformed Data						
Face	1.85(.57)	186.46(151.37)	782.62(235.16)	2.74(.84)	295.64(149.30)	1246.08(391.38)
Body	.63(.18)	35.72(18.26)	205.05(55.51)	.57(.16)	39.46(13.16)	178.23(62.88)

Table 3

Summary of Two-Way Analysis of Variance on Size-adjusted Transformed Data for Total Number of Fixations for Women Gazing at Male Pictures

Source	df	MS	F	η^2
Condition	1	3.34	39.08***	.67
Scene Region	1	57.68	129.51***	.87
Condition X Scene Region	1	4.54	30.09***	.61
Residual	19	.151		

***$p < .001$.

Table 4

Summary of Two-Way Analysis of Variance on Size-adjusted Transformed Data for First Gaze Duration for Women Gazing at Male Pictures

Source	df	MS	F	η^2
Condition	1	63756.89	28.85***	.60
Scene Region	1	827903.16	43.52***	.70
Condition X Scene Region	1	55592.19	20.75***	.52
Residual	19	2679.42		

***$p < .001$.

Table 5

Summary of Two-Way Analysis of Variance on Size-adjusted Transformed Data for Total Time for Women Gazing at Male Pictures

Source	df	MS	F	η^2
Condition	1	953265.90	42.19***	.69
Scene Region	1	13537059.56	143.45***	.88
Condition X Scene Region	1	1201835.62	35.20***	.65
Residual	19	34143.13		

***$p < .001$.

Table 6

Means and Standard Deviations of Raw and Size-adjusted Transformed Number of Fixations, First Gaze Duration, and Total Time for Male Participants Gazing at Female Images

	Erotic Images			Non-Erotic Images		
	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)
Raw Data						
Face	10.20(2.90)	728.05(366.04)	4150.24(1209.41)	13.57(4.31)	1211.76(583.74)	5532.24(1958.91)
Body	22.56(3.86)	1284.24(419.76)	6818.14(57.63)	16.99(3.34)	1113.06(1536.27)	5294.44(1509.28)
Transformed Data						
Face	1.25(.40)	98.74(66.11)	525.28(176.19)	2.26(.74)	207.23(96.84)	947.84(337.89)
Body	.74(.13)	42.66(15.90)	224.87(48.76)	.83(.16)	52.40(66.59)	290.29(131.13)

Table 7

Summary of Two-Way Analysis of Variance on Size-adjusted Transformed Data for Total Number of Fixations for Men Gazing at Female Pictures

Source	df	MS	F	η^2
Condition	1	6.06	72.35***	.79
Scene Region	1	18.88	68.36***	.78
Condition X Scene Region	1	4.24	59.94***	.76
Residual	19	7.08		

***$p < .001$.

Table 8

Summary of Two-Way Analysis of Variance on Size-adjusted Transformed Data for First Gaze Durations for Men Gazing at Female Pictures

Source	df	MS	F	η^2
Condition	1	69889.89	25.91***	.58
Scene Region	1	222435.18	34.36***	.64
Condition X Scene Region	1	48760.28	17.57***	.48
Residual	19	2775.26		

***$p < .001$.

Table 9

Summary of Two-Way Analysis of Variance on Size-adjusted Transformed Data for Total Time for Men Gazing at Female Pictures

Source	df	MS	F	η^2
Condition	1	1190661.44	63.60***	.77
Scene Region	1	4588398.49	72.01***	.79
Condition X Scene Region	1	637766.33	26.02***	.58
Residual	19	24512.59		

***$p < .001$.

Table 10

Means and Standard Deviations of Raw and Size-adjusted Transformed Number of Fixations, First Gaze Duration, and Total Time for Female Participants Gazing at Images of Couples

	Erotic Images			Non-Erotic Images		
	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)
Raw Data						
Faces	9.8(2.57)	1068.88(475.48)	4138.68(1183.46)	11.30(3.45)	972.52(324.41)	4322.90(1587.09)
Bodies	21.42(4.83)	1535.36(330.70)	6474.57(1434.96)	15.41(2.83)	1422.90(625.48)	4543.60(1184.97)
Context	8.48(4.45)	725.24(452.34)	2440.00(1223.60)	13.60(4.24)	601.44(418.37)	4117.28(1162.35)
Transformed Data						
Faces	3.27(.83)	360.54(143.67)	1389.62(392.49)	3.33(1.02)	316.74(110.68)	1347.04(564.98)
Bodies	1.34(.32)	96.26(20.78)	402.23(93.31)	.90(.18)	83.46(35.35)	263.17(70.60)
Context	.14(.07)	11.13(6.60)	39.01(19.30)	.24(.08)	11.12(7.53)	71.51(21.65)

Table 11

Means and Standard Deviations of Raw and Size-adjusted Transformed Number of Fixations, First Gaze Duration, and Total Time for Male Participants Gazing at Images of Couples

	Erotic Images			Non-Erotic Images		
	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)	# of Fixations	First Gaze Duration (milliseconds)	Total Time (milliseconds)
Raw Data						
Faces	9.60(3.31)	850.16(253.51)	4701.60(4431.95)	11.00(4.04)	862.92(309.02)	4109.04(1544.70)
Bodies	23.50(3.43)	1469.41(272.12)	7500.48(4085.87)	16.47(3.23)	1304.40(321.11)	4514.44(898.75)
Context	9.47(5.68)	647.76(437.33)	2533.83(1374.32)	14.59(5.66)	590.48(684.01)	4436.64(1708.59)
Transformed Data						
Faces	3.06(1.17)	295.09(89.63)	1214.74(470.39)	3.14(1.20)	277.50(107.19)	1247.40(523.31)
Bodies	1.48(.24)	92.99(17.82)	421.84(.52)	.96(.18)	77.49(19.39)	261.84(52.23)
Context	.15(.09)	9.93(6.42)	40.23(21.85)	.26(.11)	10.94(12.39)	77.89(31.71)

Table 12

Summary of Three-Way Analysis of Variance on Size-adjusted Transformed Data for Total Number of Fixations for Both Men and Women Gazing at Pictures of Couples

Source	df	MS	F	η^2
Gender	1	.01	.08	.002
Condition	1	.603	5.25*	.12
Scene Region	1	376.15	266.34***	.88
Gender X Condition	1	.003	.03	.001
Gender X Scene Region	1	.946	.67	.02
Condition X Scene Region	1	4.27	16.17***	.30
Gender X Condition X Scene Region	1	.03	.17	.003
Residual	38	.26		

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 13

Summary of Three-Way Analysis of Variance on Size-adjusted Transformed Data for First Gaze Duration for Both Men and Women Gazing at Pictures of Couples

Source	df	MS	F	η^2
Gender	1	3698.79	3.52	.09
Condition	1	13139.59	3.62	.09
Scene Region	1	3932697.60	426.70***	.92
Gender X Condition	1	1011.43	.28	.01
Gender X Scene Region	1	33038.35	3.59	.09
Condition X Scene Region	1	9713.42	1.16	.03
Gender X Condition X Scene Region	1	2466.46	.29	.01
Residual	38			

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 14

Summary of Three-Way Analysis of Variance on Size-adjusted Transformed Data for Total Time for Both Men and Women Gazing at Pictures of Couples

Source	df	MS	F	η^2
Gender	1	17224.37	.90	.02
Condition	1	94762.02	2.87	.07
Scene Region	1	67966978.86	254.71***	.87
Gender X Condition	1	5968.32	.18	.01
Gender X Scene Region	1	275344.19	1.03	.03
Condition X Scene Region	1	376414.46	4.54*	.11
Gender X Condition X Scene Region	1	24580.62	.30	.01
Residual	38			

* $p < .05$, ** $p < .01$, *** $p < .001$.

APPENDIX II

POST-EXPERIMENTAL INTERVIEW

Post-Experimental Interview

1. What is your age? _____

2. What is your gender? (please circle one) M F

3. What is your ethnicity?
   - ☐ African American
   - ☐ Asian
   - ☐ Caucasian
   - ☐ Hispanic
   - ☐ Native American
   - ☐ Pacific Islander
   - ☐ Other

4. What is your religious affiliation?
   - ☐ Catholic
   - ☐ Christian
   - ☐ Mormon
   - ☐ Muslim
   - ☐ None
   - ☐ Other (please specify) _____

5. Are you right or left-handed? (please circle one) R L

6. What is your sexual orientation? (optional—you do not have to answer this question)
   - ☐ Heterosexual/Straight
   - ☐ Homosexual/Gay
   - ☐ Bisexual
   - ☐ Other

7. How arousing did you find the erotic photos of the individuals?
   - □ Very arousing
   - □ Somewhat arousing
   - □ Neither arousing nor unarousing
   - □ Somewhat unarousing
   - □ Very unarousing

8. How arousing did you find the erotic photos of the couples?
   - □ Very arousing
   - □ Somewhat arousing
   - □ Neither arousing nor unarousing
   - □ Somewhat unarousing
   - □ Very unarousing

9. How arousing did you find the non-erotic photos of the individuals?
   - □ Very arousing
   - □ Somewhat arousing
   - □ Neither arousing nor unarousing
   - □ Somewhat unarousing
   - □ Very unarousing

10. How arousing did you find the non-erotic photos of the couples?
   - □ Very arousing
   - □ Somewhat arousing
   - □ Neither arousing nor unarousing
   - □ Somewhat unarousing
   - □ Very unarousing

11. Have you seen any of these pictures before? (please circle) Y N
    If yes, which pictures? (please describe)

12. Have you seen any of these people before? (please list whom)

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