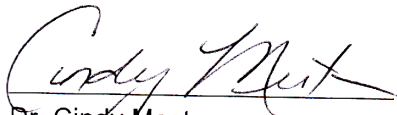



Female Sexual Arousal Response to Implied Sexual Violence

Presented by Elisabeth R. Lessels

in partial fulfillment of the requirements for graduation
with the Dean's Scholars Honor's Degree in Biology
and the Plan II Honors Program
The University of Texas at Austin


Dr. Cindy Meston
Supervising Professor

12.10.12
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Dr. Ruth Buskirk
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Acknowledgements

I owe Dr. Cindy Meston's Sexual Psychophysiology Lab a huge amount, first for taking me in as a research assistant and second for letting me work on the Pathways project. Enormous thanks go especially to Tierney Lorenz, soon to be Dr. Tierney Lorenz, who is one of the most amazing mentors one could wish for and an all-around awe-inspiring and lovely person; Carey Pulverman, who dove right in, kept me afloat, and maintained order; and, of course, Dr. Meston, for creating both the lab and a great deal of the foundations upon which we stood. Thank you all for believing in me, teaching me, and helping or hauling me every step of the way.

I'd also like to thank Dr. Ruth Buskirk for her endless patience and dedication, and Dr. David Crews for consultation and for making me a better researcher and student. I would be remiss if I did not also thank Michelle Pruett for endless moral and occasional gustatory support, my parents for feeding me and listening to me talk about female genitalia with admirable restraint, Plan II for nurturing my passion for the world, and Sarah Guermond and the entire Dean's Scholars program for making me a scientist.

Abstract

Background

There are major physiological and psychological differences between the sexual arousal experiences of men and women. While men generally experience genital and mental arousal simultaneously, these responses seem to act independently from each other in women. It has also been suggested that female genitalia respond to all sexual stimuli, no matter how uninteresting or even aversive the woman finds them. The prevailing theory suggests that this reflexive arousal is a defensive mechanism evolved to protect the genitals during sexual activity with lubrication. This is quite significant in cases of sexual violence. A lack of physical evidence on the survivor's genitalia - or testimony by the rapist that their victim responded, sometimes even to orgasm - can make prosecution of rapists difficult. Additionally, female rape survivors may find their body's response distressing, or think that they somehow "wanted it".

Methods

We examined female genital response to implied sexual violence. We recruited sexually active University of Texas students with no history of sexual abuse or current sexual dysfunction and measured their mental and physical arousal during two sets of visual erotic stimuli. In the control condition, women were shown displaying positive affect during sexual activity (smiling, actively participating in sex); conversely, the experimental condition featured

women showing negative affect (frowning, struggling). Each participant indicated their mental feelings of arousal continuously throughout the stimuli, and vaginal blood flow was recorded as an indicator of physical arousal.

Because patterns of vaginal arousal vary greatly between individuals, each participant's control session was used as a baseline to compare with that participant's experimental session. Analyses included comparing control and experimental sessions on the amount of time taken to reach maximum arousal and the magnitude of maximum arousal, the amount of time spent at relatively high levels of arousal, and the average magnitude of arousal throughout the erotic stimuli.

Results

We found that participants spent significantly more time aroused while viewing the control (positive affect) stimuli than they did while viewing the experimental (negative affect) stimuli. This was the only significant difference in arousal response between the two conditions.

Conclusions

Our data may support the theory that genital arousal behaves like a reflex, occurring quickly and strongly immediately after exposure to a sexual stimulus and, if the stimulus is not a preferred sexual cue, dropping off quickly.

Introduction

Female genital arousal is a neurovascular process primarily characterized by increased blood flow, which leads to tissue engorgement and the production of lubrication from the cervix, periurethral glands, and vagina (Traish, 2010). Unlike male genital arousal, which is highly concordant with mental arousal and occurs almost exclusively in response to preferred sexual cues, female genital arousal response in most women is nonspecific, occurring at similar levels in response to most sexual stimuli and before the subjective “feeling” of being sexually aroused (Chivers, 2010; Chivers, 2005; Suschinsky, 2007). The level of response does vary with the intensity of the sexual stimulus (e.g., images of intercourse produce a stronger response than images of masturbation) (Chivers, Seto, & Blanchard, 2007), but it does not vary strongly with either the degree of violence or with consent (Suschinsky, 2010).

There has been some discussion of the possibility that this genital arousal to non-preferred cues is the result of sympathetic nervous system activation, like that resulting from fear of sexual assault, creating increased blood flow in the genitals and thus engorgement and lubrication (Levin 2004). However, female genital response occurs in response to even non-preferred but threat-neutral stimuli (e.g. homosexual stimuli for heterosexual women), suggesting some explanation beyond mere alarm.

Another explanation of this phenomenon is the preparation hypothesis, which proposes that

automatic genital arousal is an evolved mechanism that prepares the genitals for sexual activity (Suschinsky, 2010). The potential benefits of a reflexive, immediate lubrication are quite clear. Even consensual activity typically results in some damage to the delicate tissues of the vulva (Anderson, 2012), which can easily lower an individual's future reproductive fitness. Genital injury brings increased likelihood of disease - even slight damage to the vulva can increase the risk of STI transmission (Peters, et al., 2004) – which can lead to infertility or death, as well as the stress of painful activity and the additional metabolic requirements of healing. Low levels of lubrication aggravate rates of injury and these effects (van Andel, 2008). In cases involving force, particularly nonconsensual sex, penetration without lubrication could be both extremely painful and physically costly. Individuals with even slightly lower rates of injury would have a very useful evolutionary advantage.

If the preparation hypothesis were accurate, it would explain the lack of genital injury after sexual assault (Bowyer, 1997) and would have potentially critical implications for sexual assault attitudes, treatment, and legal actions. Reports of genital arousal during rape are not uncommon (Levin, 2004). Currently, even if a survivor overcomes the psychological distress and distrust of her body's response and likely discouragement from her peers, family, and legal advisors due in part to a lack of physical evidence, the judicial system is less likely to rule in her favor without documented genital damage (Gray-Eurom, 2002). Estimates of genital injury resulting from rape vary greatly, ranging from 20% to 85% depending on the

study design. These estimates diminish greatly after 24 hours, suggesting that any injuries that do occur during rape are often quickly healed. However, in support of the preparation hypothesis, a recent review concluded that current research has not been able to distinguish between genital injuries caused by consensual sex and those caused by nonconsensual sex (Anderson, 2012). No study has found significant differences in the rates of genital injury between consensual and nonconsensual sex, though there has been some speculation that the location of injury may vary (Anderson, 2006; Anderson, 2007). Notably, however, while several studies have found higher rates of genital injury following nonconsensual sex in postmenopausal women as compared to premenopausal women, the two case-controlled studies that focused on age both failed to find higher rates despite the population's increased rates of lubrication and arousal disorders (Baker, 2008; Sommers, 2006).

Objective

The aim of this study was to obtain a more detailed description of female genital arousal in response to visual stimuli containing forceful, apparently unwanted sexual activity. We employed similar methods to previous work by Suschinsky (2010), which used short auditory stimuli to look at reaction to sex, violence, and consent. However, as visual cues typically elicit stronger response rates (Chivers, 2010), we sought to obtain a clearer picture of genital responses and to further validate previous work on the preparation hypothesis. We particularly sought to describe the speed and magnitude of arousal. We also attempted to

account for sexual preferences and fantasies, and previous exposure to visual erotica and pornography, neither of which the Suschinsky study examined. Occasional rape fantasy may be prevalent in up to 62% of women, with one study finding that 14% of women had rape fantasies at least once a week (Bivona, 2009). Sexual preferences could greatly affect responses to erotic scenes, particularly those featuring dubious consent.

We hypothesized that threatening sexual stimuli would provoke a more immediate, stronger genital response – that is, a defensive reflex - than that of nonthreatening stimuli, but that this response would likely fall off more quickly as the initial instinct of danger dissipated. We expected this effect to be less clear in women whose preferred sexual cues were closer to the activity portrayed in the threatening stimuli, i.e., women with sexual fantasies involving force or rape.

Method

Recruitment

Participants were recruited through Introduction to Psychology classes at the University of Texas at Austin and offered class credit in two parts: an initial online survey to test for eligibility, and two in-lab sessions for participants meeting eligibility criteria. The online survey consisted of a number of measures of sexual behavior, attitudes, and functioning, as well additional eligibility criteria to determine whether the respondent could participate in the study.

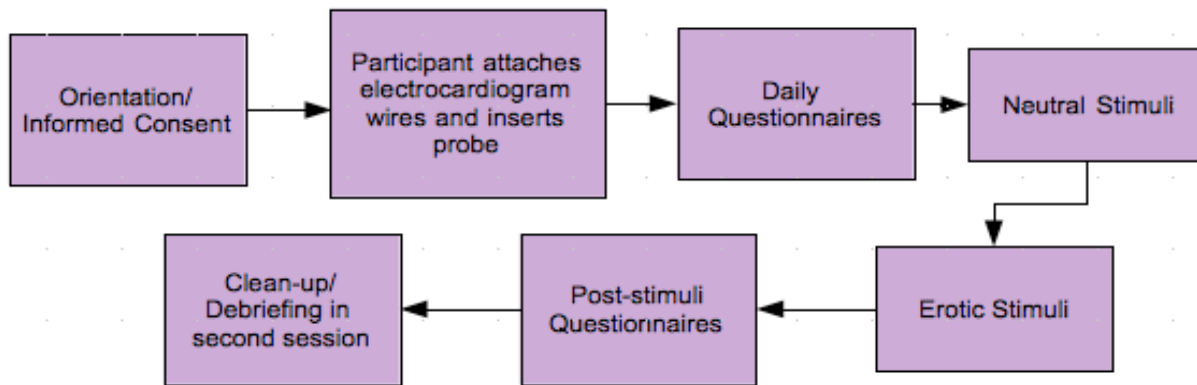
Inclusion criteria for the laboratory sessions included: heterosexual or bisexual (our stimuli featured male-female sexual activity) cisgendered female aged 18 years or older, fluent in English, with some form of partnered sexual experience (required to assess sexual functioning).

Perhaps the most important exclusion criteria dealt with history of sexual abuse or any sort of sexual aversion or distress, as the experimental stimuli had the potential to induce distress for someone with a history of sexual trauma. Other exclusion criteria were intended to reduce variability due to non-normative genital or sexual function, including: currently pregnant or breastfeeding; clinically significant untreated renal or endocrine diseases; significant levels of sexual dysfunction as measured by the Female Sexual Dysfunction Index (FSFI) (Rosen, 2000); untreated mental health disorders; pelvic nerve damage or neurological impairment; or use of medications known to impact sexual or autonomic function. Additionally, to reduce risk to participants and to lab equipment, we excluded women with positive HIV status or active pelvic, vaginal, or urinary tract infections.

Procedures

Participants who met the eligibility criteria were sent e-mails inviting them to participate, reiterating confidentiality, and briefly explaining what they would experience. Those participants expressing interest were scheduled to come in for two in-lab sessions. The two

sessions were scheduled one or, if absolutely necessary, two days apart to minimize variation in autonomic or genital arousability between sessions (Guillermo, 2010; Chivers, 2010). Both sessions followed the basic format shown below; however, the second session ended with a short debriefing. Experimenters left the room after giving a short orientation and completing informed consent procedures, and gave step-by-step instructions via an intercom in the next room. (In other words, the experimenter instructed the participant in the use of the plethysmograph (see below) before leaving the room, but gave additional technical support and reminders during the experiment through the intercom). Participants fitted the plethysmograph, filled out the questionnaire, and viewed the stimuli in privacy.



The pre-stimuli questionnaire asked about stressors or activities done earlier in the day that are known to influence sexual arousal, such as exercise (Meston, 2000), cigarette smoking (Harte, 2008), eating (which can influence cortisol, which impacts autonomic arousal; Exton et al, 2000), and sexual activity.

Stimuli

The stimuli used in the experiment were commercially available images arranged in a slideshow, without audio. We chose to use still images instead of video to roughly match the narratives of the two encounters. The neutral stimuli consisted of 30 seconds of the word “relax”, followed by 10 non-sexual “neutral” images lasting 10 seconds apiece. The same neutral stimuli were used in the control and the experimental sessions.

The neutral stimuli were followed by one of two counterbalanced sets of erotic stimuli, consisting of a series of 46 erotic images lasting 10 seconds apiece, for a total of 7 minutes and 40 seconds. All erotic images featured couples engaging in heterosexual sex, starting with sexual touching and undressing, and progressing to oral sex and then vaginal intercourse. Both the control and the experimental slideshows spent the same amount of time on images of each type of sexual activity. Both emphasized images of genitalia, as genital arousal has been shown to be maximized in response to viewing genitalia (Chivers, 2010). In the control stimuli, the sexual activity was female-centered, similar to stimuli previously shown to elicit female arousal (Laan, 1994), and the women in each picture displayed positive affect: smiling, laughing, and clearly taking an active and consenting role in the activities. The experimental stimuli showed women displaying negative affect: they are frowning or struggling, and consent is ambiguous.

Physiological Assessments

Genital arousal was recorded continuously as participants viewed the stimuli. Genital arousal was measured using a vaginal photoplethysmograph, which monitors vaginal blood flow by measuring the increases in the amount of emitted light reflected and backscattered off of the vaginal walls when they are engorged with blood during arousal. The signal was recorded using AcqKnowledge III, Version 3.7.3 (BIOPAC Systems, Inc., Santa Barbara, CA) and a Model MP100WS data acquisition unit (BIOPAC Systems, Inc.) for analog/digital conversion.

Analyses used vaginal pulse amplitude (VPA), a measurement reflecting arousal-specific phasic changes in blood flow (i.e., changes from heartbeat to heartbeat). Changes in vaginal blood volume (VBV), which is thought to represent the total blood pooling in vaginal tissues (due to both sexual and non sexual arousal), were also recorded. The data were band-pass-filtered to remove noise, and artifacts left by the plethysmograph's sensitivity to movement were manually removed from the data. Calculated from this data were the maximum VPA (arousal) levels reached, mean VPA and VBV during neutral and erotic stimuli, the time taken to reach the highest level of arousal from the beginning of the erotic stimuli, the percent change between the neutral and erotic stimuli, the slope of the regression equation fitted between the beginning of the erotic stimuli and point of max arousal (i.e., the rate of change in arousal from introduction of erotic stimuli to the maximum arousal) and the amount of time women spent at at least 90% of her maximum levels of arousal.

As patterns of arousal vary greatly between women, each participant served as her own baseline. Therefore, all analyses tested within-subjects differences between the control and experimental conditions using a repeated-measures ANOVA on the above calculated variables. The conditions (control and experimental) were set as the repeated measure, and additional tests were run using various survey results as covariates.

Self-Report Assessments

Mental sexual arousal was measured both continuously through the stimuli and with a post-stimuli survey. As the participant viewed the neutral and erotic stimuli, they indicated their current sexual arousal using a sliding measure that they pushed up or down to indicate higher or lower levels of arousal. These data were recorded and analyzed in the Matlab software package (student version, release 12). Once the stimuli have finished, the participant assessed their physiological arousal and other impressions by completing Toledano's 54-item Sexual Arousal and Desire Inventory (Toledano, 2006). Analyses of mental sexual arousal are presented elsewhere.

Results

Sample Characteristics

The eligibility survey was available Fall 2011 - Fall 2013. A total of 346 women completed the survey. Of those women, 54 were eligible for the in-lab portion of the study (16%). Eleven of

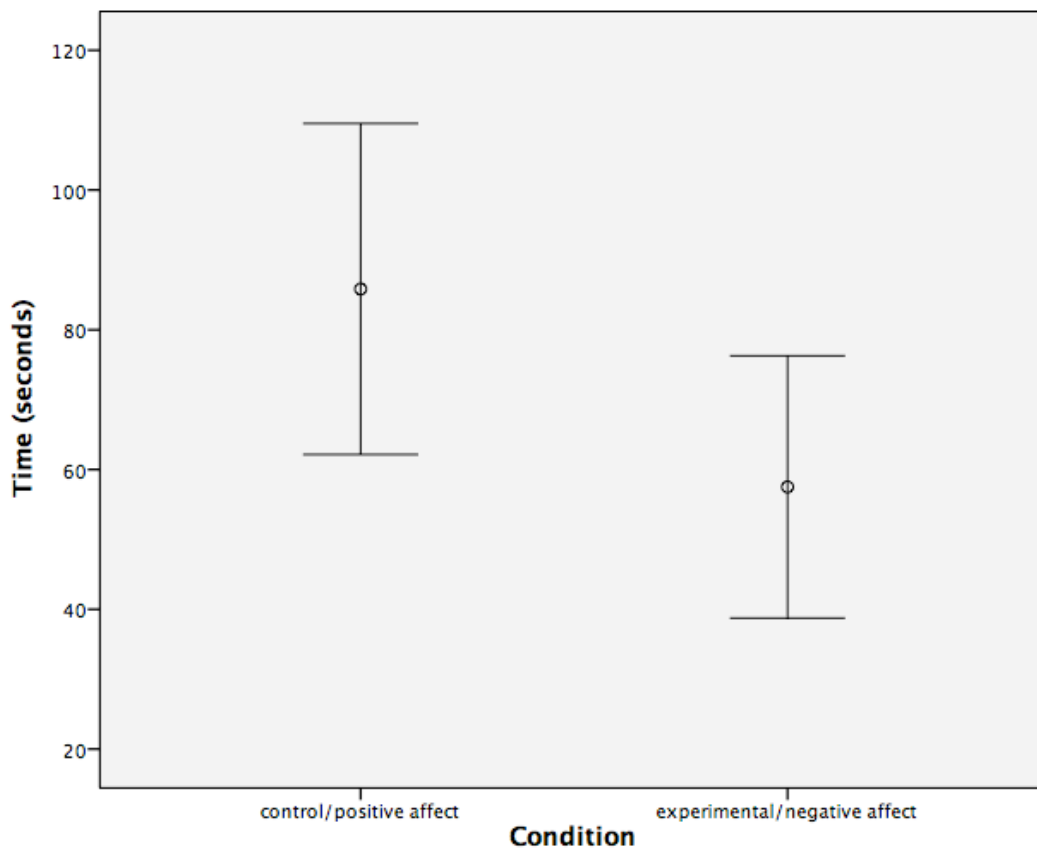
those eligible accepted invitations for the in-lab portion and successfully completed both sessions (20% of eligible, 3% of total). One participant's physiological data was unusable due to equipment malfunction and was removed from final analyses, and another's online survey results including demographic data were lost (data from this participant were included in analyses of physiologic function). The participants who attended laboratory sessions were slightly older (mean age, 21) than the average participant who took the eligibility survey (Mean age, 20; $p=.01$). Seven participants were in current relationships (lengths 8 to 48 months), and of the three that did not report a relationship, one declined to respond and another was the participant whose survey data were lost.

| Demographic | Survey Population (n = 346) | | In-lab sample (n=10) | |
|----------------------------------|-----------------------------|------|----------------------|----|
| | Count | % | Count | % |
| Ethnicity | | | | |
| White | 187 | 62.8 | 5 | 50 |
| African-American | 25 | 8.4 | 2 | 20 |
| Hispanic | 71 | 23.8 | 0 | 0 |
| Asian-American | 44 | 14.8 | 1 | 10 |
| Native Hawaiian/Pacific Islander | 3 | 1 | 0 | 0 |
| Sexual Orientation | | | | |
| 0 (Completely Heterosexual) | 234 | 67.6 | 6 | 60 |
| 1-25 | 80 | 23 | 3 | 30 |
| 26-50 | 12 | 3.5 | 0 | 0 |
| 51-75 | 8 | 2.3 | 0 | 0 |
| 76-99 | 2 | .6 | 0 | 0 |
| 100 (Completely homosexual) | 10 | 2.8 | 0 | 0 |

Physiological Measures

Repeated-measures ANOVA revealed a significant difference between the amount of time spent at high (90%+) levels of arousal between the two conditions, with more prolonged levels of high arousal occurring during the control condition ($F(1,9) = 5.896$, $p < .05$). There

were no significant differences in the maximum levels of arousal reached ($p=.402$), time to maximum arousal ($p=.499$), mean levels of arousal in VBV or VPA ($p=.329$, $p=.654$), percent change in mean arousal from the neutral stimuli to the positive stimuli (for VPA $p=.415$, for VBV $p=.774$) or percent change in maximum (VPA) arousal from the neutral stimuli to the positive stimuli ($p=.363$). When tested as covariates, neither previous exposure to or regular enjoyment of pornography or occurrence of rape fantasy had significant interactions with physiological results.



Discussion

The patterns of arousal displayed partial support for genital arousal as a protective reflex and thus the preparation hypothesis. In both conditions, the initial burst of arousal was observed equally quickly and to the same magnitude after the participant perceived a sexual stimulus. However, this arousal faded quickly in the case with a non-preferred sexual cue. It is quite plausible that the initial, defensive reflex of arousal to the possibility of harm (in seeing images of sexual threat) is quickly tempered by the conscious, rational awareness that the woman is in no actual danger. Following a brief arousal response to the threatening stimuli, arousal quickly extinguished, whereas for the more generally appealing stimuli featuring consensual sexual activity, the sexual arousal response continued at the same magnitude.

It is remarkable that these significant effects were observed despite a somewhat small sample size. We found recruitment surprisingly difficult during this study, with less than half the predicted rate of eligibility and extremely low response rates. It is likely that there were additional physiological effects or between-subjects explanatory factors that could not be observed in our small dataset.

Three major sources of ineligibility were history of sexual abuse, lack of sexual experience or sexual inactivity, and irregular menstrual cycles. Nearly one in three women (32%) who filled out the online survey reported unwanted sexual contact with some degree of coercion (“made

to” or “forced”). Three-fourths of this unwanted activity took place when the participant was age 17 or older – a high school senior or college student. The often-cited estimate of “1 in 5 women experience sexual assault”, first reported by the Centers for Disease Control (Black, 2010), although seemingly high, may not be high enough, even in a population not otherwise seen to be “at risk.”

As it is speculated that arousal response may differ between those with and without intercourse experience (Fortenberry & Hensel, 2011), participants needed to report a history of some form of consensual sexual contact with a partner (including “petting or caressing” genitals, oral, vaginal or anal sex). However, there were multiple difficulties and ambiguities that made assessing this difficult. Students may have misinterpreted the provided definition of “virgin”; although an adjustment was made to clarify these questions, these adjustments were made in the latter portion of recruitment. More of a problem, however, was the fact that the FSFI, used to measure sexual function, conventionally asks about sexual activity “within the past four weeks.” While it is impossible to say exactly how much this impacted FSFI results, the rate of women under the traditional cut-off for “sexual dysfunction” was approximately 58%, considerably higher than the often-cited 43% (Laumann, 1994). Later versions of the survey corrected for this by removing all “in the past four weeks” wording as this would be more appropriate in our population. However, rates of “dysfunction” were also often the result of participants choosing to “skip” certain questions, thus making them

artificially ineligible for the lab session portion of the study.

Low response rates can be attributed to a number of possible causes. Participating in sexuality research may have been intimidating to potential participants. The lengthy eligibility survey, which included many questions focused on rape, the level of detail in the e-mailed invitation, or the overall time commitment may have all added to the level of intimidation. Psychology 301 students are required to complete 5 credit hours of research, and only one of those credits can come from an online research survey. Those that waited to get their online survey credit may have already scheduled or completed other lab credits. Others may have been reluctant to limit 3/5ths of their research experience to one study.

The sample size and the sample itself has some implications for the results. Using only PSY 301 undergraduate students at a large, southern university created a biased sample, though not one particularly uncommon in psychology research. However, as the effects we are studying are physiological and likely evolutionarily derived mechanisms, they are not as likely to differ across populations as other variables might. Similarly, the low sample size was somewhat mitigated by using within-subject analyses, which greatly increased the power of our analyses.

Conclusion

The preparation hypothesis has major legal and cultural implications. Recognition that genital arousal is not a signifier of consent could greatly increase rates of successful prosecution of rapists, and ease some of the shame and horror their victims feel. Just the knowledge of such a defense mechanism is empowering. Additional research on more diverse populations, validation using video stimuli for even stronger results, and further investigation into the relationship between onset of mental and onset of physical arousal are all much-needed next steps towards a better understanding of female genital response.

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Biography

Betsy Lessels was born in Austin on May 30, 1990, and moved to Houston in 1996 with her parents and a multitude of cats. She returned to Austin in 2008 when she enrolled in the Plan II and Dean's Scholars honors programs at the University of Texas, and will graduate in May of 2013. She is particularly interested in sexuality research (human and animal), queer and social justice issues, and olfaction, and enjoys art, fandom, and the Japanese language. During college, she volunteered as a Healthy Sexuality Peer Educator with University Health Services, spent five weeks studying land use issues in Costa Rica as part of a Maymester program, worked as a camp counselor, and did research at the Meston Psychophysiology Lab and Baylor College of Medicine. She is not currently sure what she wants to do with her life, but she plans on having a lovely time doing it.