INTERNAL BODY AWARENESS AMONG SEXUAL TRAUMA SURVIVORS: A MULTI-METHOD STUDY

by

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A DISSERTATION

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DISSERTATION ABSTRACT

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Sexual trauma, in addition to being a human rights violation, harms people in numerous ways, including negative psychological and physical outcomes. Body-based interventions reduce sexual trauma symptoms, but limited information exists about how these interventions work. Researchers propose changes in internal body sensation awareness (i.e., interoceptive awareness; IA) as a potential mechanistic explanation. We are not aware of any studies testing that claim. Further, there is scant extant information on IA – sexual trauma relationships. Before evaluating mechanistic therapeutic hypotheses, studies need to test sexual trauma – IA associations. We focus on this understudied area here.

Through a multi-method study (behavioral, self-report and qualitative data), we tested the associations between IA and sexual trauma among females. Aim 1: Characterize IA among sexual trauma survivors. We hypothesized that survivors would have significantly lower self-reported IA than existing literature. Aim 2: Quantify the amount of variance IA explains in posttraumatic stress disorder (PTSD) symptoms. We hypothesized that IA would predict significant variance in PTSD, such that increases in IA would predict increases in PTSD. We expected that an IA – dissociation symptom interaction would

qualify that main effect via weakening it for survivors with higher dissociation. Aim 3: Through a moderated mediation model, test if IA mediates the sexual trauma – PTSD association. We hypothesized that IA would mediate that association. Further, we predicted that the IA – PTSD relationship would be moderated by dissociation: higher dissociation would attenuate the IA – PTSD association.

In this manuscript, we report results from two samples: 1) University (n = 153), and 2) community (n = 21) participants. Given ongoing community participant recruitment, the following are university participant results. Aim 1: Self-reported IA is significantly lower among survivors than comparator samples. Aim 2: Behavioral IA explained significant variance in PTSD, though opposite to the direction we predicted: we observed that as IA increased, PTSD decreased. We observed a significant interaction between self-reported IA and dissociation in predicting declines in PTSD. PTSD symptoms were lowest among survivors with high dissociation and high IA. Aim 3: IA did not mediate the sexual trauma – PTSD association. We discuss clinical implications, limitations and future directions.

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I dedicate this dissertation to all survivors of sexual trauma.
May you be happy, may you be healthy, may you be free of all fears,
may you live with ease.

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CHAPTER I

INTRODUCTION

Exposure to sexual trauma[1] is toxic to survivors physically (Freyd, Klest, & Allard, 2005) and emotionally (Kaltman, Krupnick, Stockton, Hooper, & Green, 2005). Repairing this harm is tremendously costly for individuals and their communities (Surís, Lind, Kashner, Borman, & Petty, 2004). This cost is born disproportionately by women (White House Council on Women and Girls, 2004; Kessler, 2000); in the United States, more women than men are sexually victimized (Black et al., 2011), making them an especially important research population. Female sexual trauma survivors (hereafter "survivors") are frequently burdened with increased healthcare utilization (Kartha et al., 2008) and negative physical and mental health symptomatology (Felitti et al., 1998). Due to this and other harms associated with sexual trauma, researchers have paid great attention to outcomes following sexual trauma. One of the most researched outcomes following sexual trauma is posttraumatic stress disorder (PTSD). According to diagnostic criteria (American Psychiatric Association, 2013), following exposure to a traumatic event, this condition is characterized by four symptoms clusters: intrusion, avoidance, negative cognitions about self, others and the world, and heightened arousal and reactivity. To meet diagnostic criteria, these symptoms must be at a certain threshold and have persisted for longer than one month (American Psychiatric Association, 2013). Meeting the diagnostic criteria for PTSD is not the sole harbinger of psychological

[1] We will use "sexual trauma" to refer to experiences of unwanted sexual contact throughout this paper. It is important to note, however, that not all survivors wish to label their unwanted sexual contact experiences as traumatic. We are using "sexual trauma" so as to be consistent with a majority of the literature. However, we do so with caution and awareness that perhaps not all females would label an experience of unwanted sexual contact as traumatic.

distress, however. When experienced at a level that is subthreshold diagnostically, posttraumatic stress symptoms are also unsurprisingly highly disruptive to survivors' lives (Brancu et al., 2016). Although researchers have studied how sexual trauma affects survivors' health, less is known about how it affects survivors' experiences of their own bodies.

Studying how sexual trauma affects survivors' experience of their bodies is a critical area of inquiry. It is an important topic to study, given that peoples' experiences of their bodies – particularly their awareness of their internal body sensations – are theoretically related to their ability to recognize their emotions. Survivors commonly experience alexithymia (i.e., challenges with articulating and recognizing emotions; McLean, Toner, Jackson, Desrocher, & Stuckless, 2006), and many consequences following sexual trauma are related to emotion dysregulation. Given the connection between awareness of body sensations and emotions, and that survivors' post-trauma challenges include conditions of emotion dysregulation, it is important to study the effects of sexual trauma on the physical body. Ultimately, results from such inquiries could inform clinical interventions, particularly those that focus on improving emotion regulation among survivors. Additionally, such results would likely align well with existing evidence-based treatments for survivors (e.g., cognitive processing therapy; Resick, Monson, & Chard, 2008), that are rooted in cognitive theory. As described further below, cognitive theory maintains that in order to regulate emotions, one must recognize the interconnections between physiological sensations, thoughts, emotions and behaviors. In summary, it makes sense to delve into researching body awareness among survivors, due to the critical role that body sensation recognition plays in emotional

awareness, that many survivors have challenges with emotional awareness and experience emotion dysregulation, and that existing therapies already focus on body sensation awareness.

Researchers have not extensively studied survivors' awareness of their internal body sensations, or interoceptive awareness (IA), which is a component of how people experience their own bodies. In the present study we utilized a two-part conceptualization of IA: first, IA is perceptual accuracy of internal body sensations and their nuanced changes (Craig, 2008; Pollatos, Traut-Mattausch, & Schandry, 2009); additionally, IA involves one's cognitions about and perceptions of internal body sensations, and awareness of how those body sensations are connected to emotions (Mehling et al., 2012).

Theories of emotion have long involved awareness of internal body sensations as a key element of how we experience our emotions. William James and Carl Lange began theorizing concurrently about this topic in the 1800s. Their separate bodies of work on this topic later were coined the James-Lange theory of emotion. In brief, the theory states that emotional experience is generated from changes in bodily sensations and our awareness of those sensations. Their work has been extended by other similar theories of emotion, such as those from Schachter and Singer's two factor theory of emotion (1962) and Damasio's somatic marker hypothesis (1996). An in-depth discussion of these theories is beyond the scope of this manuscript, however, suffice it to say that these theories focus on emotion being experienced and expressed through changes in and awareness of sensations in the body. In empirical studies, IA has been shown to be an active component of how people recognize their emotions (e.g., Herbert & Pollatos,

2012). Barrett and colleagues (2004) demonstrated that IA is related to increased experience of emotional intensity and heightened emotional processing of arousing stimuli. Awareness of physical sensations is also a component of key theories on how emotional distress – what is sometimes referred to as psychopathology – is maintained. Some theories of mental health outcomes following sexual trauma center around emotion dysregulation: difficulty knowing or responding to one's emotions and feelings (Frewen & Lanius, 2006).

Greenberger & Padesky's (1995) Five Aspects of Life figure (see Figure 2) outlines that physical reactions, behaviors, thoughts, moods and environment are interconnected and influence emotion regulation *and* dysregulation. Their work is based on original work by Aaron Beck (1979) through his cognitive theory. The Five Aspects of Life figure focuses on the interplay between five aspects of life in maintaining emotion dysregulation: thoughts, emotions, behaviors, physical sensations and environment. Greenberger and Padesky encourage therapists and patients alike to consider how these five aspects are interrelated. They state that psychological change and insight into psychological processes are produced through an understanding of the interrelation of these five aspects (1995). Specific to PTSD, Padesky and Greenberger (1995) and Ehlers and Clark (2000) theorize that PTSD arises through people developing dysregulated cognitions and beliefs about elements related to their traumatic event(s) that impact and interact with physical sensations, emotions, behavior and environment. Through cognitive behavioral interventions, they emphasize the importance of changing patients' cognitive appraisals of elements related to their traumatic event. Although they do not specifically discuss IA, since IA is inherently a part of physical sensation experience

(which have components of internal and external body awareness), it is likely that these theorists would agree that IA is an important component of a cognitive behavioral understanding of emotion dysregulation.

These theories and empirical results suggest that IA is a key component of how people know their emotions and feelings, and is a component of how mental health conditions are maintained. Research demonstrates that IA is a maintenance factor for mental health conditions, such as panic disorder (Ehlers, 1995). Ehlers conducted a prospective study of patients with panic disorder and patients with panic attacks but without a panic disorder diagnosis (1995). She found that more accurate perception of internal body sensations (i.e., more accurate IA) predicted worse treatment outcomes and a higher incidence of panic attacks. One possible interpretation of these findings is that people who were more aware of their internal body sensations and nuanced changes in those sensations became hypervigilant about their body sensations, which possibly led them to experience more extreme anxiety-related emotions and distorted cognitions. Along those lines, Fedroff, Taylor, Asmundson and Koch (2001) found that among survivors of traumatic automobile accidents, anxiety sensitivity (i.e., a heightened sensitivity to bodily sensations and higher likelihood of interpreting bodily sensations as anxiety related) significantly predicted PTSD higher symptoms. Dunmore, Clark and Ehlers (1999) found that cognitive appraisal of symptoms including physical sensations (e.g., "My reactions since the assault mean that I must be losing my mind", p. 814) following traumatic experiences maintained PTSD among people who had experienced physical or sexual assaults. In order to cognitively appraise a bodily symptom, one must first be aware of the bodily symptom, thus it is likely that heightened awareness of

internal bodily sensations may influence negative appraisals of such sensations. This all may suggest that too much awareness of internal body sensations is not a good thing among people who have experienced trauma.

Given this literature and that PTSD symptoms (particularly the intrusion and heightened arousal and reactivity clusters) are anxiety-related, we predicted observing higher IA (i.e., more accurate IA) among females with higher PTSD symptoms, and observing that IA would predict a significant amount of variance in PTSD symptoms (aim 2). Additionally, as PTSD symptoms (again, particularly intrusion and hyperarousal and reactivity clusters) are theoretically related to body sensation awareness, it is likely that the association between sexual assault exposure and PTSD symptoms are partially mediated by IA (aim 3).

Thus far, one study has investigated IA among survivors of sexual trauma who have a PTSD diagnosis (Mitchell, Masseo, Schlesinger, Brewerton, & Smith, 2012). The researchers assessed IA through a self-report measure with an IA subscale, the Eating Disorder Inventory-II (EDI-II; Garner, Olmstead, & Polivy, 1983). The findings from this study stand in contradiction to the information and predictions presented just now: they found that more accurate IA was related decreases in PTSD symptoms following cognitive therapy. However, these results are challenging to interpret due to the EDI-II IA subscale. The EDI-II authors operationalize IA as a construct that "reflects one's lack of confidence in recognizing and accurately identifying emotions and sensations of hunger or satiety" (Garner, Olmstead, & Polivy, 1983, p. 18). That inventory is somewhat difficult to interpret, because it contains two constructs that are merged in the results reporting: awareness of internal body sensations (hunger and fullness sensations,

specifically) and alexithymia. Higher scores on this scale are indicative of higher pathology, which means *less* awareness of hunger and fullness and awareness of emotions. There are two items from the EDI-II IA subscale that are directly related to perceptions of hunger and fullness, while the remainder of the items in the subscale (eight items in total) are related to "feelings" and "emotions", and thus potentially map on more closely to alexithymia and/or the interplay between IA and alexithymia. Alexithymia (i.e., challenges with distinguishing and articulating emotions within the self; Bagby, Parker, & Taylor, 1994) is a separate (though interrelated) construct from IA. Alexithymia tends to be high among sexual trauma survivors (McLean, Toner, Jackson, Desrocher, & Stuckless, 2006). People who have high symptoms of alexithymia (i.e., a lower awareness of and ability to describe one's emotions) tend to have lower IA (i.e., less accurate perception of internal body sensations and their nuanced changes; Herbert, Herbert, & Pollatos, 2011).

In Mitchell and colleagues study (2012), among a sample of 65 female survivors of rape or physical assault investigators reported that prior to a treatment course of cognitive processing therapy, higher PTSD symptoms were associated with greater difficulty with IA ($r = .14$, $p =$ ns). Following treatment, they observed significant improvement in IA following the 10-week treatment course of cognitive processing therapy (Mitchell et al., 2012). There are multiple explanations for these findings. One possible interpretation of their findings is that cognitive therapy helped increase awareness of internal body sensations, thereby increasing awareness of emotions. Another possible interpretation is that through cognitive therapy, participants learned to change their thoughts about their traumatic experiences which helped them allow

themselves to be aware of their body sensations and emotions, instead of avoiding them. Yet another interpretation is that participants had high dissociation tendencies, and that through learning cognitive therapy techniques – aimed at restructuring thoughts about the self, others, and the world – participants learned to become aware of their body sensations and interpret them not as signs of danger, necessarily, but as sensations coming from the body that are associated with particular emotions. Another study utilizing a different self-report measure of body awareness showed that in contrast to people who had not experienced trauma, survivors of physical and sexual trauma had higher levels of self-reported body dissociation (Price & Thompson, 2007). One might think that this would suggest low levels of IA, however this study also reported that there were no differences between survivors and non-survivors on body awareness.

The current literature on IA is somewhat inconclusive, and specific research on IA among survivors of sexual trauma is limited. However, keeping in mind theories of emotion that involve IA and cognitive theories on emotion dysregulation, it seems particularly important to learn more about how IA functions among survivors of sexual trauma. Such knowledge could aid the understanding of how awareness of internal body sensations – one of the factors in the greater construct of body awareness – covaries with exposure to sexual trauma and posttrauma symptoms. The present study aims to build upon and potentially clarify current IA research with sexual trauma survivors through multi-method assessment of IA.

The present study extends clinical psychology's understanding of the psychological aftermath of experiencing sexual trauma, through our specific focus on awareness of internal body sensations among survivors. The findings will shed light on

survivors' IA through multi-method assessment. By extension, it may contribute to our understanding of how IA impacts survivors' ability to be aware of, connect to, and possibly regulate their emotions. We predict that more accurate perception of internal body sensations (i.e., higher IA) would be positively associated with PTSD symptoms. Our theory is that higher IA will not be a "good" thing within the context of PTSD symptoms among sexual trauma survivors, and that it will be positively associated with posttrauma pathology. Recall that more accurate perception of internal body sensations is a predictor of anxiety-rooted conditions, including panic disorder (Ehlers & Breuer, 1992), more frequent panic attacks and poorer treatment outcomes (Ehlers, 1995). Therefore, if we conceptualize PTSD as a condition maintained by anxiety symptoms (e.g., Fedroff, Taylor, Asmundson & Koch, 2001), it stands to reason that more accurate (i.e., higher) IA will also be positively associated with PTSD symptoms.

The work will likely inform our understanding of body-based sexual trauma outcomes that are common among individuals, and costly to both individuals and communities. Such body-based sexual trauma outcomes include conditions related to hyper- (e.g., chronic pain, neuropathy, and irritable bowel syndrome) and hypo- (e.g., dissociation) body awareness. Evidence from the present study may inform the understanding of mechanisms of such somatic outcomes. Additionally, the present study's results may inform research on and practice of body-based therapies (e.g., yoga) for survivors. Such interventions are less costly, more accessible and less pathologized than many mental health interventions are in our society. It may also be that evidence from the present study could inform non-body-based therapies (such as prolonged exposure therapy) that already have interoceptive exposure components. Lastly, it could

be that results from this study could help guide clinicians in selecting appropriate therapies to offer to patients.

Pilot Study

Given that IA had never before been assessed with the MAIA (Mehling et al., 2012) among sexual trauma survivors, we conducted a pilot study to inform hypotheses and feasibility. We collected self-report pilot data from a sample of undergraduate students during the summer to test the relationships between self-report IA (MAIA; Mehling et al., 2012), sexual and non-sexual trauma (Brief Betrayal Trauma Survey (BBTS); Goldberg & Freyd, 2006), and trauma symptoms (Trauma Symptom Checklist (TSC-40); Elliot & Briere, 1992). Data reported here are exclusively from sexual trauma survivors in this pilot sample (n = 77).

The MAIA is self-report measure of IA that assesses the construct interoceptive awareness as a multidimensional one (Mehling et al., 2012). Mehling and colleagues' (2012) operational definition of IA includes the first part of the conceptual definition used in the present study (i.e., awareness of internal body sensations and their nuanced changes). In addition, they propose that IA invariably is closely tied to cognitions, perceptions and emotions about awareness of internal body sensations (i.e., the second portion of the conceptual definition used for the present study). Therefore, due to their proposed multifaceted conceptualization of IA, the MAIA is a scale with eight distinct subscales rather than a single score. The MAIA includes eight subscales: noticing (being aware of body sensations of discomfort, comfort and neutrality), not distracting (being inclined to not distract or ignore painful or uncomfortable sensations), not worrying (inclination to not worry or be emotionally distressed by painful or uncomfortable

sensations), attention regulation (paying attention to and controlling attention on body sensations), emotional awareness (being aware of the connection between emotions and body sensations), self-regulation (regulating distress through paying attention to body sensations), body listening (purposefully listening for insight from the body), and trusting (experiencing trust with and safety in the body) (Mehling et al., 2012). Each subscale ranges from 0-5, and higher scores are indicative of greater awareness of internal body sensations. Mehling and colleagues (Bornemann, Herbert, Mehling, & Singer, 2015) provide rationale for why a total score is not traditionally computed, which essentially boils down to the total score not accurately reflecting the nuanced components of IA measured through the MAIA. However, in this pilot study, the overall alpha for this scale (i.e., a total score) was .82, demonstrating strong internal consistency. Given this, and that other peer-reviewed papers that have reported a total score in their results (e.g., Dudley & Stevenson, 2016), we determined that computing a total score for this scale in the pilot and dissertation studies was a reasonable decision.

Bivariate correlations indicated that sexual trauma exposure was significantly positively related to Noticing (i.e., awareness of discomfort, comfort and neutrality), r = .31, p = .007 (medium effect; Cohen, 1988). This suggests that as exposure to sexual trauma increases, so does noticing (i.e., awareness of) body sensations. This result is consistent with the existing literature, including aforementioned findings (Ehlers & Breuer, 1992; Ehlers, 1995) of higher IA being associated with panic disorder. Looking at the remaining subscales, different patterns emerged:

(1) A positive relationship was observed between sexual trauma and emotional awareness (i.e., being aware of the connection between the body and emotions; r = .12).

(2) Negative relationships (small effects; Cohen, 1988) were observed between not-distracting (i.e., the inclination to not ignore uncomfortable/painful sensations; r = -.17) and trusting (i.e., trusting and feeling safe in the body; r = -.08).

The negative relationships between sexual trauma and not-distracting suggests that survivors do ignore and distract themselves from uncomfortable and painful body sensations. Additionally, as sexual trauma increases, trusting and feeling safe in the body decreases. See Table 1 for all zero-order correlations.

Partial correlations between sexual trauma and MAIA subscales indicated that when controlling for non-sexual trauma, the relationships between sexual trauma and MAIA subscales weakened. Given that some participants in the pilot study experienced sexual trauma and other forms of trauma (i.e., physical abuse), it was important to look at the partial correlations between MAIA and sexual trauma controlling for non-sexual trauma. Partial correlations between non-sexual trauma and MAIA subscales demonstrated that when controlling for non-sexual trauma, smaller effect sizes were observed (Table 2). These results suggest that non-sexual trauma also accounts for some of the relationship between sexual trauma and IA. Given this and other literature demonstrating the increased adverse effects of poly-victimization (Ford, Elhai, Connor, & Frueh, 2010), in the main dissertation study we also collected data on emotional and physical abuse. Independent samples t tests comparing mean scores for each subscale from this pilot sample with existing data showed that average MAIA scores in this sample were significantly lower than existing data, with one exception (see Table 3). Assessments of the relationships between MAIA and trauma symptoms (Table 4) showed significant positive and negative correlations.

These self-report pilot data provided a useful basis of information from which to pose hypotheses in the dissertation study about the relationships between sexual trauma exposure and MAIA subscales. The present dissertation study predictions were based on one subscale of the MAIA: the noticing subscale (4 items) and the MAIA total score. Choosing the noticing subscale seemed sensible, because it has the clearest connection with awareness of internal body sensations measured behaviorally; both noticing and the heartbeat perception task assess awareness of internal body sensations. Additionally, in this pilot study, it was the subscale that had the strongest correlation with exposure to sexual trauma both at the bivariate level (r = .31) and when controlling for exposure to non-sexual trauma (r = .28). One potentially limiting factor is that the scale reliability in this study was poor (*alpha* = .54). This may impact the ability to detect an effect with this subscale.

Dissertation Study

A Priori Aims and Hypotheses.

Aim 1. Characterize the relationship between sexual trauma exposure and IA among female sexual trauma survivors.

Aim 1, Hypothesis 1. We[2] expected that survivors of sexual trauma would have scores not significantly different from the pilot data collected for this study (Table 3) on self-reported IA (MAIA noticing subscale and MAIA total). In other words, we expected that results from the present study would replicate the pilot study results. Similar to

[2] As research is a highly active and collaborative process, I (Reinhardt) chose to use the pronoun "we" throughout this manuscript and write predominantly in the active voice. "We" refers to myself and my collaborators: Jennifer Freyd, my research assistants, my dissertation committee, my lab mates and other people who contributed to my idea for this study and interpretation of the results.

findings from the pilot study, we anticipated that results from these analyses would be significantly lower than average scores found in a large sample (n = 435) of community members with chronic pain (Mehling et al., 2013), and significantly lower than average scores found in a large sample of healthy mind-body practitioners (Mehling et al., 2012). See Table 3 for means and standard deviations for these three samples. Please note that all participants in this dissertation study (hereafter, the present study) experienced some form of sexual trauma. **Statistical analyses.** Means and standard deviations were calculated for the Noticing subscale and a total MAIA score and compared with existing literature.

Aim 1, Hypothesis 2. We expected to observe significant positive and negative correlations between self-report IA and trauma symptoms (Trauma Symptom Checklist-40 (TSC); Elliot & Briere, 1996). We anticipated that these results would replicate findings in the pilot study (Table 4). We anticipated there being a significant positive association between behavioral IA and the TSC anxiety symptom subscale. We expected there being a significant negative association between behavioral IA and the TSC dissociation symptom subscale. Planned analyses were to compute exploratory correlational analyses between behavioral IA and the remaining TSC subscales. **Statistical Analyses.** Bivariate correlations were calculated between IA (behavioral and self-report) and trauma symptoms.

Aim 1, Research Question 1. Given that this is the first study to assess behavioral IA among survivors of sexual trauma, in characterizing behavioral IA among survivors, we assessed what average behavioral IA (Bx-IA; via the HPT task) survivors would evidence. It may be that survivors' behavioral IA will be similar to results of

Pollatos and colleagues' 2009 study with university participants (n = 119; $M_{Bx\text{-}IA}$= 0.70 (SD = 0.20)), and similar to Pollatos and colleagues' 2007 study with university participants (n = 102; $M_{Bx\text{-}IA}$= 0.78 (SD = 0.17). In Pollatos and colleagues' 2009 study, depression was measured by the Beck Depression Inventory (Beck, Steer, & Brown, 1996), and State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Participants' average depression symptoms were in the mild range (M = 3.49, SD = 3.50) and average trait anxiety symptoms were moderate (M = 37.74, SD = 10.69; Pollatos, Traut-Mattausch, & Schandry, 2009). **Statistical analyses.** Bx-IA was expressed using interoceptive accuracy. The range is 0-1, with higher scores indicating more accurate perception of heartbeats. A mean and standard deviation was computed for interoceptive accuracy (Bx-IA).

Aim 1, Research Question 2. In characterizing IA among survivors of sexual trauma, we questioned if self-reported IA (specifically, the MAIA total score) would be correlated with behaviorally measured IA. Theory (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015) and empirical literature (Calí, Ambrosini, Picconi, Mehling, & Committeri, 2015; Leiter-McBeth, 2016) indicate that self-reported and behaviorally measured IA should and are not reliably correlated with one another. However, the theory is that these two ways of measuring IA are still tapping into a larger overall construct of interoceptive awareness. This theory is discussed at length by Garfinkel and colleagues (2015). Behavioral measures of IA, they say, measures "objective accuracy in detecting internal bodily sensations" (p. 67). They state that self-report measures of IA assess "self-perceived dispositional tendency to be internally self-focused and interoceptively cognizant" (p. 67). These definitions are similar to components one and

two of our operational definition of IA (see page 19 of this document). Among a sample of 135 participants, Calí and colleagues (2015) observed one significant positive correlation between one MAIA subscale and behaviorally measured IA (attention regulation and behavioral IA $r = .20$, $p = .02$), while among 87 participants Leiter-McBeth (2016) observed no significant correlations between the two measurements of interoceptive awareness. We will assess if self-reported IA and Bx-IA are correlated among this sample of sexual trauma survivors, in the context of this aim to characterize IA among survivors. **Statistical analysis.** We conducted bivariate correlation analyses between self-reported IA (MAIA; Mehling et al., 2012) and behaviorally measured IA (Heartbeat perception task; Schandry, 1981).

Aim 2. Quantify the amount of variance that IA and dissociation symptoms explain in PTSD symptoms among female sexual trauma survivors.

Aim 2, Hypothesis 1. We hypothesized that IA would predict a significant amount of variance in PTSD symptoms above control variables. Additionally, we expected that that main effect would be qualified by an interaction between IA and dissociation symptoms; we expected that the main effect would weaken for people with higher dissociation symptoms. **Statistical analyses.** We conducted a hierarchical linear regression analysis (PTSD symptoms = dependent variable) with the following steps: Step 1: age, resting heart rate, time estimate percent error, heart rate belief accuracy, physical abuse, emotional abuse; Step 2: sexual trauma, sexual harassment; Step 3: IA, dissociation symptoms; Step 4: IA × dissociation symptoms.

Aim 3. Test a moderated mediation model of relationships between sexual trauma exposure IA, dissociation and PTSD symptoms.

Aim 3, Hypothesis 1. We anticipated that the effect of sexual trauma exposure on PTSD symptoms would be partially mediated through changes in IA. Additionally, we expected that the association between IA and PTSD symptoms would be moderated by dissociation symptoms. We expected that the direct effect between sexual trauma exposure and PTSD symptoms would be partially mediated through IA; people with higher IA (behaviorally: more accurate perception of IA; self-report: higher scores on the MAIA total score) would have higher PTSD symptoms. Higher dissociation symptoms would diminish the association between IA and PTSD symptoms. **Statistical analyses.** Conditional indirect effect analyses were computed with PROCESS (Hayes, 2013) to test the degree to which the effect of sexual trauma exposure on PTSD symptoms was mediated through IA, and whether the association between IA and PTSD was moderated by dissociation symptoms. Past research (Dunn et al., 2010) has demonstrated that resting heart rate, percent error on time estimation trial, and belief of accuracy detecting heartbeats were significantly associated with behavioral IA. Thus, we will control for the aforementioned variables in this model. Please see Figure 1.

Research Design

Power Analyses

Aim 2: To assess number of participants needed for this aim, it was necessary to conduct a sensitivity power calculation through G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) with the following parameters: critical alpha of 0.05, power of 0.8, sample size of 150, number of tested predictors (3: IA, dissociation, IA × dissociation), and total number of predictors (11; see predictors listed above in Aim 3). With these parameters, G*Power indicated that the critical F would be 2.67 and the effect size (f^2)

would be 0.07. This indicates a small effect size, according to Cohen's guidelines (1988).

Aim 3: The literature on adequate sample sizes to achieve power of 0.8 for moderated mediation models suggests that sample sizes between 100-200 are sufficient. This is so long as all paths within the model have a standardized regression coefficient of .39 or higher (Wang & Preacher, 2015; p. 12), or "medium" strength according to Cohen's (1988) guidelines. In particular, Wang and Preacher (2015) found that small effect sizes (.14) yielded power of only .19-.50 for a sample size of 100-200, but medium effect sizes (.39) yielded almost perfect power, at .98 to 1.0 for a sample size of 100-200 (Wang & Preacher, 2015; p. 12). Preliminary data from this study indicated that correlations between variables in this model were .30 or higher. Given these two analyses and time, resource and compensation constraints, the target sample size was 150 for participants from the University of Oregon Human Subjects Pool. We aimed to recruit and run up to 50 community participants (given funding constraints). We aimed to cut recruitment off for the dissertation study (due to time constraints) by the middle of February, 2017.

We will assess the first portion of our IA operational definition behaviorally (through the heartbeat perception task (HPT) with the mental tracking method, as outlined by Schandry, 1981) and via self-report (with the Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012). We will assess the second portion of our IA conceptualization through the MAIA alone. Through open-ended questions, we will collect qualitative data on aspects of IA. It is important to note that we will not conduct a formal qualitative analysis of the open-ended data. This present report

will rely mostly on the quantitative data and our analyses of the quantitative data will be informed by the open-ended responses. We read through all open-ended responses and select quotes that enrich our understanding and illustration of the quantitative findings. We will integrate responses to the open-ended questions throughout the results and discussion sections. For the purposes of this manuscript, we will rely on the behavioral and self-report data and will integrate the qualitative data throughout to enhance our understanding of IA among survivors. We expect that collecting data on IA through these three methods will provide comprehensive information about how IA functions among sexual trauma survivors.

In summary of our aims and hypotheses, to learn how IA functions among sexual trauma survivors, we will first characterize IA among survivors (aim 1). Next, we will conduct a hierarchical linear regression and quantify the amount of variance that IA explains in PTSD symptoms (aim 2). We predict that above and beyond control variables, IA will explain a significant amount of variance in PTSD symptoms, such that increases in IA will predict increases in PTSD symptoms. We also anticipate that that main effect will depend on the interactive effect of dissociation symptoms and IA: the association between IA and PTSD symptoms will diminish for females with higher levels of dissociation. To assess potential mechanisms through which sexual trauma confers an effect on PTSD symptoms, we will conduct a moderated mediation analyses (aim 3; see conceptual model depicted in Figure 1). In this model, we predict that among female sexual assault survivors, interoceptive awareness (IA) will partially mediate the association between sexual assault exposure and PTSD symptoms. We also predict that

this will differ depending on dissociation symptoms. We expect that higher dissociation symptoms will diminish the association between IA and PTSD symptoms.

CHAPTER II

METHOD

Participants

We recruited two samples of female participants: a university student sample using the University of Oregon Human Subjects Pool (HSP) and a community sample comprised of participants from the Eugene and Springfield, Oregon areas. Recruitment for the community sample is ongoing and thus this manuscript will largely focus on results from the university sample. Because it is inappropriate to interpret data from small sample sizes within the context of correlational analyses, and because recruitment is ongoing, we will only report descriptive statistic results for the community sample. Inferential statistics for aims 1 and 2 will only be conducted on the university sample data. This study focuses on female participants, because they have higher exposure to sexual violence than males (Black et al., 2011) and some studies suggest that gender may influence differences in IA (Cameron, 2001; Cameron & Minoshima, 2002).

University student sample: We collected data from 152 female participants (M_{age} = 19.90 (*SD* = 3.5)), 149 of whom identified "woman" as their gender identity, and 4 of whom identified "genderqueer/gender non-conforming" as their gender identity. Seventy-three percent of the sample identified as White or Caucasian. See Table 5 for descriptive statistics. Based on power analyses, we aimed to recruit at least 150 participants through the HSP given the advantages that recruiting from this source provides. First, there is little self-selection in the HSP, because participants do not know the purpose of the study when they initially express interest in it. Participants being blind to those study aspects decreases self-selection bias. Second, given the lack of self-

selection, it can be argued that data from the HSP offer different aspects of generalizability than data from a community sample. Inclusion criteria were female gender, age 18-70 and at least one experience of unwanted sexual contact (e.g., touching, kissing, or penetration). Potential participants provided answers to these inclusion criteria questions through the UO HSP Prescreen measure. If potential participants were eligible, they were able to sign up for an appointment for the present study, which was named the "Avett Study" in the University's research appointment time and credit allocation system, Sona. HSP participants received two course credits (out of the four required during one term of their course) for their participation.

Community sample: Forty-seven people expressed interest in participating in the study, and we were able to screen the eligibility of 33 potential participants via phone. The 14 people who we did not phone screen did not respond to our phone messages. As of April 13, 2017, we collected data from 21 female participants between the ages of 18 and 70 from the Eugene-area community. Of the people who we screened but did not participate, two people participated in the consent process, but decided to not participate; one person was ineligible due to being under age 18; ten people were lost to follow up. Our aim is to collect data from a total of 50 participants from the community. Due to time limitations, we will report descriptive statistics on this sub-sample of community participants and continue to meet with participants until we have met with 50 people. Participants were recruited via Craigslist, outreach through community organizations (e.g., Oregon Lane County's Sexual Assault Support Services) and posters in the community. Sexual trauma is highly stigmatized in our society and many survivors are reluctant to identify as such. We anticipated that this might have posed challenges for

recruitment. Because sexual trauma is highly co-occurring with emotional and physical abuse and chronic pain, we separately advertised for potential participants with highly stressful life experiences (e.g., emotional or physical abuse) or chronic pain. We had separate advertisements for exposure to sexual trauma, experience of highly stressful life experiences and chronic pain. As of April 13, 2017, the average age in this sample (n = 21) was 40.43 (SD = 15.51) and all participants selected "woman" as their gender identity. See Table 5 for full demographic characteristics. Community participants received $20 in cash for their participation.

Materials

Informed consent form. The informed consent document outlined general information about the study purpose, "We are asking you to participate in a research study investigating the relationship between heart activity and life experiences that some people have." The consent form noted that the person had been identified as a potential participant, because they identified as female and indicated that they had had stressful life experiences. At informed consent, we did not inform participants that we were specifically focusing on sexual abuse experiences, because we were concerned that their advance knowledge of this might influence the results. For example, knowing that the study was about sexual abuse might have elevated participant's heart rates prior to participating in study activities (e.g., electrocardiogram recordings). Additionally, the consent form outlined the possible risks, possible benefits, compensation and confidentiality. It also listed contact information for the two co-investigators (Kristen Reinhardt and Jennifer Freyd) and the University of Oregon Office of Research Compliance Services. See Appendix A for informed consent form.

Demographic questions. We asked the participants multiple demographic questions that were modified versions of questions researchers have used in past studies (see Appendix B for these items; e.g., Foynes & Freyd, 2011). We gathered information regarding participants' age, gender and ethnic identity, place of birth and if participants were fluent in spoken English. See Appendix B for demographic questions.

Validation items. We included five validation items within surveys that were evenly spaced apart from one another throughout the survey battery. The point of these items was to assess participant's attention to following instructions throughout the survey battery, thereby providing a proxy for validating their responses. The purpose of including validation items (sometimes also called attention check items) is to detect participants who may be contributing noise to data through providing inaccurate or imprecise answers to questions (Oppenheimer, Meyvis, & Davidenko, 2009). This noise can contribute to decreases in statistical power (Oppenheimer et al., 2009). Such noisy data might be due to participants not reading directions fully or answering questions randomly. It might also be that participants respond aimlessly due to boredom from a survey battery that is too long. These responses are not as easily caught in analyses for outliers. Krosnick (1991) developed a theory to understand people who contribute to noisy data by hypothesizing that people sometimes endorse the initial answer to a question or randomly answer a survey. He stated that people may behave in this way to minimize expenditure of cognitive effort when completing a survey battery. To identify such participants, Oppenheimer and colleagues (2009) introduced instructional manipulation check items (IMC), which are the same as validation items. Such questions indirectly test if participants are reading questionnaire instructions. To assess this, IMCs

are similar in answer format and length to other questions within a survey. The items were located in four separate surveys in the present study. An example item that we used was, "Since I'm paying attention, I'll mark option 3". This item was placed within the MAIA, which has similar question stem statements that participants answer on a five-point Likert scale. Through these questions, researchers request that participants disregard initial survey instructions, and rather pay attention to the IMC instruction. Participants who answered more than two out of five validation questions incorrectly were excused from analyses. See Appendix C for these items (all on one page), as well as Appendices E, G, I, and M to view validation items in the context of the surveys in which they were embedded.

Physical activity scale (Stanford Cardiovascular Disease Prevention Program as cited in Ehlers & Breuer, 1992). We asked participants to rate their general physical activity on a seven-point Likert scale. Participants are told, "Based on the following definitions, please indicate your level of physical activity in general." The measure offers definitions of Light, Moderate, Strenuous and Very Strenuous physical activity. For example, Moderate physical activity is defined as "Moderate physical activities: activities that are as strenuous as lifting or carrying objects up to 5 pounds, mowing the lawn with an electrical mower, rapid walking on flat ground." Participants have seven answers that describe general levels of physical activity through behaviors. An example answer on the scale is, "Moderate physical activity for at least 1 hour and at least 4 times per week, or strenuous physical activity at least once a week." Physical activity is important to measure in research on IA, because physical activity has been related to interoceptive accuracy (Dunn et al., 2010). If physical activity is significantly correlated

with interoceptive accuracy, it is important to include as a covariate in regression models (Dunn et al., 2010). Researchers have used this measure in past interoceptive awareness research (Dunn, Dalgleish, Ogilvie, & Lawrence, 2007; Dunn et al., 2010; Ehlers & Breuer, 1992). See Appendix D for full scale.

Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012). The MAIA is a scale that assesses IA through eight separate subscales, each yielding a separate score. As previously noted, the scale was not initially constructed with a total score, though the present study utilizes a total score. The MAIA includes eight subscales: 1) noticing (being aware of body sensations of discomfort, comfort and neutrality); 2) not distracting (being inclined to not distract or ignore painful or uncomfortable sensations); 3) not worrying (inclination to not worry or be emotionally distressed by painful or uncomfortable sensations); 4) attention regulation (paying attention to and controlling attention on body sensations); 5) emotional awareness (being aware of the connection between emotions and body sensations); 6) self-regulation (regulating distress through paying attention to body sensations); 7) body listening (purposefully listening for insight from the body), and 8) trusting (experiencing trust with and safety in the body) (Mehling et al., 2012). Each subscale range is 0-5 (never – always) and lower scores are indicative of less awareness of internal body sensations (i.e., lower IA). Additionally, research supports the scale's ability to discriminate body awareness between groups that would be hypothesized to differ on body awareness (e.g., students of mind-body practices who do not teach versus expert mind-body teachers; Mehling et al., 2012). The initial scale development study results reflected internal consistency in the questionable ($0.7 > \alpha \geq 0.6$) to good ($0.9 > \alpha \geq 0.8$) ranges as follows:

noticing: $\alpha = 0.69$; not-distracting: $\alpha = 0.66$; not-worrying: $\alpha = 0.67$; attention regulation: $\alpha = 0.87$; emotional awareness: $\alpha = 0.82$; self-regulation: $\alpha = 0.83$; body listening: $\alpha = 0.82$; trusting: $\alpha = 0.79$ (Mehling et al., 2012). Mehling and colleagues noted potential concern about the three scales with internal consistency levels below 0.70, and also noted that they decided to accept alpha levels of greater than 0.65 (2012). They also indicated that those three scales (noticing, not-distracting, and not worrying) each have three items, which enhances the sensitivity of the alpha calculation. Similarly, internal consistency for this study ranged from questionable ($0.7 > \alpha \geq 0.6$) to good ($0.9 > \alpha \geq 0.8$), with Cronbach's alpha levels as follows: noticing, $\alpha = 0.62$; not-distracting: $\alpha = 0.74$; not-worrying: $\alpha = 0.63$; attention regulation: $\alpha = 0.85$; emotional awareness: $\alpha = 0.81$; self-regulation: $\alpha = 0.80$; body listening: $\alpha = 0.85$; trusting: $\alpha = 0.88$; MAIA total: $\alpha = 0.90$. Descriptive statistics are available in Table 6. See Appendix E for full scale.

Abuse history inventories:

We measured various abuse types in this study: psychological/emotional abuse, physical abuse, sexual harassment, betrayal trauma and sexual assault. For all the measures (described below), we utilized the following age ranges in data collection: before turning age 14, between ages 14-17 and age 18 and older. These age ranges represent adaptations from the original validation of the below scales. In the present study analyses, we collapsed across age range and looked at lifetime abuse, by abuse type.

Psychological Maltreatment Scale (PSY; Briere & Runtz, 1988). This is a seven-item inventory of verbal psychological maltreatment, adapted from Briere and Runtz's Family Experiences Questionnaire. The scale was initially developed to assess

psychological maltreatment at age 16 or younger by mothers and fathers, separately. We modified the instructions to ask about "caregiver abuse", given that many people are raised by people other than biological mothers and fathers. Through posing behavioral items (e.g., yell at you, insult you, criticize you), the scale asks participants to document how often per year a caregiver psychologically abused them (before age 14 and between age 14-17). Additionally, the scale asks participants to document how often per year any adult in their life psychologically abused them at age 18 or older. Participants are asked how many times per year they experienced these events: never (coded as 0) through over 20 times a year (coded as 6). The scale range for this measure was 0 (indicative of no psychological abuse by an adult) to 126 (indicative of exposure to each of the six psychological abuse events over 20 times per year across all age ranges). We summed the distinct number of events each person experienced throughout their lifespan, to yield a possible score of 0 (indicative of no psychological abuse) to 21 (indicative of exposure to all seven types of psychological abuse at all three age ranges). Items in this scale are summed to yield total abuse scores for each participant, across the lifespan. In the scale development study, data supported good-excellent internal consistency ($\alpha = 0.87$), and good validity (Briere, n.d.). In this study, internal consistency was excellent ($\alpha = 0.97$). See Table 7 for descriptive statistics, and Appendix F for full measure.

LONGSCAN Measure of Physical Abuse (LONGSCAN; Barnett, Manly, & Cicchetti, 1993). This inventory (created by investigators at the LONGSCAN consortium who conduct child maltreatment longitudinal studies) measures physical abuse through behavioral items, along the following domains: Endangerment (e.g., "Has any adult hit you with something dangerous like a baseball bat, a shovel, or something

else that hurt you badly?"), physical injury (e.g., "Has any adult broken one of your bones?") and physical abuse (a composite of the two aforementioned domains). Participants answered "yes/no" (coded 1, 0 respectively) to the items across each age range. Researchers developed these items based on acts of caregiver abuse that would meet the threshold for abuse as defined by Child and Protective Services (Everson et al., 2008). The inventory is traditionally scored by determining sums for the endangerment subscale (six items), the physical injury subscale (nine items), and physical abuse (a total score for all items). Higher scores are indicative of more physical abuse experiences. In our analyses, we computed one total score of lifetime physical abuse with a range of 0 (indicative of no exposure to physical abuse) to 45 (indicative of a "yes" answer to all physical abuse events during all three age ranges). Research supports good face and content validity in this scale (Everson et al., 2008). Through data collected at the LONGSCAN Coordinating Center, researchers found that among 836 12-year old participants overall physical abuse significantly positively correlated with Trauma Symptom Checklist (Elliot & Briere, 1992) at $t = 0.24$-0.26. The present study demonstrated excellent internal reliability, Chronbach's alpha = 0.91. See Table 7 for complete descriptive statistics. See Appendix G for full measure.

Sexual Experiences Questionnaire (SEQ; Fitzgerald, Gelfand, & Drasgow, 1997). This is an 18-item inventory of sexual harassment across the following domains: gender harassment, unwanted sexual attention and sexual coercion. Gender harassment is conceptualized as negative comments that are related to gender, including inappropriate and offensive sexual comments. Unwanted sexual attention is conceived of as physical contact that is unwanted, uninvited and sexual in nature. Also, encapsulated within this

construct are verbal or physical advances where the perpetrator tries to influence the victim to have sexual relations with them. Lastly, sexual coercion is defined as a perpetrator using a threat (sometimes for the sake of subsequent rewards, such as a promotion or money) to coerce a victim into having sexual relations with them (Fitzgerald, Magley, Drasgow, & Waldo, 1999). Fitzgerald and colleagues (1997) assert that these operational definitions (derived from focus groups and extensive instrument development) assess psychological and behavioral sexual harassment that is not welcomed or wanted by the victim, and sexual advances that the victim does not reciprocate. They clarify that the items do not necessarily classify as sexual harassment that would be consistent with sexual harassment that could be prosecuted in a court of law (Fitzgerald, Drasgow, Hulin, Gelfand, & Magley, 1997).

The three domains are measured through behavioral items, such as "Have there been situations where people treated you 'differently' because of your sex" (a gender harassment item); "Made unwanted attempts to establish a romantic sexual relationship with you despite your efforts to discourage it?" (an unwanted sexual attention item); "Made you feel threatened with some sort of retaliation for not being sexually cooperative?" (a sexual coercion item). Participants are asked to note the number of times they have experienced any of these behaviors from other people on a 5-point Likert scale (1 = never to 5 = very often; we coded these items as 0-4). Scoring procedures of the SEQ vary and include sum totals, an average score or frequency of experience (Gutek, Murphy, & Duoma, 2004). Here, we utilized an aggregate total score of the number of events across the lifespan (each subscale weighted equally). Overall, reports indicate that the measure has excellent overall internal consistency among a student

sample ($\alpha = 0.92$), and good internal consistency for gender harassment ($\alpha = 0.81$) and unwanted sexual attention ($\alpha = 0.82$), and poor internal consistency for sexual coercion ($\alpha = 0.41$; Fitzgerald et al., 1988). The authors stated that low internal consistency for this last scale was due to participants endorsing these items at a low rate (Fitzgerald et al., 1997). Because sexual harassment was being measured as a covariate in this study, we focused only on the sum score for sexual harassment across the lifespan. The possible range of scores was 0 (indicative of no exposure to sexual harassment) to 54 (indicative of exposure to every type of sexual harassment across all three age ranges: before turning age 14, between ages 14-17 and age 18 and older). Internal consistency for this study was excellent ($\alpha = 0.96$). Research demonstrates good validity for this measure, with scores correlating positively with other measures of sexual harassment (Fitzgerald et al., 1997). See Table 7 for descriptive statistics. The full measure can be found in Appendix H.

Brief Betrayal Trauma Survey (BBTS; Goldberg & Freyd, 2006). This ten-item inventory behaviorally assesses exposure to betrayal trauma. A betrayal trauma is a type of trauma occurring within the context of a close relationship, where the victim is dependent on the perpetrator for survival. Perpetrators can be individuals (Freyd, 1996) or institutions (Smith & Freyd, 2014). Betrayal traumas can be lower or higher in betrayal. Lower betrayals (LBT) are non-interpersonal potentially traumatic events (i.e., natural disasters and motor vehicle accidents; e.g., "You were in a major automobile, boat, motorcycle, plane, train, or industrial accident that resulted in significant loss of personal property, serious injury to yourself or a significant other, the death of a significant other, or the fear of your own death.") and events that occur in interpersonal

contexts where the victim and perpetrator are not close, and presumably the victim does not depend on the perpetrator for survival (e.g., "You were deliberately attacked so severely as to result in marks, bruises, blood, broken bones, or broken teeth by someone with whom you were very close (such as a parent or lover)."). Higher betrayals (HBT) occur in interpersonal contexts where the relationship between the victim and perpetrator is "very close", where presumably the victim *does* depend on the perpetrator for survival (e.g., "You were emotionally or psychologically mistreated (e.g., threatened, terrorized, confined, isolated, or regularly belittled, demeaned, humiliated, rejected, ignored, scapegoated, blamed, yelled at, or harshly criticized) by someone with whom you were very close."). Participants are asked to indicate the frequency of exposure to these events: never, 1 or 2 times, more than that (coded 0, 1, 2 respectively). In analyses, we utilized a sum total number of lower and higher betrayal events that a person experienced across the lifespan (i.e., LBT sum across the lifespan (range 0-12) and HBT sum (0-11) across the lifespan). Goldberg and Freyd's assessed the test-retest stability of this measure and found adequate test-retest stability (mean *gamma* = 0.75; 2006). Past studies have demonstrated adequate scale reliability (Platt & Freyd, 2015). This study demonstrated adequate reliability as well: LBT ($\alpha = 0.73$), HBT ($\alpha = 0.81$). See Table 7 for full descriptive statistics. This measure is in Appendix I.

Sexual Experiences Survey – Short Form Victimization (SES; Koss et al., 2006). The SES is a ten-item inventory of unwanted sexual experiences. The SES assesses how frequently a participant experienced various unwanted sexual acts, across multiple ranges of time. Additionally, this questionnaire measures perpetrator tactics during an unwanted sexual experience. We utilized eight of the ten items, due to two of

the ten items not being relevant for this study's specific aims. Items one through seven behaviorally assess a participant's exposure to attempted and completed unwanted sexual experiences. Items one through seven begin with a distinct unwanted sexual act (e.g., "A man put his penis into my butt, or someone inserted fingers or objects without my consent by:"). Unwanted sexual acts appear in order from theoretically least ("Someone fondled, kissed, or rubbed up against the private areas of my body…or removed some of my clothes without my consent (*but did not attempt sexual penetration*) by:") to theoretically most severe (e.g., "Have you been raped?"). Unwanted sexual acts are each then followed by five descriptions of tactics that perpetrators utilize to coerce victims into being sexually complicit (e.g., "Showing displeasure, criticizing my sexuality or attractiveness, getting angry but not using physical force, after I said I didn't want to."). These coercion tactics are the same for each of the seven different unwanted sexual experiences, and are also ordered from theoretically least severe ("Telling lies, threatening to end the relationship, threatening to spread rumors about me, making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.") to theoretically most severe ("Using force, for example holding me down with their body weight, pinning my arms, or having a weapon."). The survey asks participants to note how many times this has happened (0, 1, 2, 3+; coded 0, 1, 2, 3 respectively) during each of the standard age ranges for this study. The last question of the survey is "Have you ever been raped?" to which participants are asked to answer "yes/no". Beyond providing descriptive data in another form (i.e., directly asking about rape, versus behaviorally describing it), the purpose of this item is to illustrate the point that many survivors are more likely to endorse behavioral items that amount to the experience of

rape, versus endorsing an item asking them if they had been raped. This item was just analyzed for descriptive data, and not folded into the overall SES score. Higher scores on this inventory are indicative of more experiences of different types of victimization. Koss and colleagues (2007) state that this survey can be scored in multiple ways, though recommend scoring to assess the frequency of unwanted sexual contact. Consistent with other studies, we calculated one sum score representing the number of types of unwanted sexual events a participant experienced across their lifespan (i.e., overall victimization score). This does not account for the number of times a person experienced one particular form of sexual trauma. The possible range is 0 (indicating no exposure to unwanted sexual contact) to 7 (indicating exposure to each type of unwanted sexual contact). Reliability of this scale was excellent ($\alpha = 0.94$). See Table 8 for descriptive statistics. See Appendix J for full measure.

Trauma Symptom Checklist-40 (TSC-40; Elliot & Briere, 1992). This is a 40-item survey that assesses distress related to traumatic experiences. Within the TSC-40, there are six different clusters of trauma-related symptoms: dissociation, anxiety, depression, sexual abuse trauma index, sleep disturbance, sexual problems. This survey assesses a broad range of symptoms common among trauma survivors, and is not limited to assessing PTSD symptoms. Researchers can also calculate an overall score of trauma-related symptoms, which is a combination of all six symptom clusters. Participants are asked to reflect over the past two months and indicate how frequently (0 = never through 3 = often) they have experienced any of the following symptoms. An example item is, "How often have you experienced each of the following in the last two months…restless sleep?" Among a sample of 2,959 women (49% of whom had experienced some form of

childhood trauma), Elliot and Guy (1993) found the TSC-40 to have good overall internal consistency ($\alpha = 0.89$). Research on validity is mixed for the TSC: some studies of clinical (Bagley, 1991) and non-clinical (Briere & Runtz, 1989) samples support discriminate validity of the TSC-40, as it has been shown to discriminate between traumatized and non-traumatized people. However, other studies (e.g., Whiffen, Benazon, & Bradshaw, 1997) have not shown that the TSC-40 can discriminate between child sexual abuse survivors and non-survivors in a clinical sample. These authors note that validity could be low due to two factors: 1) outcomes of sexual trauma survivors are heterogeneous and thus might not neatly cluster together in all samples and 2) items on the TSC-40 are on multiple subscales, resulting in intercorrelations between scales. Much of the data supporting the instrument's validity, however, is drawn from work with non-clinical samples, as we are working with in this study, thus we deemed it sensible to use. The average total score for this measure in a clinical sample of sexual abuse survivors was 71.81 (*SD* = 35.27; Zlotnick et al., 1996). In a non-clinical sample of women who had experienced sexual abuse (*n* = 761), the average total score was 26.02 (*SD* = 12.1) (Elliot & Briere, 1992). In the present research, internal consistency was excellent, with Chronbach's alpha at 0.94. See Table 9 for descriptive statistics. See Appendix K for this full measure.

Posttraumatic Checklist 5 (PCL-5; Weathers et al., 2013). This 20-item survey assesses posttraumatic stress symptoms consistent with the DSM-5 diagnosis of posttraumatic stress disorder. On a five-point Likert scale (0 = not at all to 4 = extremely), participants are asked to indicate how much they were "bothered by" various symptoms (i.e., "Repeated, disturbing, and unwanted memories of the stressful

experience?"). The total possible score on this measure is 80. The PCL-5 assesses all domains of PTSD symptoms: intrusion, avoidance, negative alterations in cognitions and moods, and arousal/reactivity. The PCL-5 is scored by creating sum scores for each subscale, and a total score. Validation research (Blevins, Weathers, Davis, Witte, & Domino, 2015) on this measure with college students suggested excellent internal consistency ($\alpha = 0.94$), and robust convergent and discriminate validity. In this study, internal consistency was excellent ($\alpha = 0.95$). Although the research is preliminary and further validation work necessary, the National Center for PTSD currently states that a score of 33 is suggestive of a PTSD diagnosis (PTSD Checklist for DSM-5 (PCL-5), 2016). Among 558 undergraduate students who had experienced various traumatic events, the average total score on the PCL-5 was 13.02 (*SD* = 15.11; Blevins, Weathers, Davis, Witte, & Domino, 2015). See Table 9 for descriptives. See Appendix L for this full measure.

Wessex Dissociation Scale (WDS; Kennedy et al., 2004). This 40-item self-report survey assesses dissociation, as it is conceptualized through Kennedy and colleagues cognitive model of dissociation (2004). In short, their cognitive model of dissociation (founded in Beck's cognitive theories) outlines dissociation as a method by which mental process are detached throughout the information processing stages, and across different schematas (i.e., cognitive, behavioral/motivational, affective, and physiological). They theorize that these cognitive separations happen at three stages: automatic dissociation (i.e., preconscious; least severe); within-mode dissociation (i.e., conscious); between-mode dissociation (i.e., non-conscious; most severe). To inhibit distress, previously paired mental processes are detached or dissociated from one another.

This dissociation of mental processes stops future coupling of aversive information from thoughts, emotions, behaviors/motivations, or physiological sensations. For example, if a person was to experience a trauma, dissociation would stop future cognitive processing that would pair trauma-associated information with aspects of thoughts, emotions, behaviors/motivations, or physiological sensations. In this way, dissociation can be thought of on the one hand as a protective cognitive mechanism, though on the other hand as a barrier to integrating experiences and memories (Kennedy et al., 2004). Further elaboration on this model is outside the scope of this paper, but we encourage interested readers to consult Kennedy and colleague's 2004 report on their theory.

The WDS generates a total score of dissociation, and subscale scores based on the three levels of information processing, supported by their theory: Level 1 (automatic dissociation), level 2 (within-mode dissociation), level 3 (between-mode dissociation). Higher scores are indicative of greater dissociation. The WDS measures less severe (e.g., separating the experience of smelling peanut butter from having smelled it during a traumatic event, resulting in sometimes randomly smelling peanut butter in absence of a distinct traumatic memory) and severe (e.g., dissociation resulting in multiple identities, as in dissociative identity disorder) forms of dissociation, while other measures of dissociation focus largely on severe forms of dissociation. Given that a majority of our results will be from a non-clinical sample of university students, it was a sensible choice to use the WDS to assess a full range of dissociation experiences, from less to more se severe. Research supports good to excellent internal consistency ($\alpha = 0.90$ in a non-clinical sample; 0.95 in a clinical sample) and good convergent validity with other measures of dissociation. In this study, internal consistency was excellent ($\alpha = 0.95$).

The clinical mean for the total WDS score is 1.9 (*SD* = 0.80), and the non-clinical sample mean is 0.88 (*SD* = 0.38; Kennedy et al., 2004). See Table 9 for descriptive statistics. See Appendix M for this measure.

Open-ended questions. The open-ended question section of the survey battery was comprised of four open-ended questions about participant's awareness of internal body sensations. We developed these questions for the present study to assess women's phenomenological experience of their internal body sensations and to provide fodder for hypothesis generating for future studies. Data from these questions will be integrated throughout the results and discussion sections, thereby informing our analyses of the self-report and behavioral data. A full qualitative analysis is not presented here, but will be in future studies.

The first question asks participants "How aware are you of your internal body sensations (e.g., heartbeat, breathing, digestion) on a day-to-day basis? For example, do you frequently notice your breathing? If so, in what situations? Another example: do you ever notice that you are frequently not aware of your heartbeat? Or are you always aware of your heartbeat? What situations increase or decrease such awareness? Please feel free to add any of your related thoughts to these questions." All four questions are similarly worded, with an initial question about awareness of internal body sensations, followed by example situations to prompt the types of answers most relevant to the present study. The second question is regarding awareness of internal body sensations during sexual experiences. The third question is regarding when awareness of internal body sensations is strongest, and the fourth question is regarding when awareness of internal body sensations is weakest. Participants are asked to provide an example of a

situation for the third and fourth questions. See Appendix N for these open-ended questions.

Procedure

The University of Oregon Research Compliance Services office approved the purpose, design and methods of this study. Please see Figure 3 for a pictorial representation of the aims and flow of this study. All research activities occurred in the Zalewski Lab in Straub Hall, University of Oregon in two adjoining rooms: the researcher was in the "acquisition room" and the participant was in the "run room". For the majority of the study, the researcher was in the acquisition room, though occasionally was in the run room to deliver instructions to the participant. Participants completed all activities in the run room, which had curtains on the walls. The curtains approximated a noise attenuated environment, similar to what researchers have described in previous studies of behavioral IA (e.g., Pollatos, Traut-Mattausch & Schandry, 2009). The following equipment was with the participant in the run room: a measuring tape affixed to the wall (to measure height), an iPad and wireless keyboard (which the participant used throughout the study activities), noise reduction headphones (which the participant wore to hear sound when watching videos, and to listen to study task instructions), a headphone splitter and 22-foot extension cord (which enabled the participant and researcher to hear all audio content concurrently), wireless clicker paired with a doorbell in the acquisition room (which the researcher instructed the participant to press if they had any questions throughout the study procedures), wireless EKG monitor (described below), table, chair, table lamp and heavy curtains hung on the walls (to dampen the noise in the room, and decrease sound coming into the room). For a majority of the

study, the researcher was in the acquisition room, where the EKG acquisition tower and associated hardware was located. The researcher also had a pair of headphones that she wore when the participant listened to audio content throughout the study (explained further below).

The total study visit time was between 1.5-2.5 hours long. With one of four trained female research assistants or Reinhardt, potential participants first reviewed and then gave informed consent. Training research participants occurred over a time period of four-weeks, which involved their reading the study standard operating procedure (a binder of study operating instructions – available upon request – that was always in the acquisition room) and several practice runs where the research participant played various roles (i.e., participant and then researcher). Only one researcher was with one participant at a study session.

Aims 1 – 3: Please see Figure 3 for a pictorial representation of this study flow. We first asked participants to remove any time devices (i.e., watches or cell phones) from their reach. Participant's ability to monitor the passing of time using technology would interfere with several study procedures (resting heart rate, heart beat perception task and time estimation task). Second, we collected participants' height and weight to compute body mass index (BMI; weight/(height^2) x 703; Centers for Disease Control and Prevention, 2015), as BMI has been associated with heartbeat perception abilities in the past and is an important covariate to measure (Dunn et al., 2010). We weighed participants on a standard bathroom scale. We collected height in the run room on measurement strip affixed to the wall of the run room. We then helped the participant get set up for the electrocardiogram (EKG) recordings. The purpose of the EKG was to

measure heartbeats at various stages of this appointment. The EKG set up involved the following steps: we first instructed participants on how to affix disposable biosensors on their body on their distal right collarbone, lower left rib cage, and lower right abdomen (modified Lead-II montage; See Appendix O). We told participants that we would leave the run room while they placed the biosensors on their own body. As we trained the participant how to affix the biosensors on their own body, we pointed both to a diagram posted on the wall of the research room depicting correct biosensor placement, as well as to the correct biosensor placement location on the researchers own body, over their clothes. Before we left the run room, we pointed to the white clicker on the table. We told the participant that if they had any questions as they were placing biosensors, or at any other point in the study, they could press the clicker which would ring a bell in the acquisition room, and we would come in and answer their question. We then left the room and instructed the participant to knock on the door when they had the biosensors on. After the participants told us they were done placing biosensors on their body, we asked the participant to point over their shirt to where they placed the sensors. If we noticed that the biosensors were placed incorrectly (which was rarely the case), we repeated the placement instructions and had the participant affix a new set of biosensors in their correct locations. We then handed three electrodes (one at a time) to the participant and instructed them on which electrode to connect to which biosensor.

We decided in advance that participants would themselves place biosensors and electrodes on their bodies and researchers would either not be in the room (as was the case with biosensor placement), or would turn their heads away from participants (as was the case during electrode to biosensor connecting). The rationale behind this decision

was to respect the possibility that participants might want to maintain as much privacy as possible and reduce any potential triggering experiences. A researcher staying in the room or placing the biosensors/electrodes on the participant might have also increased arousal and heart rate, which may have interfered with data collection and reliability. A researcher touching the body of a trauma survivor could be invasive and trigger memories of traumatic events. Sexual trauma robs survivors of control over their bodies, and this is fundamentally a violation of privacy. Given that all participants in this study were sexual trauma survivors, it was important to us to provide the most control and privacy possible to research participants throughout their study visits.

Electrodes were connected to a wireless EKG monitor (MindWare Mobile Recorder). EKG was sampled at 1 kHz via BioLab. Researchers (Dunn et al., 2010) have suggested that beliefs about ones' knowledge of and/or ability to estimate resting heart rate is another potential confound or latent explanation for heartbeat perception ability (i.e., behavioral IA). Given this, we measured actual resting heart rate through a seated five-minute EKG recording (See appendix P; i.e., "Resting HR" in Figure 3). Prior to starting the recording, we told the participant that they would watch a five-minute video depicting ocean creatures under water. This video has been used in past research to support participants in paying attention and staying awake during five-minute EKG recordings. During this five-minute recording, we asked participants to keep their eyes open (to further encourage them to stay awake), maintain their regular breathing pattern and keep their bodies as still as possible, given that body movement disrupts EKG recording quality. We told participants that we would come back into the room at the end of the video to move them on to the next task. Following the EKG recording, we

assessed the participant's knowledge of their resting heartbeat by presenting participants with the following question within a Qualtrics survey software on an iPad "What do you believe your resting heart rate is over 60 seconds? In other words, how many times do you believe your heart beats during one minute while you are resting? Please type your answer in the space below, in numbers:" of resting heartbeat (Appendix P). We reminded participants to neither look at any time devices nor take their pulse in order to do this.

The participant then performed the heartbeat perception task (HPT) to measure behavioral IA. The HPT assesses interoception accuracy. The participant heard pre-recorded standardized instructions (Appendix Q for audio instructions) through the noise attenuating headphones that they used, and also saw an abbreviated version of the instructions on the iPad (Appendix R). We modified these instructions from those used in prior research (Ainley, Maister, Brokfeld, Farmer, & Tsakiris, 2013; personal communication with Vivien Ainley, September 19, 2016). Instructions were to count their heartbeats silently through concentrating on the feelings in their bodies (i.e., not taking their pulses). The participant was not informed about their performance on the task, nor were they made aware of the durations of the counting periods. The researcher also listened to the instructions in the other room. The instructions included: Schandry's (1981) HPT task Mental Tracking Method with slight modifications as in previous research (e.g., Ehlers & Breuer, 1992; Dunn et al., 2010). In this task, the participant counted their heartbeats silently for two trial blocks, each including the following trials: 35-, 25-, and 45-second heartbeat counting periods. Prior to the actual trials, there was be a 12-second practice trial (per Ehlers & Breuer, 1992) to ensure participant understanding. We reminded the participant that they could let us know if they had any

questions during the trials. As the participant monitored their heartbeats, the EKG recordings simultaneously documented participant heartbeats, and we manually segmented the counting periods through creating keyboard event markers. Counting periods were indicated by a countdown ("3, 2, 1…") and then the word "go" at the start, and then the word "stop" at the end. After each counting period, participants reported the counted number of heartbeats into a Qualtrics (an online data collection platform) survey on an iPad. Following the practice trial, each HPT block proceeded as follows: resting (60 seconds), counting (35 seconds), resting (30 seconds), counting (25 seconds), resting (30 seconds), counting (45 seconds), resting (60 seconds) (Schandry, 1981). Existing research (e.g., Schandry, 1981; Pollatos, Traut-Mattausch, Schroeder, & Schandry, 2007; Pollatos, Traut-Mattausch, & Schandry, 2009;; Ainley, Tajadura-Jiménez, Fotopoulou, & Tsakiris, 2012; Ainley, Maister, Brokfeld, Farmer, & Tsakiris, 2013) has computed interoception accuracy through the following formula:

$$\left\{\frac{1}{3}\Sigma\left[1-\left(\frac{\left|\text{EKG recorded heartbeats} - \text{participant counted heartbeats}\right|}{\text{EKG recorded heartbeats}}\right)\right]\right\}$$

It is important to assess the validity of Bx-IA to examine whether participants are following instructions, and to evaluate over- or underestimation that is systematic. As discussed by Ehlers and Breuer (1992), if participants are guessing their number of heartbeats and not following instructions, over- and underestimation would be equally likely. If participants underestimate their heartbeats, it is likely that they are following the instructions and miss counting some of the actual beats (Ehlers & Breuer, 1992; Stevens et al., 2011). It may be that errors like these are due to inaccurate perception. Alternatively, as Schandry (1981) explains, it is easy for participants to miss one or two heart beats if the participant adds beats on the start or end tones of the task. It is standard

in the literature (e.g., Ehlers & Breuer, 1992; Stevens et al., 2011) to question the validity of the HPT based on the percentage of participants who overestimate their heartbeats. The standard criterion for overestimation (Schandry, 1981) is when the difference between EKG recorded and participant counted heartbeats is more than two. We assessed the validity of the HPT by assessing the percentage of people who overestimate the number of heartbeats across trials. This is traditionally done by computing a mean error score with the following formula: (EKG recorded heartbeats – participant counted heartbeats) / EKG recorded heartbeats (Stevens et al., 2011). Mean error scores are then summed and divided by six.

Some literature (e.g., van der Does et al., 2000) suggests that it is important to see if the distribution of interoceptive accuracy is bimodal. This assessment is necessary to conduct so that researchers can choose if they will treat interoceptive accuracy as a continuous or categorical variable. Ehlers (1998) suggests that it is only necessary to treat interoceptive accuracy as a categorical variable if the distribution is bimodal, or if any participants show very poor performance on the HPT task (accuracy rates < .3 or 30%). Also within the context of characterizing Bx-IA among survivors, we conducted exploratory data analysis on Bx-IA to see if the distribution was unimodal or bimodal, and assessed for very poor performers. We planned to treat the variable as categorical (low estimators and high estimators) if the distribution was bimodal and/or there were many very poor performers. We planned to treat the variable as continuous (range: 0-1, with higher scores indicating greater accuracy) if the distribution was unimodal and/or few very poor performers. Similar criteria for deciding whether to use a categorical versus continuous variable has been used by Dunn et al., 2007.

Following completion of the first HPT task block and still listening to pre-recorded instructions, the participant then completed one block of time estimation accuracy task trials (Dunn et al., 2010). Prior research has shown that ability to estimate time accurately is sometimes a confound or latent explanation for heartbeat perception ability. Thus, measuring ability to estimate time is necessary. The participant heard instructions (Appendix S) to estimate three periods of time (23-, 56-, and 40-seconds). Participants also saw abbreviated instructions on the iPad (Appendix T). This constituted one time estimation accuracy task block. The participant heard a countdown ("3, 2, 1…") to notify them that the time estimation would soon start, and then a tone to indicate the start of the estimation period, as well as an end tone to stop estimating time. The participant documented their estimation of the length of elapsed time into a Qualtrics survey on an iPad. Following the time estimation tasks, the participant heard instructions (Appendix U) to repeat the HPT task block once again, as before. Again, they saw abbreviated instructions on the iPad (Appendix V). We then offered the participant a break.

Following their brief break, the participant completed questionnaires on the iPad via Qualtrics survey software and typed answers to open-ended questions about their awareness of internal body sensations. The survey software presented the questionnaires in blocks, as follows:

- Demographics and physical activity: demographics and physical activity.
- Body awareness survey: MAIA (Mehling et al., 2015)
- Non-sexual abuse survey block: PMS and LONGSCAN; delivered randomly to the participant through a Qualtrics randomizing function.

- Sexual abuse survey block: SEQ, BBTS and SES-SV; delivered randomly to the participant through the same randomizing function.

The next block of surveys had to do with trauma symptoms that people sometimes experience related to a sexual trauma. It is standard practice to ask trauma survivors to answer questions about symptoms related to one "worst event" (as in the PCL-5 standard instructions; Weathers et al., 2013). This practice is typically done in person, when a clinician is administering a trauma symptom inventory through a diagnostic interview. The rationale for doing this is primarily to establish a diagnosis of PTSD related to one traumatic event (i.e., Criterion A in the DSM-5; American Psychiatric Association, 2013). The other rationale for doing this is to prompt survivors to remember their worst traumatic event, in an attempt to evoke associated trauma symptoms or reactions related to that specific event. Because we administered trauma symptom inventories through Qualtrics and not in person, following the abuse inventory blocks, we presented the participant with the following question: "If you indicated that you had more than one unwanted sexual experience, which of these events do you think was the worst overall? Please bring that experience to mind. If you've had several unwanted sexual experiences, it can be hard to determine which was worst. They may have all been horrible. If it's hard to determine which was the worst, please bring to mind the one that bothers you the most currently, or has caused you the most problems in the past."

Qualtrics then administered the following trauma symptom inventories to the participant: TSC-40 and PCL-5. Following completion of those surveys, the participant saw this text: "You may now stop keeping your worst unwanted sexual experience in mind."

Participants then completed the Wessex Dissociation Scale (WDS; Kennedy et al., 2004), a measure that assesses general dissociation, as well as with dissociation that is associated with traumatic experiences. Following completion of the WDS, Qualtrics presented the participant with the four open-ended questions. When the participant was finished typing answers to the open-ended questions, they saw the following text "Please press the white clicker to let the researcher know you are finished." The researcher then debriefed the participant about the nature and aims of the study (Appendix W). Within the context of that debriefing, the researcher explicitly pointed out local resources for sexual trauma therapy and emergency service, should the participant have experienced distress during the study. We then paid the participant either in two course credits (university participants) or $20 cash (community participants).

CHAPTER III

RESULTS

Validation Check Items

We first assessed the number of participants whose data satisfied the validation assessment (i.e., answering no more than two out of five validation items incorrectly). In the university sample, only one participant exceeded the acceptable threshold for the validation items. Their data was therefore excluded from data analysis. All community participants satisfied the validation assessment.

Descriptive Results[3]

We assessed participant's interoceptive awareness (IA) both behaviorally (behavioral IA (Bx-IA); heartbeat perception task with Mental Tracking Method; Schandry, 1981) and via self-report (Multidimensional Assessment of Interoceptive Awareness (MAIA) noticing subscale and MAIA total score; Mehling et al., 2012). The average score for Bx-IA was 0.75 (*SD* = 0.17). The average score for the MAIA noticing subscale was 2.37 (*SD* = 0.76) and the mean MAIA Total score was 2.15 (*SD* = 0.57). See Table 6 for descriptive statistics for all interoceptive awareness variables and MAIA subscales. Bx-IA was not significantly correlated with any covariates (time estimation accuracy, heart rate belief accuracy, age, physical activity, or BMI). It was also not correlated with the total score of the MAIA (i.e., the primary measure that we used to represent self-report IA; see Table 11). Of all the covariates, the highest correlation with Bx-IA was BMI, $r = -.10$, $p = 0.20$. Per past research (Dunn et al., 2010), due to lack of

[3] Unless noted as results from community participants, the results we report here are from the university student participant sample.

significant associations between Bx-IA and these covariates (Table 10) the covariates were left out of subsequent analyses.

We assessed the validity of the HPT by evaluating over- and underestimators of heartbeats. Across trials, a majority of participants underestimated their heartbeats, suggesting validity of the HPT. Negative scores indicate overestimators, while positive scores indicate underestimators. Overall, seven participants overestimated their heart rates (5%; i.e., scores less than 0) and 133 participants underestimated their heart rates (90%; i.e., scores greater than 0). Across trials, there were two participants (1%) who had accurate perception (scores of 0). Other studies support the small to zero instance of accurate perceivers when trials are averaged (Van der Does et al., 2000). There were five participants with missing data (3%). Using Schandry's 1981 over- and underestimation criteria, we identified over- and underestimation as being present when the difference between recorded and counted heartbeats is more than two. Using that criteria across trials, there were no participants who would be classified as over or under-estimating. The number of participants who underestimated their heartbeats (difference scores greater than positive two) was 111 (73%). These results suggest validity of the HPT, and are similar to existing literature (e.g., Ehlers & Breuer, 1992; Stevens et al., 2011). The greater number of underestimators suggests HPT validity, because it suggests that participants followed the instructions for the task and missed a couple of beats across trials (Schandry, 1981; Stevens et al., 2011). Because only 5% of the sample overestimated their heartrates, we did not test for differences in PTSD symptoms between over- and underestimators, due to the highly unequal number of participants in the over- and underestimating portions of participants in the sample.

As previously mentioned, researchers (e.g., van der Does et al, 2000) suggest utilizing a categorical variable for Bx-IA if the distribution is bimodal. A bimodal distribution would indicate that there are essentially two groups of performers: low and high heartbeat estimators. Because a histogram of Bx-IA revealed a negatively skewed unimodal distribution in both samples of participants (skewness = -0.80 (university); -0.64 (community)), we treated Bx-IA as a continuous variable as opposed to a categorical variable. Previous research (e.g., Dunn et al., 2007) has utilized this rationale for determining to use a continuous versus categorical version of Bx-IA. Previous researchers (Ehlers, 1998) have also argued that a categorical variable should be utilized if there is a high percentage of participants who evidence poor accuracy (Bx-IA < .30). In the university sample, there were only three participants who fell below that arbitrary threshold. In the community sample, no participants fell below that threshold. Thus, this was another rationale for treating Bx-IA as a continuous variable.

We assessed the possibility that participants at the tails of the IA distributions (i.e., very high and very low) might drive some of our observed effects. For Bx-IA, we created a categorical variable that separated the bottom 25% (n = 36; M_{PTSDSx} = 28.33 (SD = 20.52), middle 50% (n = 67; M_{PTSDSx} = 25.79 (SD = 18.64) and upper 25% (n = 35; M_{PTSDSx} = 12.71 (SD = 12.71) of the data. We followed the same procedure for MAIA total: bottom 25% (n = 36; M_{PTSDSx} = 28.33 (SD = 19.75), middle 50% (n = 65; M_{PTSDSx} = 24.91 (SD = 18.28) and upper 25% (n = 32; M_{PTSDSx} = 19.96 (SD = 15.64). There were significant differences between two of the categories (Bx-IA: upper 25% was significantly lower on PTSD symptoms in comparison to the bottom 25%, t (69) = 2.28, p = .006; middle 50% was significantly higher in PTSD symptoms in comparison to the

upper 25%, t (100) = 2.54, p = .041. We computed analyses in aims 2 and 3 with continuous versions of the IA variables and categorical versions of the IA variables. We did not observe any meaningful differences in results when assessing the results from models with continuous IA variables versus models categorical IA variables. There were a few potential outliers in the university sample Bx-IA distribution, so assessing their respective influences was necessary (i.e., through assessing Cook's D, DFBETAs and residual plots). We ran all models including and excluding those potential outliers. None of the results patterns changed, so we kept potential outliers in the dataset.

We measured participants' abuse histories and focused on lifetime psychological abuse by caregivers (PMS; Briere & Runtz, 1988), lifetime physical abuse (LONGSCAN; Barnett, Manly, & Cicchetti, 1993), lifetime exposure to betrayal trauma (BBTS; Goldberg & Freyd, 2006), sexual harassment (SEQ; Fitzgerald, Gelfand, & Drasgow, 1997) and exposure to sexual abuse (SES; Koss et al., 2006). For these analyses, all abuse statistics are across the lifetime (i.e., birth to current age). For the university sample, as measured by the PMS (Briere & Briere, 1992), the average number of times participants experienced psychological abuse was 13.38 (SD = 6.47). The community sample experienced an average of 18.33 (SD = 4.13) instances of psychological abuse. University participants experienced an average of 1.78 types of physical abuse (SD = 3.56), with a majority of their abuse experience occurring prior to the age of 14 (M = 1.17, SD = 2.08).[4] University participants experienced an average of 2.28 lower betrayal traumas (SD = 2.30) and an average of 3.22 higher betrayal traumas (SD = 2.58). Community participants on average experienced 5.81 (SD = 3.49) lower

[4] There was an error in collecting physical abuse data for the community sample, and thus we are unable to reported it.

betrayal and 6.81 (*SD* = 3.92) higher betrayal traumas. The average number of instances of sexual harassment that university participants experienced was 28.59 (*SD* = 11.25), and the average among the community sample was 32.86 (*SD* = 14.64). Please see Table 7 for complete descriptive statistics. Regarding sexual trauma (measured by the SES; Koss et al., 2006), university participants had experienced an average of 3.45 different types of sexual trauma (*SD* = 1.90) and community participants had experienced an average of 4.43 different types of sexual trauma (*SD* = 2.18). Please see Tables 7 and 8 for descriptives.

Participants reported psychological symptoms related to their "worst" experience of sexual trauma. We assessed trauma symptoms (TSC-40; Elliot & Briere, 1992), PTSD symptoms (PCL-5; Weathers et al., 2013), and dissociation symptoms (WDS; Kennedy et al., 2004). As discussed above, the average total score for the TSC-40 in a clinical sample of sexual abuse survivors was 71.81 (*SD* = 35.27; Zlotnick et al., 1996), and average scores in a non-clinical sample of female sexual abuse survivors was 26.02 (SD = 12.1; Elliot & Briere, 1992). The average overall TSC-40 score in the university sample was 40.67 (*SD* = 21.44), and the average score for the community sample was 62.62 (*SD* = 24.05). Interestingly, and related to Aim 1, an independent samples *t* test comparing the average TSC-40 scores of the university sample for the present study and the pilot study showed that the average score for the present sample was significantly higher (meaning more trauma symptoms) than the pilot study's average score (*M* = 33.35, *SD* = 18.39), $t(219) = 2.54$, $p = .01$. This difference between samples may be due to random sampling error, differences in data collection method (i.e., the pilot study data were collected online, while data from the present study were collected in person; and

participants in the pilot study were not prompted to bring to mind their worst experience of sexual trauma as they completed the symptom inventories), or systematic differences between the two samples. One possible systematic difference is that the samples for the present study were recruited based on their trauma history, while data from the pilot study were from the general university population and not pre-screened for trauma history. See Table 9.

As mentioned above, among undergraduate student trauma survivors, the average PCL-5 total score 13.02 (SD = 15.11; Blevins, Weathers, Davis, Witte, & Domino, 2015). For the university sample, the average total PCL-5 score was 24.13 (*SD* = 18.41). The community sample average score was 34.24 (*SD* = 22.24). A diagnostic cutoff score of 31-33 is utilized as a symptom severity threshold for a PTSD diagnosis (Bovin et al., 2016), and this cutoff score was determined in a large sample of military veterans. In the university sample of participants, 32.2% of university participants and 53% of community participants were at or above a score of 31. Administering the PCL-5 alone is not sufficient for diagnosing PTSD, however. Semi-structured clinical interviews conducted by a trained mental health professional are the gold standard for psychological diagnoses. Thus, these results ought to be considered descriptive as opposed to diagnostic (see Table 9).

Recall that the average WDS total score is 1.9 (*SD* = 0.80) in a clinical sample, and the non-clinical sample mean is 0.88 (*SD* = 0.38; Kennedy et al., 2004). For the university sample, the average total dissociation score was 1.18 (*SD* = 0.72). The average score for the community sample was 1.72 (*SD* = 0.73). See Table 9 for psychological symptom subscale means and standard deviations.

A Priori Hypotheses Testing

Aim 1. Characterize the relationship between sexual trauma exposure and IA among female sexual trauma survivors.

Aim 1, Hypothesis 1. We expected that survivors of sexual trauma would have average scores on self-reported IA on the MAIA noticing subscale and MAIA total score, potentially replicating pilot data (n = 77) collected for this study. Results from an independent samples t tests did not support this hypothesis. See Table 12 for means and standard deviations for these four samples on all MAIA subscales. Average scores for MAIA noticing were significantly lower in the present study (M = 2.37, SD = 0.76) than in the pilot study (M = 3.26, SD = 0.82), $t(228) = 8.13$, $p < .0001$. Similarly, average scores for MAIA total were significantly lower in the present study (M = 2.15, SD = 0.57) than in the pilot study (M = 2.73, SD = 0.46), $t(216) = 7.65$, $p < .0001$. The differences between the present study and the pilot study may be due to sampling error, or difference in data collection method. The pilot study data were collected through an online survey, and data for the present study were collected in person. Time of year and engagement in physical activity also explain these differences, as we will address in the discussion section.

We anticipated that results from these analyses would be significantly lower than average scores found in a large sample (n = 435) of community members with chronic pain (Mehling et al., 2013), and lower than average scores found in a large sample of healthy mind-body practitioners (n = 325; Mehling et al., 2012). The hypothesis was supported. There was a significant difference between the chronic pain sample's average

score on the MAIA noticing subscale ($M = 3.58$, $SD = 1.16$) and the average score on the MAIA noticing subscale for the present study ($M = 2.37$, $SD = 0.76$), $t(586) = 12.02$, $p < .0001$. Sexual trauma survivors had significantly lower scores on the MAIA noticing subscale than participants with chronic pain. There was also a significant difference between mean scores on the MAIA Noticing subscale in the comparison between healthy mind-body practitioners ($M = 3.94$, $SD = 0.59$) and sexual trauma survivors in the present study ($M = 2.37$, $SD = 0.76$), $t(476) = 24.67$, $p < 0.0001$. We could not conduct mean comparisons on MAIA total scores between these samples, because the MAIA total score was not calculated for the comparator studies. See Table 12.

Aim 1, Hypothesis 2. We expected to observe significant positive and negative correlations between self-report IA and trauma symptoms (Trauma Symptom Checklist-40 (TSC); Elliot & Briere, 1996), potentially replicating results from the pilot study (Table 4). We anticipated a significant positive association between behavioral IA and the TSC anxiety symptom subscale. We expected a significant negative association between behavioral IA and the TSC dissociation symptom subscale. We planned to compute exploratory correlational analyses between behavioral IA and the remaining TSC subscales.

Overall, some of the correlations were similar between the pilot study and data from the present study on self-report IA. However, we observed more differences than similarities in correlations between the pilot study data and data from the present study. See Table 13 for correlations between behavioral IA and TSC subscales. The MAIA subscales that demonstrated the strongest associations (effect sizes of small-medium; Cohen, 1988) with the TSC subscales were not distracting and trusting. These

associations were similar to those observed in the pilot study. See Tables 4 and 13 for full correlation matrices (differences highlighted). Regarding correlations between behavioral IA and trauma symptoms, bivariate correlations showed that that there were no significant correlations. Although not significant and contrary to our prediction, there was a negative correlation between behavioral IA and TSC anxiety symptoms (r = -.07, p = .40). Again, though not significant, consistent with our prediction there was a negative correlation between behavioral IA and TSC dissociation symptoms (r = -.07, p = .37).

Aim 1, Research Question 1. To characterize IA among survivors, we assessed what their average Bx-IA would be. As a starting point, we reasoned that survivors' Bx-IA might be similar to results of Pollatos and colleagues' 2009 study with university participants (n = 119; M = 0.70, SD = 0.20) and Pollatos, Traut-Mattausch, Schroeder and Schandry's 2007 study. We selected these studies as comparators, because both of those study's samples were university participants, similar to the present study. **Statistical analyses.** Bx-IA was expressed using interoception accuracy. See Table 16 for zero-order correlations between EKG recorded and participant counted heartbeats.

In order to decrease sampling error, we conducted two blocks of three counting periods each for a total of six counting periods. We did not manipulate any variables between the two blocks, but we conducted a paired samples t test to check for possible differences between the two blocks. Results showed no significant differences between the two trials in either sample, as expected (t(146) = -.99, p = .32; r = .72, p < .001), so we combined the two blocks resulting in six trials. Thus, the formula was:

$$\left\{\frac{1}{6}\,\Sigma\left[1-\left(\frac{\left|\text{EKG recorded heartbeats} - \text{participant counted heartbeats}\right|}{\text{EKG recorded heartbeats}}\right)\right]\right\}$$

An independent samples *t* test showed significant differences between the mean Bx-IA for the present sample ($M = 0.75$, $SD = 0.18$) and the mean Bx-IA score in the Pollatos et al. (2009) study ($M= 0.70$, $SD = 0.20$), $t(270)$ 2.16, $p = .03$. This demonstrates that participants from this study had significantly higher Bx-IA than participants in Pollatos and colleagues' 2009 study. However, a comparison between the mean Bx-IA score for the present study and another research study (Pollatos, Traut-Mattausch, Schroeder, & Schandry, 2007) with a similar university population indicated no significant differences between samples, $t(253) = 1.33$, $p = .18$.

Aim 1, Research Question 2. To further characterize IA among survivors, we investigated whether self-reported IA (specifically the MAIA Total score) would not be significantly correlated with behaviorally measured IA. There were no significant correlations between behaviorally measured IA and self-reported IA in the university sample (see Table 11). Although not significant, results did indicate two correlations between MAIA subscales and behaviorally measured IA in the small effect range (not-worrying and behavioral IA: $r = .14$, $p = .09$; body listening and behavioral IA: $r = -.15$, $p = .08$). These results provided justification to assess these predictors in separate models (as was done in aims 2 and 3).

Aim 2. Quantify the amount of variance that IA and dissociation symptoms explain in PTSD symptoms among female sexual trauma survivors.

Aim 2, Hypothesis 1. We hypothesized that IA (behavioral IA (Bx-IA) and self-reported IA (MAIA total[5]) in separate models) would predict a significant amount of variance in PTSD symptoms above control variables. Additionally, we expected that that

[5] We determined we would use MAIA total alone to represent self-reported IA in aims 2 and 3, given that the noticing subscale is accounted for in the MAIA total score.

main effect would be qualified by an interaction between IA and dissociation symptoms; we expected that the main effect would weaken for people with higher dissociation symptoms. Given that results in aim 1 showed that self-reported IA and behaviorally measured IA were not correlated with each other, we put them in separate regression models. **Statistical analyses.** For the first model (behavioral IA; Bx-IA), we conducted a hierarchical linear regression analysis using PTSD symptoms as the dependent variable (measured by the PCL-5; Weathers et al., 2013) with the following steps: Step 1: age, physical abuse, emotional abuse, higher betrayal trauma, lower betrayal trauma; Step 2: sexual assault, sexual harassment; Step 3: Bx-IA, dissociation symptoms; Step 4: Bx-IA*dissociation symptoms. For the second model (self-reported IA; MAIA total), we conducted a hierarchical linear regression analysis again using PTSD symptoms as the dependent variable with the following steps: Step 1: age, physical abuse, emotional abuse, higher betrayal trauma, lower betrayal trauma; Step 2: sexual assault, sexual harassment; Step 3: IA, dissociation symptoms, MAIA total; Step 4: MAIA total*dissociation symptoms. We centered continuous predictors (Bx-IA, MAIA total, and dissociation) prior to computing interaction terms. In addition to considering quantitative data for this aim, we considered related qualitative data as well.

Results with behavioral IA (Bx-IA, i.e., Heartbeat perception task; Schandry, 1981) as the IA variable. The hypothesis here was that behaviorally measured interoceptive awareness would predict a significant amount of variance in PTSD symptoms. See Table 14 for full results of all variables listed. A hierarchical linear regression analysis revealed that behaviorally measured IA did explain a significant amount of variance in PTSD symptoms over and above control variables, as predicted.

However, the direction of the effect was opposite to what we had hypothesized. In the present study, higher behavioral IA (i.e., more accurate perception of heartbeats) was associated with a decrease in PTSD symptoms, as opposed to an increase. In step 3 when behavioral IA and dissociation were added to the model, the amount of predicted variance increased by 15.2% (R^2 Δ = .152, $F(2, 115) = 15.60$, $p < .001$). In this step, the predictors that drove the effect on PTSD symptoms were experiences of higher betrayal trauma (b = 0.19, p = .04), unwanted sexual contact experiences (b = 0.23, p = .002), Bx-IA (b = -0.20, p = .003), and dissociation (b = 0.46, $p < .001$). In the final step when the interactive effect of Bx-IA and dissociation was added, the amount of predicted variance was negligible, increasing by only 0.1% (R^2 Δ = .001, $F(1, 114) = 13.99$, $p < .001$). As previously stated, when added to the model, the effect of Bx-IA on PTSD symptoms was negative. This is contrary to the overall prediction gestalt of the a priori hypotheses, which was that more accurate perception of internal body sensations, as measured by the heartbeat perception task, would be associated with higher PTSD symptoms. What these results suggest, rather, is that more accurate perception of heartbeats is inversely related to PTSD symptoms in the presence of these control variables. This means that the more aware a person is of their heartbeat, the lower their PTSD symptoms are.

The pattern of results observed above, particularly that Bx-IA predicts decreases in PTSD symptoms, was echoed in some participants words in the open-ended questions. Although participants did not specifically identify PTSD symptoms, they did allude to the benefits of paying attention to internal body sensations during stressful sexual experiences. One participant (P88) commented:

In stressful sexual experience[s]*, I have noticed my breathing and heartbeat more as it was something I used to ground myself…* (answer to question #2)

Results with self-reported IA (MAIA total; Mehling et al., 2012) as the IA variable. The hypothesis that self-reported IA would predict a significant amount of variance in PTSD symptoms was not supported. Please see Table 15 for full regression results, and Figure 4 for a line graph of the interaction between self-reported IA and dissociation symptoms. A hierarchical linear regression showed that MAIA total did not explain a significant amount of variance in PTSD symptoms (b = -0.12, p = .08), while dissociation symptoms did explain a significant amount of variance (b = .45, p < .001). In the next step, the interaction between MAIA total and dissociation symptoms explained a significant amount of variance in PTSD symptoms (b = -0.17, p = .02). The effect of dissociation symptoms is strengthened for people 1 standard deviation below the mean of self-reported IA, while the effect of dissociation symptoms gets weaker the higher people are on self-reported IA (see Figure 4).

Through the open-ended questions (and un-prompted by the question), participants commented on their difference in awareness of internal body sensations during consensual and unwanted sexual experiences. We assume that consensual sexual experiences are on the whole pleasant, while unwanted sexual experiences are on the whole unpleasant and potentially traumatic. As we will address in the discussion section, answers like these informed our interpretation of the interaction between self-reported IA and dissociation. For example:

P48: *Typically, I am aware of my heartbeat and my breathing during sexual experiences. If they are unwanted experiences I tend to tune them* [heartbeat and breathing] *out. I assume my heartbeat and breath increases because of nerves during consensual experiences.*

We interpret the above to reflect using dissociation as a coping mechanism during unwanted sexual experiences.

And:

P60: *I'm more aware of my breathing and heart beat during sexual experiences with someone I actually like and care about. In situations were the other person is a stranger or someone I do not care much about, I'm less aware of my internal body sensations. I feel more numb.*

We interpret the above also reflect the utilization of dissociation as a coping mechanism during unwanted sexual experiences, while during consensual sexual experiences the participant endorses having heightened awareness of internal body sensations. These two quotes illustrate the interaction between self-reported IA and dissociation predicting lower PTSD symptoms. The quantitative and qualitative data suggest that people who have high levels of self-reported IA and dissociation symptoms may be able to fluidly titrate between IA and dissociation, perhaps depending on whether a situation is pleasant or unpleasant/traumatic.

Aim 3. Test a moderated mediation model of relationships between sexual trauma exposure IA, dissociation and PTSD symptoms.

Aim 3, Hypothesis 1. We hypothesized that the effect of sexual trauma exposure on PTSD symptoms would be partially mediated through changes in IA. People with

higher IA (behaviorally: more accurate perception of IA; self-report: higher scores on the MAIA total score) would have higher PTSD symptoms. Additionally, we anticipated that the association between IA and PTSD symptoms would be moderated by dissociation symptoms (measured by the WDS; Kennedy et al., 2004). Higher dissociation symptoms would diminish the association between IA and PTSD symptoms. All variables were treated as continuous. Behavioral IA (Bx-IA), MAIA total score and dissociation were mean centered prior to analysis. Given results from aim 1, two separate models (one with behaviorally measured IA, and one with self-reported IA) were computed. PROCESS (the SPSS macro through which we conducted these analyses; Hayes, 2013) requires that there be no missing data for participants utilized in the analysis. As such, out of the total sample of 152, the number of participants in the Bx-IA model was 125 and the self-reported IA model was 122.

A moderated mediation model did not support this hypothesis. *Results with behavioral IA (Bx-IA, i.e., heartbeat perception task; Schandry, 1981) as the IA variable.* The indirect effect of the number of instances of unwanted sexual contact on PTSD symptoms was not mediated by behaviorally measured IA (see Figure 5). Participants who had more experiences of unwanted sexual contact did not have higher behaviorally measured IA ($b = 0.003$, $SE=0.008$, $p = .75$). The direct pathway between unwanted sexual contact and PTSD symptoms was strong ($b = 2.09$, $SE = 0.652$, $p = .002$) and stayed consistent when the mediator (behaviorally measured IA) and the moderator (dissociation symptoms) were added to the model ($b = 2.09$, $SE = 0.652$, $p = .002$). Both behavioral IA and dissociation were significant predictors of PTSD symptoms (Bx-IA: $b = -21.54$, $SE = 7.15$, $p = .003$; dissociation: $b = 15.36$, $SE = 1.72$, $p < .001$), but their

interaction was not (b = 4.41, SE = 12.27, p = .72). In other words, increased PTSD symptoms appear to be related to higher reported unwanted sexual contact, higher dissociation, and lower behavioral IA, but there is no evidence that IA explains the relationship between unwanted sexual contact and PTSD symptoms.

Results with self-reported IA (MAIA Total; Mehling et al., 2012) as the IA variable.[6] Similarly, the indirect effect of the number of instances of unwanted sexual contact on PTSD symptoms was not mediated by self-reported interoceptive awareness (see Figure 6). Participants who experienced more unwanted sexual contact did not have higher self-reported IA (b = 0.016, SE=0.027, p = .56). Similar to the previous model, the direct pathway between unwanted sexual contact and PTSD symptoms was strong (b = 1.63, SE = 0.664, p = .02) and stayed consistent when the mediator (self-reported IA) and the moderator (dissociation symptoms) were added to the model (b = 1.63, SE = 0.664, p = .02). In this model, dissociation was a significant predictor of PTSD symptoms (dissociation: b = 15.21, SE = 1.80, p < .001), but self-reported IA was not (MAIA Total: b = -3.86, SE = 2.21, p = .08). Similar to results in aim 2, the interaction between dissociation and self-reported IA, however, was significant (b = -8.89, SE = 4.11, p = .03). People who are one standard deviation below the mean on both dissociation and self-reported IA have lower PTSD symptoms. However, the effect of dissociation on PTSD symptoms becomes weaker the higher people are on self-reported IA. This makes sense: IA might be inconsistent with some aspects of dissociation. For people who are one standard deviation above the mean on IA, the effect of dissociation on PTSD

[6] There were a few possible outliers in this model, which we assessed them through investigating residual plots, Cook's D and DFBeta's, and found no differences between models with and without possible outliers. Thus, we kept possible outliers in the data for this analysis.

symptoms is weaker than for people who are at the mean on self-reported IA. For people one standard deviation below the mean on self-reported IA, the effect of dissociation symptoms on PTSD is strengthened.

In sum, the results from the two aims are very similar. Both suggest that higher PTSD symptoms are associated with more experiences of unwanted sexual contact and higher dissociation symptoms. Results from both aims indicate that there is no evidence suggesting that the effect of number of unwanted sexual contact experiences is transmitted to PTSD symptoms through IA (measured behaviorally and via self-report). In other words, these results indicate that IA is not a mechanism at play between number of unwanted sexual contact experiences and PTSD symptoms. Data from both aims support an inverse association between IA and PTSD symptoms: as IA increases, PTSD symptoms decrease. The interesting difference between the behavioral and self-report models is that the model including self-reported IA demonstrated a significant interaction between IA and dissociation symptoms in predicting PTSD symptoms (in both aims 2 and 3). In contrast, in both aims the model with behaviorally measured IA did not show a significant interaction between behaviorally measured IA and dissociation. Some overlap and some discrepancies are to be expected since it appears that self-reported and behaviorally measured IA are assessing different aspects of a broader IA construct.

CHAPTER IV

DISCUSSION

The overall aim of this study was to assess the associations between exposure to sexual trauma and interoceptive awareness (IA) among female survivors through multi-methods. Specifically, aim 1 of this study was characterizing interoceptive awareness among survivors of sexual trauma, and assessing associations between IA and trauma symptoms. Aim 2 of this study focused on quantifying the amount of unique variance that IA explains in PTSD symptoms, over and above control variables (i.e., age, abuse history variables, and dissociation). In aim 3 of the study, we tested IA as a potential mediator of the effect of unwanted sexual contact on PTSD symptoms, concurrently testing the moderating effect of dissociation symptoms on the association between interoceptive awareness and PTSD symptoms. To gain a comprehensive picture of IA, we measured the construct both via behavioral observation (i.e., the heartbeat perception task with the Mental Tracking Method; Schandry, 1981), self-report (i.e., the Multidimensional Assessment of Interoceptive Awareness (MAIA); Mehling et al., 2012) and open-ended questions (i.e., qualitative data). We relied predominantly on the behavioral and self-report data for this present manuscript, and integrated qualitative data where it aided in our interpretation of the quantitative data.

Overall, the results from this study indicate that interoceptive awareness is an active component of survivors' posttrauma experiences. These results suggest that survivors of sexual trauma have lower self-reported IA than other published studies (aim 1). Additionally, in comparison to average behavioral IA scores in studies with similar samples, survivors have behaviorally measured IA that is significantly lower than one

sample and no different from another sample (aim 1). Through hierarchical regression analyses (aim 2), IA (measured both behaviorally and via self-report) was found to predict lower PTSD symptoms. This is interesting for many reasons, including that this contrasts with the anxiety literature (upon which we based study predictions), which shows that higher IA predicts higher anxiety symptoms (e.g., Ehlers, 1995; Ehlers & Breuer, 1992; see Domschke, Stevens, Pfleiderer, & Gerlach, 2010 for a review). As we will discuss later, this finding potentially makes more sense when PTSD is conceptualized of as a condition maintained by avoidance rather than anxiety symptoms. Additionally, there was evidence that behaviorally measured interoceptive awareness is a unique predictor of PTSD symptoms, even over and above other historically robust covariates, such as dissociation. We cannot infer causality here, though; it could also be that PTSD predicts behaviorally measured interoceptive awareness. Self-reported IA interacted with dissociation symptoms, predicting lower PTSD symptoms. This interaction was particularly meaningful for PTSD symptoms among university students with high dissociation symptoms. There was no evidence that IA (either self-report and behavioral) was a mediator of the association between sexual trauma exposure and PTSD symptoms (aim 3). In the same analyses (aim 3), though, self-reported IA interacted with dissociation symptoms, similar to results from the hierarchical regression analysis (aim 2). In terms of PTSD symptoms, the interaction between self-reported IA and dissociation was only beneficial for survivors with higher symptoms of dissociation and higher self-reported IA. For those people, higher IA and higher dissociation predicted PTSD symptoms lower than the clinical cutoff of 33. On the other hand, for other participants, low IA and high dissociation symptoms predicted PTSD symptoms higher

than the clinical cutoff of 33. These results indicate that it may be make more theoretical sense to think of IA as a moderator of the association between dissociation and PTSD symptoms. Taken together, these findings provide an initial picture of how IA functions in survivors' post-trauma experiences.

Regarding the interaction we observed in both aim 2 and 3 (which we will discuss further below), we found that people who score high on *both* dissociation and self-reported IA have the lowest PTSD symptoms. This was illustrated through some qualitative data (see results section, aim 2). This interaction might seem counter-intuitive. Here we present a hypothetical vignette illustrating how the interaction might manifest in a clinical situation. Imagine that a male student (John) raped a female student (Madison) while at a party. One year following the rape, Madison has to see John often on campus because he is in some of her classes. It might be that in order to pass by John in the hallway, Madison dissociates during the moments where they walk by one another. In this situation, dissociation is a useful coping mechanism for Madison. However, by this time (one year following being raped by John) Madison has also started dating someone: Kyle. When they have sex, in order to not have memories about when John raped her, Madison focuses on her internal body sensations happening in the present moment. Focusing on internal body sensations in this situation helps Madison experience the non-violent sex with Kyle, as opposed to getting caught in trauma-related memories associated with John raping her. We hope that this vignette illustrates how high dissociation together with high self-reported IA might be associated with lower PTSD symptoms: the survivors who are able to titrate between dissociating from and then being aware of their experiences have the lowest PTSD symptoms in this

sample (see Figure 4). On the other hand, if Madison was high on dissociation and low on self-reported IA, she would likely have higher PTSD symptoms (as the aim 2 model predicts). She would dissociate while around John, and also likely dissociate during sex with Kyle. In that case, instead of experiencing the non-violent sex with Kyle, Madison would likely be lost in a web of trauma-related flashbacks.

Reprise of Aims and Hypotheses

Aim 1: Overall, the thrust of this aim was to characterize interoceptive awareness among sexual trauma survivors. Specifically, we sought to establish levels of interoceptive awareness among sexual trauma and see whether findings from the pilot study replicated in this present study. This aim also focused on testing the relationships between symptoms from sexual trauma exposure and IA. We aimed to assess if results from this study replicated pilot study results. Additionally, in this aim we compared interoceptive awareness of sexual trauma survivors to existing similar research participant samples, with the ultimate purpose of situating it within the interoceptive awareness literature. Lastly, we assessed whether self-reported IA and behaviorally measured IA would be correlated in a sample of sexual trauma survivors. This aim is important, given that there is scant literature on interoceptive awareness among sexual trauma survivors.

Aim 1, Hypothesis 1: We predicted that self-reported IA (represented by the MAIA total score and the MAIA Noticing subscale) would replicate results from a pilot study of female trauma survivors. Results were not consistent with this hypothesis, as self-reported IA was significantly lower in the present study than in the pilot study sample. This could be due to various factors: first, it could be explained by random

sampling error. Second, it could be due to differences in measurement technique. Data in the present study were measured through an in person lab study, while data for the pilot study were measured through an online study. There are various costs and benefits to data collected online versus in person, a comprehensive review of which is outside the scope of this paper. Although there are potentially equivalent costs and benefits to both, one significant benefit of collecting data in person (as we did in the present study) is that data are collected in a controlled and distraction-free environment. It might be that in such an environment facilitates better concentration, which may have contributed to the difference in results (participants answering online surveys do so in an environment of their choice, which might include more distractions than a controlled environment). It might therefore be that the data collected in this study was more reflective of participant's "true" interoceptive awareness. However, the case could also be made for these data being less ecologically valid, because participants were not answering questions while in their day-to-day routines, which was the case for the online survey participants in the pilot study. Third, data for the present study were collected during the academic year (fall and winter), while data for the pilot study were collected during the summer. It might be that time of year and associated levels of physical activity impact reported levels of IA. Dunn and colleagues stated (2010) that physical activity has been associated with behaviorally-measured IA in past research, and as such is commonly assessed as a covariate for IA. Although this is the case, a recent study found no differences in self-reported IA (using the MAIA; Mehling et al., 2012) between two groups of women, one that engaged in physical activities and one that did not (Brytek-Matera & Kozieł, 2015). Comprehensive data on physical activity were not collected for

the pilot study. However, in the present study we did collect data on level of daily physical activity, which was non-significantly positively associated with self-reported (r = .13, p = .11) and behaviorally measured (r = .05, p = .56) IA. This suggests that for the present study, the more physically active a person is the more aware of their internal body sensations they are, though the associations are weak. Given the similarities in the samples (all trauma survivors attending universities), this finding may generalize to the pilot study as well. Additionally, many participants in this study commented in open-ended responses that they are more aware of their body sensations during physical activity. For example:

> P15: *I frequently notice my breathing when I am doing physical activity. When I am doing school work or working, or any concentration activity, I do not notice my heartbeat or breathing unless I try.*

And:

> P93: *I think about my heartbeat when I do physical activity. For some reason I want as high (fast) of a heartbeat as possible in these physical situations. I usually only concentrate on my breathing when practicing yoga. Other than that, again, I only become aware during physical activity.*

Given that people tend to be more physically active during summer months (and potentially less active during academic terms), it might be that increased physical activity led to higher levels of interoceptive awareness in the pilot study. This would be interesting fodder for future research. This finding and potential future research have good implications for physical interventions for trauma survivors.

Additionally, we hypothesized that that self-reported IA in the present sample of sexual trauma survivors would be significantly lower than average noticing scores found in a large sample (n = 435) of community members with chronic pain (Mehling et al., 2013), as well as significantly lower average noticing scores found in a large sample of healthy mind-body practitioners (n = 325; Mehling et al., 2012). Statistical comparisons supported this hypothesis. Self-reported IA in this sample of sexual trauma survivors was significantly lower than the chronic pain sample, as well as significantly lower than a sample of healthy mind-body practitioners. Regarding the comparison between data from the present study and data from the chronic pain sample (Mehling et al., 2013) in comparison to the mind-body sample (Mehling et al., 2012), these results fit within some theories of body awareness among people experiencing pain and among people who have experienced sexual trauma. The fear-avoidance model of chronic pain (Vlaeyen & Linton, 2000) proposes that some people experiencing chronic pain pay a great amount of attention to their painful body sensations, which inspires anxiety and worry which leads people to avoid engaging in activities that cause more pain. In accordance with this theory, people with chronic pain would have a heightened awareness of their body sensations and utilize avoidance of physical activity to cope with their anxiety. If we conceptualize PTSD as a condition maintained by avoidance symptoms, it would make sense that sexual trauma survivors report significantly lower self-reported IA. Perhaps survivors use avoidant coping mechanisms to dampen awareness of their bodily sensations that remind them of their sexual trauma. Many cognitive behavioral theories on PTSD posit that avoidance symptoms stunt psychological healing by supporting the process of habituating to traumatic memories (Foa & Rothbaum, 1998), some of which

may be body-based. Pineles and colleagues (2011) found a significant interaction between physiological reactivity to a narrative of their own trauma and avoidance behaviors in predicting worse PTSD symptoms. The present average self-reported IA scores being significantly lower than the chronic pain sample may be due to a combination of avoidance symptoms, and dissociation symptoms.

Price and colleagues (2007) have assessed body dissociation among survivors of sexual trauma, and found that female child sexual abuse survivors and female physical abuse survivors evidenced significantly more body dissociation than women who had not had such trauma experiences. The findings from the current study that sexual trauma survivors have significantly lower self-reported interoceptive awareness than a healthy sample of mind-body practitioners make sense. Researchers theorize that mind-body interventions increase IA (Emerson, 2015; van der Kolk et al., 2014), which may be one factor in their higher average scores. If it is true that people who practice mind-body interventions have higher self-reported interoceptive awareness than people who do not practice such interventions, then it makes sense that self-reported interoceptive awareness from the present sample of participants is lower than the healthy sample of mind-body practitioners. We observed a similar pattern of results in the pilot study. These findings being replicated is a helpful contribution to the self-reported IA and sexual trauma literatures.

Another explanation for the low levels of self-reported IA observed in this study might be related to the study population: undergraduate students. University students oftentimes exist in environments rife with unwanted sexual contact, and betrayal trauma on interpersonal and institutional levels. Betrayal trauma and its theorized coping

mechanism, betrayal blindness, might hinder awareness of internal body sensations. Institutional betrayal (Smith & Freyd, 2013) is a similar theoretical construct as Freyd's initial betrayal trauma theory (1996). Here, however, it is not individuals but rather institutions who are perpetrating and breaking trusted bonds. Research has shown that students experience high levels of betrayal trauma on college campuses. At the interpersonal level, for example, Rosenthal, Smidt and Freyd (2016) documented 23.4% of graduate students experienced sexual harassment from university faculty members on college campuses. This is an example of an interpersonal betrayal, as graduate students frequently have close and dependent relationships with faculty members. Smith and Freyd's 2013 study showed that among 345 undergraduate female students, roughly half of whom had experienced unwanted sexual contact, 47% of the women reported experiencing institutional betrayal.

One coping mechanism for betrayal trauma (both interpersonal and institutional) is "blindness" or dampened awareness of the traumatic violation (Freyd, 1996; Delker & Freyd, in press). In many cases of betrayal, victims need to maintain their relationships with perpetrators in order to survive. It therefore may be adaptive to be unaware or blind to the trauma, in order to maintain the relationship with the perpetrator. Betrayal blindness is theoretically distinct from dissociation in that the function of betrayal blindness is to remain unaware of the trauma in the service of prioritizing the relationship needed for victim survival. It is possible that one component of betrayal blindness is turning away from internal body sensations, potentially leading to lower of IA. As discussed in the introduction, certain theories of emotion (e.g., James-Lange theory of emotions) state that it is through body sensations that we become aware of our emotions,

and that body sensations can exacerbate emotions. One of the components of betrayal trauma that survivors may attempt to remain blind to are the physical sensations associated with the emotions in response to the betrayal trauma. Indeed, this is common in other conceptualizations of symptoms of and mechanisms for coping with trauma (e.g., experiential avoidance of emotions mediates the association between exposure to childhood sexual abuse – commonly a betrayal trauma – and subsequent psychological symptoms; Marx & Sloan, 2002). In summary, the high frequency of betrayal trauma on college campuses and important role that betrayal blindness may play among this population might have played a role in the lower levels of self-reported interoceptive awareness that we observed in this study. Future researchers ought to assess the similarities in interoceptive awareness between this sample and other samples of sexual trauma survivors.

Aim 1, Hypothesis 2. We expected observing significant positive and negative correlations between self-report IA and trauma symptoms (Trauma Symptom Checklist-40 (TSC); Elliot & Briere, 1996) similar to the pilot study (Tables 4 and 13). Given existing literature on behavioral IA and the MAIA, we anticipated there being a significant positive association between behavioral IA and the TSC Anxiety symptom subscale. Due to the theoretical differences between behavioral interoceptive awareness (higher scores characterized by more awareness of heart beats) and dissociation (higher scores characterized by a lack of awareness of internal and external phenomena, including bodily sensations) we expected to observe a significant negative association between behavioral IA and the TSC Dissociation symptom subscale. We computed

exploratory correlational analyses between behavioral IA and the remaining TSC subscales.

Overall, some of the correlations were similar between the pilot study and data from the present study on self-report IA. However, there were more differences than similarities in correlations between the pilot study data and data from the present study. In the present study, the MAIA subscales that demonstrated the strongest associations (effect sizes of small-medium; Cohen, 1988) with the TSC subscales were not distracting and trusting. These associations were similar to those observed in the pilot study. Regarding correlations between behavioral IA and trauma symptoms, bivariate correlations showed that that there were no significant correlations. Contrary to prediction, there was a negative correlation between behavioral IA and TSC anxiety symptoms (r = -.07, p = .40). This result is different from the existing literature on behaviorally measured IA and anxiety, which shows that higher behavioral IA is positively associated with anxiety symptoms. However, there are differences between the present study and existing literature in terms of context of the anxiety symptoms and measurement instruments. In the present study, we measured anxiety symptoms within the context of trauma. Prior to participants answering the TSC, we primed them to recall their "worst" sexual trauma and have that in mind when answering the questions in the TSC and PCL. In doing this, we may have successfully trained participants to focus on anxiety related to the traumatic event, rather than anxiety stemming from social situations or anxiety related to general uncertainty about the future. Existing studies measuring associations between behavioral IA and anxiety have utilized interventions to heighten other forms of anxiety, such as social anxiety (e.g., Stevens et al., 2011). Other studies

have assessed anxiety in the absence of anxiety-related prompts or experimental manipulations (e.g., Dunn et al., 2010; Pollatos et al., 2009). Therefore, results from this study on trauma-related anxiety are potentially different enough from socially-related anxiety or anxiety devoid of specific trigger so as to not be comparable. It is important to note that the association between anxiety and behavioral IA effect size was very small in the present study, so it is important to not over interpret these results. Future studies with larger samples of trauma survivors could measure trauma-related anxiety with the TSC as well as another anxiety measure used in other behavioral IA research to be able to more directly compare associations.

Further, other studies on behavioral IA have utilized anxiety inventories that measure general state and trait anxiety through the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983; e.g., Dunn et al., 2010; Stevens et al., 2011; Pollatos et al., 2009), or anxious arousal through the MASQ-S (Watson & Clark, 1991; Dunn et al., 2010). The STAI assesses anxiety at the level of cognitions and bodily arousal, and the MASQ-S measures items that specifically focus on bodily hyperarousal symptoms. Although there is some overlap with those aforementioned anxiety constructs and items on the TSC Anxiety subscale, there are also items on the TSC that are more linked to trauma-related anxiety. For example, there are items that focus on somatic anxiety (e.g., "How often have you experienced stomach problems in the past 2 months?"), but there are also other items that could be construed as specifically assessing trauma-related anxiety. Examples include: "How often have you been afraid of men in the past 2 months?" This item would likely get a higher rating from a person who had been sexually assaulted by a man, as opposed to a person who experienced general

anxiety symptoms. Another item that seems distinct to trauma-related anxiety is: "How often have you engaged in unnecessary washing in the past 2 months?" Trauma survivors often comment that they feel unclean following sexual assault (a phenomena referred to as "mental pollution"; Fairbrother & Rachman, 2004) and as such, this item would likely be more associated with trauma-related anxiety as opposed to social anxiety. Notably, in the university sample there were mostly negative associations between self-reported interoceptive awareness and TSC anxiety (see Table 13), which is similar to associations between an anxiety inventory and the MAIA (Mehling et al., 2012). In summary, the associations observed here between behaviorally measured IA and anxiety differ from the literature, and might do so because of different self-report anxiety inventories utilized across studies or because trauma-related anxiety (especially when prompted with a traumatic event memory) is different from other forms of anxiety measured in the behavioral IA literature.

Consistent with our prediction, there was a negative correlation between behavioral IA and TSC dissociation symptoms (r = -.07, p = .37) with a very small effect size. It makes sense that these two variables would be negatively related, as in order to perform well on the heartbeat perception task, one needs to be able to pay attention to one's heartbeat for sustained periods of time. In the case of people who are higher on dissociation, it might be that they either a) are more likely to have lapses of attention that would interfere with performance on the heartbeat perception task, or b) associate their heartbeats with memories of sexual trauma and therefore avoid paying attention to a body sensation that is associated with a traumatic event. Either way, the negative association observed is too weak to make firm conclusions about the nature of the relationship

between these two variables. Future studies could further investigate these associations by experimentally manipulating dissociation (perhaps by introducing a trauma-related memory to survivors who are prone to high levels of dissociation) and then testing behavioral interoceptive awareness before and after the dissociation manipulation.

Aim 1, Research Question 1. Here, we assessed survivors' average behaviorally measured IA, and compared our results to those of two studies (Pollatos et al., 2009; Pollatos et al., 2007). These studies were selected as comparators given the similar participant samples: university participants. Behaviorally measured IA in the present study was significantly higher than Pollatos et al., 2009, but not statistically different from Pollatos et al., 2007. These mixed results make sense in light of the range of published average levels of behaviorally measured interoceptive awareness in the literature, that range from a low of .5 (Stutterlin, Schultz, Stumpf, Pauli, & Vogele, 2013) to a high of .84 (Werner, Pres, Duschek, & Schandry, 2010). Future researchers may consider comparing Bx-IA among sexual trauma survivors to other participant samples that are similar on dimensions (i.e., clinical symptoms) other than demographics.

Aim 1, Research Question 2. The purpose of this research question was to further assess whether self-reported and behavioral interoceptive awareness function among sexual trauma survivors is similarly to existing literature. Specifically, we tested the correlation between self-reported and behavioral interoceptive awareness. Based on existing theory (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015) and empirical literature (Calí, Ambrosini, Picconi, Mehling, & Committeri, 2015; Leiter-McBeth, 2016), we expected that self-reported IA (specifically the MAIA Total score) would not be significantly correlated with behaviorally measured IA. We found that self-reported

IA and behaviorally measured IA were not significantly correlated with each other, a result that is consistent within the context of the literature. These results provided justification to assess these predictors in separate models (as was done in aims 2 and 3).

These results also further support the theory that self-reported IA and behaviorally measured IA are measuring different aspects of an overall construct. As previously mentioned, Garfinkel and colleagues (2015) define behaviorally measured IA as "objective accuracy in detecting internal bodily sensations" (p. 67). They label this construct "interoceptive accuracy" instead of behaviorally measured IA. They discuss measures of self-reported IA as assessing "self-perceived dispositional tendency to be internally self-focused and interoceptively cognizant" (p. 67). Instead of calling this construct self-reported IA, they label this construct "interoceptive sensibility". These two definitions are consistent with how we operationalized IA in the present study. Future studies with sexual trauma survivors might utilize these terms to fit within the broader literature that is now adopting such terminology. Additionally, assessing participants' confidence of their heartbeat perceiving accuracy (as suggested by Garfinkel et al., 2015) would provide another layer of validity to the heartbeat perception task.

Aim 2. The point of aim 2 was to test the amount of variance that interoceptive awareness explains in PTSD symptoms among female sexual trauma survivors. This aim is important, because it contributes information about the direction of effect that IA has on PTSD symptoms, and the overall explanatory power of interoceptive awareness within this population.

Aim 2, Hypothesis 1. We hypothesized that interoceptive awareness would predict a significant amount of unique variance in PTSD symptoms above control

variables. Additionally, we expected that that main effect would be qualified by an interaction between IA and dissociation symptoms; we expected that the main effect of interoceptive awareness would weaken for people with higher dissociation symptoms. We computed two separate models: one with behaviorally measured IA as a predictor and another with self-reported IA as a predictor. In the model with behaviorally measured IA, behaviorally measured IA predicted a significant amount of variance in PTSD symptoms, over and above many control variables. IA measured through self-report did not predict a significant amount of variance in PTSD symptoms. In the model with behaviorally measured IA, the interaction between IA and dissociation symptoms did not predict a significant amount of variance in PTSD symptoms. However, in the model with self-reported IA, the interaction between IA and dissociation *did* predict a significant amount of variance in PTSD symptoms.

Interestingly in both models, the direction of the effect of IA on PTSD symptoms was contrary to our predictions, as well as contrary to the anxiety and behavioral IA literature on which we based those predictions. However, these results are consistent with what little literature there is on anxiety and self-reported IA. In both models, IA was negatively associated with PTSD meaning that for every one unit increase in IA, PTSD symptoms decrease. For the model with behavioral IA, assuming mean values on each of the control variables, the model predicts that when behavioral IA increases to 0.93 (i.e., one standard deviation (.18) above the mean of 0.75), PTSD symptoms would be expected to decline from 26.75 (the expected PTSD value at the mean of all predictors in step 3 of this model) to a score of 23.15 on the PCL-5. For the model with self-reported IA with the same assumption of mean values as previously mentioned, the model predicts

that when self-reported IA increases to 2.73 (i.e., one standard deviation (0.57) above the mean of 2.16), we would predict that PTSD symptoms would fall from 26.06 (the mean value of PTSD symptoms in step 3 of this model) to a score of 23.30.

As previously mentioned, these findings are contrary to literature on anxiety and behavioral IA, but consistent with the small literature on anxiety and self-reported IA. This suggest is that behavioral IA and self-reported IA, though overlapping in some respects, are really measuring different aspects of interoceptive awareness. Regarding the anxiety literature on behavioral IA, which in part inspired predictions for this aim, studies (e.g., Pollatos et al., 2009; Dunn et al., 2010; Ehlers & Breuer, 1992) report that behavioral IA (as measured by Schandry's 1981 heartbeat perception task) predicts a significant amount of variance in anxiety symptoms and that the regression coefficients are positive. This suggests that as anxiety symptoms increase, behavioral IA (i.e., accuracy of predicting one's own heartbeats) also increases. Findings from this study might be different from this body of literature for two reasons: first, upon closer look at the anxiety and behavioral IA literature, many of the studies utilized populations with anxiety levels that more closely resembled clinical populations. The PTSD symptoms in this study's sample were on average sub-clinical, which may have accounted for the difference in results. Second, although PTSD does have anxiety components – hyperarousal and intrusion symptoms are similar to anxiety symptoms (symptom clusters E and B, respectively, in the DSM-5; American Psychiatric Association, 2013) – and used to be categorized as an anxiety disorder in the DSM-IV-TR (American Psychiatric Association, 2000), PTSD is actually comprised of many other symptom clusters that are not directly anxiety related (for example, cluster D is symptoms of negative changes in

thoughts and mood associated with the trauma). Further, PTSD is now no longer regarded as an anxiety disorder in the DSM-5 (American Psychiatric Association, 2013), as it was in previous editions of the DSM. Initially basing these study predictions on the anxiety literature was a sensible choice due to their being no literature on behavioral IA and PTSD and due to the similarities between PTSD and anxiety disorders. Additionally, our predictions made sense in the context of conceptualizing PTSD as maintained by anxiety symptoms. However, results from this study suggest that the association between behavioral IA and PTSD is different from the established associations in the behavioral IA and anxiety literature.

There is one correlational study that includes a correlational analysis between self-reported IA and state and trait anxiety (Mehling et al., 2012). Mehling and colleagues (2012) computed correlations between all eight MAIA subscales and the trait anxiety score from the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Results indicated significant negative correlations ranging from small (Emotional Awareness: r = -.19) to medium (not-worrying, self-regulation, and trusting: r = .46). Although a total score was not computed or related to trait anxiety in this study, given the negative correlations for all subscales, we can surmise with caution that had it been computed and analyzed, the correlation between the MAIA total score and trait anxiety would have been negative as well. The results from the present study fit within the context of this existing literature, though the effects of self-reported IA on PTSD symptoms should be considered with caution given the lack of statistical significance (p = .08). This might be due to lack of power; because of missing data, the present study was under-powered for this model. Power calculations suggested the need

for 150 participants for this aim. Although collected data from enough participants to be adequately powered (n =152), with missing data the total number of participants included in the analysis for this aim was 121. These data provide a good starting point from which to base predictions for an adequately powered analysis.

As referenced and discussed previously, findings from both conceptualizations of interoceptive awareness measured here fit very well within the literature suggesting that PTSD is a condition maintained by avoidance as symptoms (Foa & Rothbaum, 1998), as opposed to maintained by anxiety symptoms. Exposure-based therapies for PTSD are effective partly through decreasing avoidance to triggering trauma-related stimuli (Foa & Rothbaum, 1998). These findings are also potentially consistent with the theories on how mind-body interventions with survivors of sexual trauma work. Researchers (e.g., van der Kolk et al., 2014) have theorized that trauma-sensitive yoga interventions lead to decreases in PTSD symptoms by way of increasing interoceptive awareness (i.e., a negative association). Qualitative data from the present study suggest support of this theory. Through the open-ended questions, some participants spontaneously commented on having heightened awareness of their internal body sensations during yoga practice. For example:

> P125: *I am probably most aware of my internal body sensations when I am practicing yoga, deep breathing or other body aware exercises.*

And:

> P90: *I am generally unaware of my heartbeat and breathing in most situations. I usually become aware of it when I get anxiety and notice how fast my heartbeat and breathing has gotten. I also become aware of these*

things when I am in my yoga class and am instructed to focus on breathing and the body in general.

Data like these lend support to IA potentially being a mediator of the treatment effect of yoga on PTSD symptoms. Future experimentally designed studies ought to test this possibility.

Within this aim, as we also observed in aim 3 of this study, the findings in the self-reported IA model are more complex due to the significant interaction between self-reported IA and dissociation symptoms. The interaction between self-reported IA and dissociation symptoms predicted lower PTSD symptoms. This was particularly evident for people higher in dissociation symptoms. The effect of dissociation symptoms on PTSD symptom severity was stronger for people who had low self-reported IA, while the effect of dissociation symptoms on PTSD symptom severity was weaker for people who had high self-reported IA. In this sample, high levels of dissociation generally predict higher, or more severe, PTSD symptoms. In the presence of higher levels of self-reported IA, however, the relationship between dissociation and PTSD symptoms was weaker. For those people, PTSD symptoms were predicted to be well below the diagnostic cut point (see Figure 4). For people with higher levels of dissociation and lower levels of self-reported IA, though, the effect of dissociation was strengthened, whereby high dissociation predicts higher PTSD symptoms. People with that dissociation and IA profile are predicted to have PTSD symptoms well above the diagnostic cut point (see Figure 4). Consider these findings together: there was a significant interaction between self-reported IA and dissociation, and self-reported IA on its own did *not* predict significant variance in PTSD symptoms. These findings suggest

that self-reported IA may play a more important role as a moderator of dissociation, rather than a predictor of PTSD symptoms on its own. However, this statement ought to be considered with caution, considering that the effect estimates between self-reported IA and the interaction are not that different from one another. With this finding in mind, future studies ought to consider implementing a randomized controlled trial looking at the effect of interventions that enhance interoceptive awareness among sexual trauma survivors with high levels of dissociation symptoms and low baseline levels of self-reported interoceptive awareness. Such a study could assess whether increasing self-reported interoceptive awareness leads to decreases in PTSD symptoms.

It could always be the case that there are third variables that would more accurately explain variance in PTSD symptoms. One variable that we measured in this study and previously discussed – engagement in physical activity – is a plausible third variable candidate. Although it would have been ideal to collect comprehensive data on physical activity (which future studies ought to do), we did assess average level of daily physical activity. We ran the models in aims 2 and 3 with physical activity added as a covariate, though, and it did not account for significant variance in PTSD symptoms in either model. The way that we measured level of physical activity, is limited, however: even though the measure contains behaviorally specific explanations of physical activity level, it has only one item. Future studies ought to measure physical activity through more items, and measure engagement in specific types of exercise (e.g., yoga, running, cycling). Even though physical activity did not emerge as a third variable in these analyses, it is possible that engaging in specific types of exercise would explain more variance in PTSD symptoms than IA.

Aim 3. The point of aim 3 was to build on the previous regression analyses, and assess the mechanisms of the association between exposure to sexual trauma and PTSD symptoms. We aimed to assess whether the effect of experiencing sexual trauma is conferred to PTSD symptoms through interoceptive awareness, and whether that mediated effect depends on a person's dissociation symptoms.

Aim 3, Hypothesis 1. We hypothesized that the effect of sexual trauma exposure on PTSD symptoms would be mediated through changes in IA. People with higher IA (behaviorally: more accurate perception of heart beats; self-report: higher scores on the MAIA total score) would have higher PTSD symptoms. Additionally, we anticipated that the association between IA and PTSD symptoms would be moderated by dissociation symptoms (measured by the WDS; Kennedy et al., 2004). Higher dissociation symptoms would diminish the association between IA and PTSD symptoms.

The results suggested that IA (measured behaviorally and via self-report) does not mediate the association between sexual trauma and PTSD symptoms. Further, the results showed that changes in exposure to sexual trauma are not related to changes IA. Resembling the results from aim 2, IA was negatively associated with PTSD symptoms and dissociation predicted higher PTSD symptoms. Additionally, there was a significant interaction between self-reported IA and dissociation symptoms that predicted lower PTSD symptoms. The interaction had a particularly strong effect for people with higher dissociation and higher IA. We did not observe this in the model with behaviorally measured IA. Given that the results from the second half of this model are very similar to the results from aim 2, further discussion of that finding is unnecessary. However, we will discuss the lack of association between sexual trauma exposure and IA, as well as the

potential reasons accounting for IA not being a mechanism of the relationship between sexual trauma and PTSD symptoms. We will also discuss the implications of these findings.

Sexual trauma exposure did not predict unique variance in IA (behavioral or self-report). In other words, people who experienced one type of sexual trauma and people who experienced two types of sexual trauma were not predicted to differ on IA. This might be explained by a lack of variability in experiences of sexual trauma in this sample. Second, this sample of participants experienced moderate to high dissociation symptoms. It might be that the presence of dissociation symptoms made it challenging for people to report on body awareness. We think this is a plausible explanation both for the lack of association between sexual trauma exposure and IA, as well as the lower levels of self-reported IA in this sample (related to aim 1). Results from both models showed that interoceptive awareness did not mediate the association between sexual trauma and PTSD symptoms. This might be explained by these IA data hitting a floor effect; the variance in IA observed here might be reduced to a degree that makes measuring relationships between it and other variables challenging. It might be that IA does affect the association between sexual trauma and PTSD symptoms, but only for medium to high levels of IA (versus the levels of self-reported IA observed here that are lower than existing research (see results from aim 1 and Table 12)). Future studies could investigate this among a sample of survivors who more closely resemble a clinical population.

This sample was underpowered for the analyses in aim 3, as well, which could also account for the lack of observed effect. Although we collected data from enough people (n = 152) warranted to achieve power of 0.8 (Wang & Preacher, 2015), the

standardized regression coefficients for interoceptive awareness were in the small effect size range (0.14 and lower) as opposed to the medium effect size range (at least 0.39). As mentioned previously, in a sample size of 100-200 with standardized regression coefficients in the small effect range, Wang and Preacher (2015) showed power of 0.19-0.50. Given that the regression coefficients for interoceptive awareness in these analyses were in the small, as opposed to medium, effect size range, it is likely that a much larger sample size would be needed to have adequate power to detect effects. The PROCESS macro (Hayes, 2013) that we used to estimate this model requires complete data from participants. Although we collected data from a sufficient number of participants, there was complete data from fewer participants (self-reported IA model $n = 122$; behaviorally measured IA model $n = 125$) than was indicated as necessary from the power calculations. This may also account for the lack of observed effect.

Results from aim 2 and aim 3 showed that changes in IA predict declines in PTSD symptoms. Additionally, both analyses showed that self-reported IA interacted with dissociation symptoms in predicting lower PTSD symptoms. However, when IA was put in the position of mediator between sexual trauma exposure and PTSD symptoms, the association between sexual trauma exposure and PTSD symptoms remained strong. Although there are limitations of interpreting results from a correlational study as opposed to relying on outcomes from an experimental design assessing the mechanisms of change of an intervention, these findings suggest that IA may be more appropriately thought of as a moderator of the association between dissociation and PTSD symptoms. As previously stated, IA is discussed in the literature as a potential mechanism of action that when increased through a body-based intervention – like yoga – confers decreases in

PTSD symptoms among survivors of sexual trauma symptoms. Results from the present study do not support that, given that IA did not mediate the association between sexual trauma and PTSD symptoms. However, we do not wish to over-interpret our results, because the present study was correlational. In order to effectively test whether IA is a mechanism of action of body-based interventions for PTSD, future researchers would need to run an experimentally designed intervention study. Within the context of the present correlational study results, instead of IA being a mediator on its own, though, perhaps IA is an important component of a larger construct that could mediate the relationship between sexual trauma exposure and PTSD symptoms: emotion regulation.

As previously mentioned in the introduction, some theories of emotion (e.g., James-Lange theory of emotion (James, 1884) and Damasio's somatic marker hypothesis (1996)) regard changes in bodily sensations and awareness of those sensations as a chief way that people meet the emotions they are experiencing. Some participants' answers to open-ended questions illustrated the connections between body sensation awareness and emotions, particularly regarding their experience of negative emotions. For instance:

> P73: *I only notice my internal body sensations when I am stressed out or having anxiety. I will notice if I'm breathing too heavily and feel self-conscious about that, but I usually don't notice my heartbeat.*

Some participants noted the connection between both negative and positive emotions, and body sensations:

> P116: *I am usually aware of my body sensations if I'm very stressed/uncomfortable or very happy. In both situations, I feel my heart*

beating faster as well as the frequency of my breathing increasing. Apart from those extremes, I am not usually aware of my body as much.

Cognitive behavioral theories also include awareness of physiological symptoms as a factor that can contribute to emotional distress (Padesky & Greenberger, 1995; Figure 2). Interoceptive awareness has been shown to track with emotional experience: Dunn and colleagues (2010) showed that higher behavioral interoceptive awareness (i.e., more accurate perception of heart beats) moderated the association between changes in heart rate and self-reported ratings of arousal related to viewing various emotional pictures. Herbert, Herbert and Pollatos (2011) reported that behavioral interoceptive awareness predicted changes in alexithymia, such that as behavioral interoceptive awareness increased, alexithymia was predicted to decrease. Further, Pollatos and Schandry (2008) demonstrated that people with high behavioral interoceptive awareness (i.e., scores higher than .79, a cut point from a median split they conducted on the distribution) showed stronger psychophysiological reactivity to emotionally-valenced pictures, and remembered emotional pictures more than people with low behavioral interoceptive awareness. They interpreted this to mean that people with high interoceptive awareness process emotional information better and have more dependable recall of emotionally-related memories. Critchley and colleagues (2004) have observed brain activation (through functional magnetic resonance imaging) and volume of gray matter (measured via voxel-based morphometry) in the right anterior insular cortex during a heartbeat perception task. This area of the brain that is also associated with emotional and introspective awareness. Regarding self-reported interoceptive awareness, Mehling and colleagues (2012) showed negative correlations between the Difficulties in

Emotion Regulation Scale (Gratz & Roemer, 2004) and subscales on the MAIA ranging from small (.13) to large (.54) effects. This suggests that higher IA relates to people having fewer challenges regulating emotions. Taken together, the current literature suggests that interoceptive awareness is positively related both to emotional awareness and emotion regulation.

The literature on deficits in emotion regulation among trauma survivors is robust. Theoretically, researchers state that interpersonal traumas occurring in the early years of life derail typical emotion regulation skills that typically develop during that age range (e.g., Cloitre, Stovall-McClough, Zorbas, & Charuvastra, 2008; Ford, 2009; van der Kolk et al., 1996). In Betrayal Trauma Theory, Freyd (e.g., 1996) discusses that betrayal blindness is a regulation mechanism through which the survivor remains unaware of the abuse that their caregiver has perpetrated against them. Betrayal blindness could be conceptualized as a strategy for suppressing natural and understandable emotions within the context of childhood sexual abuse (e.g., betrayal, rage, terror, fear, betrayal). Although this strategy maintains the relationship between the perpetrator and survivor, it might also stunt the development of adaptive emotion regulation. Further, it might result in survivors disregarding or learning to not trust their reasonable and understandable emotions generally in their lives, rather looking to others for information on their emotional state. Along similar lines in the Biosocial Theory of Emotion Dysregulation, Linehan (1993) suggests that emotion regulation skills arise from a combination of individual biology, and social learning and reinforcement. If a caregiver is sexually abusing a child, for example, the child would likely learn that they are reinforced for emotions associated with submission to the trauma (e.g., mild manufactured happiness).

The child would be reinforced for suppressing their primary emotions to the trauma (e.g., fear and disgust) and further reinforced for secondary emotions to the trauma that comfort the perpetrator. Further, if a caregiver is too busy abusing their child, it is likely that they will not have time to model emotion regulation behaviors for the child.

There is empirical evidence for trauma survivors having difficulties regulating emotions as well. For example, Cloitre, Miranda, Stovall-McClough, and Han (2005) researched emotion regulation as a predictor of functional impairment among a sample of women (n = 164) who survived childhood trauma (64% reporting a history of sexual abuse). Among these women, the researchers found that when controlling for PTSD symptom severity, difficulties regulating negative emotions uniquely predicted functional impairment. Additionally, when levels of alexithymia are tested between traumatized groups and non-traumatized groups, there are consistent findings that alexithymia is higher among people who have experienced trauma (e.g., Mclean, Toner, Jackson, Desrocher, & Stukless, 2006). When these findings are considered in light of the previously mentioned findings on alexithymia and IA, it is likely that one's ability to recognize internal body sensations is indeed implicated in emotion regulation processes among sexual trauma survivors. When examining the association between experiences of higher betrayal (including sexual abuse by someone close to the survivor) and PTSD symptoms, Goldsmith, Chesney, Heath and Barlow (2013) showed that difficulties with regulating emotions mediated the association and predicted higher posttrauma symptoms.

In summary, there exist theoretical explanations and empirical findings on IA and its role in emotion recognition. Additionally, the literature points to the important role of awareness of emotions in order to regulate emotions. Awareness of emotions depends, in

part, on awareness of internal body sensations (i.e., IA). Lastly, there is literature on deficits in emotion regulation among sexual trauma survivors. Given this information and because interoceptive awareness was not supported as a mediator in this study, it might be the case that that IA is instead an important part of the larger process of emotion regulation among sexual trauma survivors. Thinking of some results from aim 2 and 3 together – that behavioral IA uniquely predicts lower PTSD symptoms and self-reported IA interacts with dissociation symptoms in predicting lower PTSD symptoms – as previously mentioned, IA might be better construed as a moderator of the association between dissociation and PTSD symptoms. As a moderator, it might be a characteristic to consider when clinicians are determining what trauma intervention to offer to patients. We will discuss this more in the clinical implications section.

Clinical Implications

The first clinical implication of this research stems from the documentation of IA among survivors of sexual trauma. When working with survivors of sexual trauma, it could be helpful for clinicians to keep in mind what this research has shown: that IA (particularly self-reported IA, and to a certain extent behaviorally measured IA as well) is lower among survivors of sexual trauma than other populations. Knowing this may help clinicians make sense of their patient's difficulties with awareness and descriptions of body sensations, which may also impact their patient's abilities to clearly know and articulate their emotions. These challenges may stymie patient's progress in particular types of psychotherapy that in some part depend on awareness of body sensations and emotions (i.e., cognitive behavioral therapy). Assessing patient's IA via self-report may help improve treatment planning and outcomes.

It is important to note that psychologists often discuss trying to impact mediators through psychological interventions, while moderators are thought of as markers of what interventions could be effective for patients based on their profile on the specific moderator. We have discussed that the results from this study suggest that IA is a moderator, and have also discussed that there is no evidence from this present correlational study that IA is a mediator. However, it remains an open question as to whether or not IA is a mediator of the effect of specific interventions for female survivors. It might be that treatments for PTSD work by targeting IA, even if IA is not a mechanism for the initial development of PTSD. IA's role in treatment efficacy warrants future research. With these points in mind, clinicians may wish to add an IA self-report measure to an intake assessment battery, and integrate the resulting information into a case conceptualization and treatment planning. Beyond the MAIA (Mehling et al., 2012), there are many other self-report measures of IA, including the Scale of Body Connection (Price & Thompson, 2007), the Body Perception Questionnaire (Porges, 1993). For a comprehensive review of available measures, please see Mehling et al., 2009. Knowledge of a patient's baseline IA may help clinicians determine what intervention to offer.

Through the interaction between dissociation symptoms and self-reported IA, data from this study suggest that self-reported IA is a moderator of PTSD symptoms among female survivors of sexual trauma. If after the intake assessment, a clinician observes that a patient is high on dissociation and high on interoceptive awareness, the clinician could then have more confidence in offering an intervention that makes use of the patient's high levels of self-reported IA. Also, especially with the qualitative quotes in

the results section and in the clinical vignette in discussion section in mind, it might be that a survivor with this profile is able to titrate between using dissociation and body awareness as coping mechanisms. One intervention that has been shown to be effective for intervening upon PTSD and that could be useful in this case could be acceptance and commitment therapy for PTSD (ACT; Walser & Westrup, 2007). ACT presupposes high levels of awareness of felt emotions, which facilitates identification of a person's values. Identification of values supports committing to acting in accordance with one's values (one of six central processes of ACT; Hayes, n.d.). Given the links between emotional awareness and IA, if a person is high in self-reported IA we would also expect them to be able to be aware of and articulate their emotional experience fluidly. It could also be that exposure-based therapies could work well for people already high in IA. Although there is an abundance of evidence that exposure-based therapies are beneficial for many trauma survivors (Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010), there is also evidence that it has high dropout and nonresponse rates (Schottenbauer, Glass, Arnkoff, Tendick, & Gray, 2008). It would be very useful for the field to know if high baseline levels of IA would predict less dropout and better treatment outcomes. Future research could focus on that topic.

If after assessment a clinician learns that their patient is high on dissociation and low on interoceptive awareness, the clinician might choose an intervention that provides specific instructions for staying aware of the present moment and identifying bodily sensations related to emotions. Data from this study indicate that people with high dissociation and low IA have the highest PTSD symptoms. Two sensible interventions for patients with that profile would be dialectical behavior therapy (DBT; Linehan, 1993;

2015) and trauma sensitive yoga (Emerson, 2015). Other interventions that directly utilize the body as a healing instrument, such as self-defense courses (Hollander, 2014; Rosenblum & Taska, 2014), could be other excellent choices for survivors with low IA.

Knowing that there are links between interoceptive awareness and difficulty articulating one's emotional experience might offer clinicians different ways to address enhancing skills in articulating emotional experience. This is already done in some psychotherapies utilized with survivors of sexual trauma, such as DBT skills training (Linehan, 1993; 2015). In DBT emotion regulation skills, patients are taught different ways to become more aware of their emotions through psychoeducational information on the various components of emotions (e.g., physiological changes related to emotions and outward facial and bodily expressions of emotions). This awareness building facilitates both outward and inward identification of emotional experience, and is ultimately aimed at supporting later-learned emotion regulation skills. One aspect of this section of DBT skills training focuses on teaching patients about the physiological changes associated with emotions (e.g., racing hearts are oftentimes associated with anger). It might be that this type of training would be particularly useful, though perhaps somewhat flummoxing for sexual trauma survivors who are high in dissociation symptoms and low in interoceptive awareness. Clinicians would be well-served to integrate the findings from this research into their approaching such material with sexual trauma survivors, knowing that it might be especially challenging for some survivors to even feel physiological sensations associated with certain emotions.

Limitations

There are several limitations that readers ought to keep in mind when considering the findings from this study. First, the results of the heartbeat perception task may be limited for the following reasons. Researchers have observed that results of this task have been affected by stress (Schultz & Vögele, 2015), specifically that with more stress the accuracy of perceiving ones heartbeat increases. Participants might have experienced an increase in stress following the informed consent procedure, where they learned that the study was about "stressful life experiences" and that they would be asked questions about such experiences that they may have had. This may have influenced our results. However, we took great care to minimize potential stressors: for example, the point of our having participants place biosensors on their bodies was partly in order to reduce the likelihood of the research assistant putting their hands on the participant's body. That could have otherwise been a trauma-related trigger for the participant.

Secondly, self-reported assessments of trauma exposure and trauma-related symptoms provide only one view of information on symptoms and trauma histories. It might be that conducting clinical interviews to assess trauma exposure and trauma-related symptoms would 1) potentially provide more comprehensive data and 2) provide potential opportunities for researchers to provide survivors with supportive responses to their traumatic disclosures. Research (see Ullman, 2002 for a review) supports that positive responses to traumatic disclosures can lead to lower posttrauma symptoms. It could therefore be useful for survivors to disclose their abuse histories in person, so that they could receive supportive responses from researchers. Third, comparisons between the present study and comparator studies in aim 1 are limited in that we are not certain

that the chronic pain sample and mind-body samples did not include trauma survivors, as the published papers did not specify that trauma was assessed. Forth, this sample was predominantly White, which introduces limitations to our findings. Lack of racial and ethnic diversity limits our nuanced understanding of how IA functions among sexual trauma survivors. It also limits the ways in which we can generalize these findings. As sexual trauma research is conducted more with White women than women of color (Amar, 2008) and some studies show that women of color experience higher rates of sexual trauma than White women (Hampton & Gillotta, 2006; Rettison & Planty, 2003) it is critical from generalizability and social justice perspectives to widen the scope of studied races and ethnicities in the sexual trauma and interoceptive awareness research.

Lastly, our methodological choice to utilize noise cancellation headphones in the heartbeat perception task may have introduced limitations to the behavioral IA data. In the open-ended questions, some participants commented that they could sense their heartbeats in their ears. For example:

> P120: *I notice my heartbeat when it is fast. For example: after running or cycling I can feel my heartbeat up to my ears (hopefully this description makes sense).*

Although it is standard practice to administer the heartbeat perception task through noise attenuating headphones (e.g., Ainley et al., 2012; Ainley et al., 2013), it might be that for participants who sense their heartbeats through pulsing sensations in their ears, the headphones may have enhanced people's awareness of their heartbeats. On the other hand, there were other participants who noted that they were more aware of their heartbeats with the headphones off:

P122: *... Now just sitting here with the headphones off, concentrating on my heartbeat, I feel more aware of it in my ears and chest than I did with the noise-cancelling headphones on…*

Therefore, it might be that our use of the headphones dampened some participants' awareness of their heartbeats. These potential limitations of the behavioral IA data ought to be considered when researchers and consumers interpret and compare these data to the extant research on IA.

Future Directions

We leave this study with more questions than answers, and now outline seven of the many future research possibilities. First, a future study could look at how race and ethnicity impacts IA among sexual trauma survivors. Given that research shows that trauma survivors from some racial and ethnic backgrounds (e.g., African American and Asian) somaticize various psychological symptoms (Kleinman, 1982; Ryder, Yang, Zhu, Yao, Heine, & Bagby, 2008; Zhou et al., 2015) and that somatic symptoms are common among sexually abused Asian Americans (Rao et al., 1992; Moghal et al., 1995), it might be that we would observe higher IA among people from such racial and ethnic backgrounds. As described above, a limitation of this study – both for more nuanced understanding of IA among trauma survivors, and generalization of findings – is that a majority of the sample identified as White/Caucasian and non-Hispanic. Future research on people who identify as Black, African American, Asian, Native American and Pacific Islander (to name a few) would be a boon to the body of knowledge on IA among sexual trauma survivors.

Second, future research could directly compare IA between sexual trauma survivors and non-survivors in the same study. This would further establish the normative ranges of IA among sexual trauma survivors, through comparing survivors' IA to non-survivors IA in the same sample. Third, a study could test if utilizing pre-intervention assessments of IA would aid clinicians in identifying the most effective treatments to offer to sexual trauma survivors, and assessing whether the chosen treatments predict better outcomes among sexual trauma survivors. Forth, researchers ought to implement randomized controlled trial studies of body-based interventions with sexual trauma survivors. In these studies, they could assess IA with behavioral and self-report, and monitor change in IA across time. Ideally, researchers would assess IA prior to each treatment session. This way, researchers could assess the progression of change in IA across time, and also assess whether there is an ideal dose-response relationship between amount of intervention and increase in IA related to decreases in PTSD symptoms. Such a study could also assess IA as a mediator of the treatment effect on PTSD symptoms.

Fifth, regarding the findings in aim 1, hypothesis 2 (which assessed the associations between trauma-related symptoms and interoceptive awareness) correlation results are challenging to accurately and meaningfully interpret. It would be useful for future research to conduct an exploratory factor analysis between the MAIA, heartbeat perception task, TSC-40 and PCL with a large sample size (at least $n > 200$). The point of such research would be to investigate the underlying factors of these measurements, to see which ones are shared and which are distinct. Two studies could be initiated: one through an online data collection mechanism (such as Amazon's Mechanical Turk) to get

a large nationally representative sample. The other study could include data collected in person through institutions where experiences of unwanted sexual contact are frequent (such as college campuses or the military). This information would help future researchers more accurately interpret the results from their studies.

Sixth, although collecting resting lab-based data are an important first step for this research, researchers (e.g., Farb et al., 2015) suggest that it is critical to collect data on IA within the contexts of situations in peoples' lives. The question progresses from how high or low is a survivor's IA, to can a survivor feel interoceptive sensations when they need to. Is a survivor able to call the sensations into their awareness when they need to feel and understand the sensations and likely related emotions? How do different situations impact awareness of interoceptive signals? Which body sensations are survivors most attuned to in different contexts? In the open-ended responses, we noticed that many participants commented on being aware of their breathing more than their heartbeats. For example:

> P127: *I am definitely more aware of my breathing than my heartbeat during sexual activities. I can feel my heartbeat more when I am about to orgasm but other than that, I don't notice it a whole lot. My breathing on the other hand, is a different story. I am normally very aware of my breathing during sexual activities.*

Data like these suggest that assessing different types of internal body sensations given different contexts would be a wise methodological choice, one that could contribute more specified information. One study design aspect that could address the interoception in situational context question could be assessing survivors IA throughout

their days via ecological momentary assessment (for a review of these methods, see Shiffman, Stone, & Hufford, 2008). Researchers could text message participants throughout their days to assess not only their IA levels, but also the emotions they perceive to be associated with the interoceptive sensations and to receive a brief description of the situation the person is in. This research method could also potentially shed light on how a person interprets their interoceptive sensations. It is also important to assess this last element via a semi-structured interview qualitative study with survivors on their interpretations of various interoceptive sensations during contexts that are of importance to healing from sexual trauma. Such situations could be interpretations of interoceptive sensations during consensual sex, when a survivor has a trauma-related memory, or when a survivor must see or interact with their perpetrators.

Lastly, future research ought to assess confidence ratings following trials in the heartbeat perception task. This would assess the consistency between accuracy of detecting heartbeats and subjective report of such accuracy. Garfinkel and colleagues (2015) assert that such assessment is important, because it shows a participant's meta-awareness of and confidence in recognizing interoceptive information from their bodies.

Conclusion

To summarize, this study assessed interoceptive awareness among two samples of female sexual trauma survivors: a university (n = 152) and a community (n = 21) sample. We assessed interoceptive awareness (IA) through three measurement techniques: a behavioral task, self-report and open-ended qualitative questions. We based a majority of our data analysis for this manuscript on the behavioral task and self-report data, and turned to the qualitative data to help inform and illustrate our interpretations of the results

and discussion. To our knowledge, this is the first study to assess IA among sexual trauma survivors using those two assessment mechanisms. It appears to be the first to assess IA behaviorally among survivors. Overall, results indicated that sexual trauma survivors have significantly lower self-reported IA than existing research, though comparisons between existing literature and the present study were inconclusive regarding behaviorally measured IA. These results produced an initial representation of the associations between IA and trauma symptoms among sexual trauma survivors.

Results demonstrated that self-reported IA and behaviorally measured IA are not significantly correlated, replicating previous research and reifying the conceptualization that the two measurement techniques are assessing different aspects of a larger construct. We showed that behavioral IA predicts unique variance in PTSD symptoms, such that as accuracy perceiving heartbeats increases, PTSD symptoms decrease. We also demonstrated that there is an interaction between self-reported IA and dissociation symptoms in predicting PTSD symptoms, such that changes in the interaction predict a decline in PTSD symptoms. The effect of this interaction on PTSD symptoms was particularly beneficial for people high in IA and dissociation symptoms. People with those IA and dissociation profiles were predicted to have the lowest PTSD symptoms. Lastly, we provided evidence that IA is not a mediator between exposure to sexual trauma and PTSD symptoms. Taken together, these results indicate that instead of conceptualizing IA as a mediator of the relationship between sexual trauma and PTSD symptoms, it is potentially more accurately thought of as a moderator of the association between dissociation and PTSD symptoms.

The clinical implications of these findings include our suggestions that clinicians assess IA at intake appointments with patients. Assessing IA may aid clinicians in offering the most effective interventions for patients, based on how high or low their pre-treatment IA is. We reviewed several treatments that could be effective for people with high IA (e.g., ACT and exposure-based therapies) and people low in IA (e.g., DBT, trauma-sensitive yoga and self-defense courses). Although we did not find evidence supporting that IA is a mediator between sexual trauma exposure and PTSD symptoms, it may be that randomized controlled trials on interventions could find that IA mediates the effect of the intervention on PTSD symptoms. Future studies should investigate this possibility.

Given that certain theories of emotions propose relationships between IA and emotional awareness, it is critical to study awareness of internal body sensations among people who are suffering psychologically. Because sexual violence ravages the physical body, such investigations have unique promise for survivors of sexual trauma. Studies can extend the present work by investigating IA within contexts where survivors can avoid harm and experience healing. Future studies on IA may ultimately support reductions in suffering and feelings of self-connection among survivors.

APPENDIX A

INFORMED CONSENT FORM

University of Oregon Psychology Department
Informed Consent for Participation as a Participant in
Dynamics Lab HMS Study
Investigators: Kristen Reinhardt, MS and Jennifer J. Freyd, PhD

Introduction & Purpose:

- We are asking you to participate in a research study investigating the relationship between heart activity and life experiences that some people have. We are interested to learn how your heart has responded due to certain life experiences that you may have had. We hope that this study will help us know more about impact of these experiences.
- You were selected as a possible participant because you indicated that you identify as female and that you have had stressful life experiences.
- We ask that you read this form and ask any questions that you may have before agreeing to participate in the study.
- Your participation in the study is entirely voluntary. Even if you decide to sign up for the study, you may drop out at any time and for any reason.

Description of the Study Procedures:

- If you agree to be in this study, we would ask you to do the following things:
  You will engage in one study visit that will last approximately 90 to 120 minutes.
  We will ask you to wear biosensors that will allow us to record your heart rate. The biosensors will be placed on your collarbones and lower ribcage. The biosensors are the same normally used in doctor's offices to measure heart rate. The measurement device can easily be clipped to your clothes. We will ask you to maintain a regular breathing pattern during the recording. We will teach you how to breathe regularly during the recording period.
  We will ask questions about your health practices, sexual experiences and stressful and potentially traumatic life experiences that you may have had.
  We will ask you to answer questions about emotions and physical sensations that you may have had.
  We will ask you to watch brief videos about other peoples' stressful physical, sexual, or social experiences.

Risks/Discomforts of Being in the Study:

- First, you may experience feelings of sadness or worry when asked about stressful experiences from your past. Any discomfort is likely to be passing. You can skip any questions you do not want to answer. At the end of your participation in the study, you will receive a debriefing form that lists options for seeking psychological care, should you be interested in that.
- Second, the adhesiveness of biosensors used for heart monitoring can leave minor red marks or cause minor temporary tenderness of the skin (similar to removing a

Band-Aid). Although this reaction is unlikely, all mark and tenderness should disappear within a few hours. The biosensors used in this study are widely used in medical and other research settings, and all researchers are trained on proper application and removal of the biosensors to further reduce any risks.

- Third, this research study may involve other risks that are currently unforeseeable.

Benefits of Being in the Study:

- There are no known benefits associated with participating in this study, and it is possible that there will be no direct benefits for you. However, your taking part in the study may benefit society.

Payments:

- This study will take approximately 2 hours to complete. You will receive the following reimbursement:
- If you are a University of Oregon student recruited through the University of Oregon Human Subjects Pool, you will receive 2 credits for your participation. If you discontinue participation in the middle of the study, you will receive ¼ credit for each 15 minutes of participation, rounded up to the next 15 minutes. For example, if you complete 1-15 minutes you will receive ¼ credit, if you complete 16-30 minutes you will receive ½ credit, and so on. If you keep your scheduled study appointment but choose not to participate in the study at all, you will still receive ¼ credit.
- If you were not recruited through the University of Oregon Human Subjects Pool, you will receive $20 in cash for your participation. Please be aware, compensation for participation in research may be considered taxable income. The University requires tracking for compensation that is paid to you; this includes your name and signature. This information is stored confidentially and separate from research data. If you receive $600 or more in a calendar year, you may be contacted to provide additional information (e.g. Social Security Number) for tax reporting purposes.

Costs: There is no cost to you to participate in this research study.

Confidentiality:

- The records of this study will be kept private. In any sort of report we may publish, we will not include any information that will make it possible to identify participants. Research records will be kept in a locked file.
- All data will be collected confidentially. The data from this study will be stored in a de-identified fashion. That is, we will not have any information regarding your identity stored with the data. Signed, study consent forms will be kept in locked file cabinets in locked offices. We will keep the data on laboratory and investigator computers and back-up devices. Only researchers will have access to this de-identified data. This de-identified data will be kept indefinitely to allow for additional analyses.
- All Institutional Review Board and internal University of Oregon auditors may review the research records.

- As with all research, there is a chance that the confidentiality of your information could be compromised; however, we are taking the precautions mentioned in the above bullets to minimize this risk.
- Information collected for the purpose of this research study will be kept confidential as required by law. The results of this study may be published for scientific purposes, but your records or identity will not be revealed.

Voluntary Participation/Withdrawal:

- Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with the UO Psychology Department or the UO Linguistics Department. If you decide to participate, you are free to withdraw your consent and discontinue participating at any time without penalty. The Psychology and Linguistics Departments have established alternative assignments for students who do not wish to participate as research subjects. Please see your instructor if you would rather complete an alternative assignment.

Contacts and Questions:

- If you have questions regarding your rights as a research subject, contact the Research Compliance Services, University of Oregon at (541) 346-2510 or ResearchCompliance@uoregon.edu. You have been given a copy of this form to keep.
- Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies.
- If you would like to contact the investigators, you can reach Kristen Reinhardt at kreinha5@uoregon.edu 541-357-9179 or Jennifer Freyd at jjf@uoregon.edu or 541-346-4950.

Copy of Consent Form:

- You will be given a signed copy of this form to keep for your records and future reference.

Statement of Consent:

- I have read (or have had read to me) the contents of this consent form and have been encouraged to ask questions. I have received answers to my questions. I give my consent to participate in this study. I have received (or will receive) a copy of this form.

Signatures/Dates [Both participant and researcher printed and signed their names and dated two identical consent forms. Each person kept one original copy of the form for her records.]

APPENDIX B

DEMOGRAPHIC QUESTIONS

Your age in years (for example, 18): _____

Your current gender identity:
- o Woman
- o Transwoman
- o Genderqueer/gender non-confirming
- o A gender not listed here (please specify): _____

Ethnic identification (please check as many as apply to you):
- o African American/Black
- o Hispanic or Latino/a
- o Native American/American Indian
- o White/Caucasian/European American
- o Asian American
- o Pacific Islander
- o A race/ethnicity not listed here (please specify): _____

Where were you born?
- o United States
- o Other (please specify): _____

Are you fluent in spoken English?
Yes ☐ No ☐

APPENDIX C

VALIDATION ITEMS

In the Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012):

	Never	1	2	3	4	Always
Since I'm paying attention, I'll mark option 3	❍	❍	❍	❍	❍	❍

In the LONGSCAN Measure of Physical Abuse (LONGSCAN; Barnett, Manly, & Cicchetti, 1993):

	Before turning age 14		Throughout age 14, 15, 16, and 17		Age 18 and older	
	No	Yes	No	Yes	No	Yes
Please demonstrate that you're paying attention by marking "no" in all three columns	❍	❍	❍	❍	❍	❍

In the *Brief Betrayal Trauma Survey* (BBTS; Goldberg & Freyd, 2006):

	Before Age 14			Age 14 through age 18			Age 18 or Older		
	Never	1 or 2 times	More than that	Never	1 or 2 times	More than that	Never	1 or 2 times	More than that
Because I am paying attention, I will mark "1 or 2 times" in all three age ranges.									

In the *Wessex Dissociation Scale* (WDS; Kennedy et al., 2004):

	Never	Rarely	Sometimes	Often	Very Often	All the time
Please mark 'sometimes' to show that you're paying attention.	❍	❍	❍	❍	❍	❍

APPENDIX D

PHYSICAL ACTIVITY SCALE

Based on the following definitions, please indicate your level of physical activity in general.

Definitions of activity levels

light physical activities: activities that are as strenuous as standing or walking leisurely

moderate physical activities: activities that are as strenuous as lifting or carrying objects up to 5 pounds, mowing the lawn with an electrical mower, rapid walking on flat ground.

strenuous physical activities: activities that are as strenuous as construction work, scrubbing the floor or brisk walking uphill.

very strenuous physical activities: activities that are as strenuous as carrying heavy objects such as wood or cement, digging with heavy tools, jogging.

Rating Scale

- sedentary lifestyle, at work and at leisure
- predominantly sedentary lifestyle, with standing or walking or other light physical activities
- moderate physical activity for at least one hour and at least four times per week, or strenuous physical activity at least once a week.
- moderate physical activity for at least one hour per day, or strenuous physical activity at least twice a week.
- strenuous physical activity for at least one hour and at least four times per week, or very strenuous physical activity for at least 20 min and at least four times per week.
- strenuous physical activity for at least one hour per day, or very strenuous physical activity for at least 20 min per day
- more than 5

APPENDIX E

MULTIDIMENSIONAL ASSESSMENT OF INTEROCEPTIVE AWARENESS

Below you will find a list of statements. Please indicate how often each statement applies to you generally in daily life.

	Never					Always
	0	1	2	3	4	5
When I am tense I notice where the tension is located in my body.	❍	❍	❍	❍	❍	❍
I notice when I am uncomfortable in my body.	❍	❍	❍	❍	❍	❍
I notice where in my body I am comfortable.	❍	❍	❍	❍	❍	❍
I notice changes in my breathing, such as whether it slows down or speeds up.	❍	❍	❍	❍	❍	❍
I do not notice (I ignore) physical tension or discomfort until they become more severe.	❍	❍	❍	❍	❍	❍
I distract myself from sensations of discomfort.	❍	❍	❍	❍	❍	❍

When I feel pain or discomfort, I try to power through it.	❍	❍	❍	❍	❍	❍
When I feel physical pain, I become upset.	❍	❍	❍	❍	❍	❍
I start to worry that something is wrong if I feel any discomfort.	❍	❍	❍	❍	❍	❍
I can notice an unpleasant body sensation without worrying about it.	❍	❍	❍	❍	❍	❍

I can pay attention to my breath without being distracted by things happening around me.	❍	❍	❍	❍	❍	❍
I can maintain awareness of my inner bodily sensations even when there is a lot going on around me.	❍	❍	❍	❍	❍	❍
When I am in conversation with someone, I can pay attention to my posture.	❍	❍	❍	❍	❍	❍
I can return awareness to my body if I am distracted.	❍	❍	❍	❍	❍	❍
I can refocus my attention from thinking to sensing my body.	❍	❍	❍	❍	❍	❍

I can maintain awareness of my whole body even when a part of me is in pain or discomfort.	❍	❍	❍	❍	❍	❍
I am able to consciously focus on my body as a whole.	❍	❍	❍	❍	❍	❍
I notice how my body changes when I am angry.	❍	❍	❍	❍	❍	❍
When something is wrong in my life I can feel it in my body.	❍	❍	❍	❍	❍	❍
I notice that my body feels different after a peaceful experience.	❍	❍	❍	❍	❍	❍
I notice that my breathing becomes free and easy when I feel comfortable.	❍	❍	❍	❍	❍	❍
I notice how my body changes when I feel happy / joyful.	❍	❍	❍	❍	❍	❍
When I feel overwhelmed I can find a calm place inside.	❍	❍	❍	❍	❍	❍
When I bring awareness to my body I feel a sense of calm.	❍	❍	❍	❍	❍	❍
I can use my breath to reduce tension.	❍	❍	❍	❍	❍	❍
When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.	❍	❍	❍	❍	❍	❍
I listen for information from my body about my emotional state.	❍	❍	❍	❍	❍	❍
When I am upset, I take time to explore how my body feels.	❍	❍	❍	❍	❍	❍

I listen to my body to inform me about what to do.	❍	❍	❍	❍	❍	❍
I am at home in my body.	❍	❍	❍	❍	❍	❍
I feel my body is a safe place.	❍	❍	❍	❍	❍	❍
I trust my body sensations.	❍	❍	❍	❍	❍	❍
Since I'm paying attention, I'll mark option 3	❍	❍	❍	❍	❍	❍

APPENDIX F

PSYCHOLOGICAL MALTREATMENT SCALE

When you were 14 or younger, how often did the following happen to you in the average year? Answer for your parents or stepparents or foster parents or other adult in charge of you as a child:

	Never	Once a year	Twice a year	3-5 times a year	6-10 times a year	11-20 times a year	Over times 20 a year
Yell at you	○	○	○	○	○	○	○
Insult you	○	○	○	○	○	○	○
Criticize you	○	○	○	○	○	○	○
Try to make you feel guilty	○	○	○	○	○	○	○
Ridicule or humiliate you	○	○	○	○	○	○	○
Embarrass you in front of others	○	○	○	○	○	○	○
Make you feel like you were a bad person	○	○	○	○	○	○	○

When you were age 14-18, how often did the following happen to you in the average year? Answer for your parents or stepparents or foster parents or other adult in charge of you as a teenager:

	Never	Once a year	Twice a year	3-5 times a year	6-10 times a year	11-20 times a year	Over times 20 a year
Yell at you	○	○	○	○	○	○	○
Insult you	○	○	○	○	○	○	○
Criticize you	○	○	○	○	○	○	○
Try to make you feel guilty	○	○	○	○	○	○	○
Ridicule or humiliate	○	○	○	○	○	○	○

you							
Embarrass you in front of others	○	○	○	○	○	○	○
Make you feel like you were a bad person	○	○	○	○	○	○	○

When you were 18 or older, how often did the following happen to you in the average year? Answer for any adult in your life:

	Never	Once a year	Twice a year	3-5 times a year	6-10 times a year	11-20 times a year	Over times 20 a year
Yell at you	○	○	○	○	○	○	○
Insult you	○	○	○	○	○	○	○
Criticize you	○	○	○	○	○	○	○
Try to make you feel guilty	○	○	○	○	○	○	○
Ridicule or humiliate you	○	○	○	○	○	○	○
Embarrass you in front of others	○	○	○	○	○	○	○
Make you feel like you were a bad person	○	○	○	○	○	○	○

APPENDIX G

LONGSCAN MEASURE OF PHYSICAL ABUSE

The next questions are about physically hurtful things that may have happened to you at any time in your life, from when you were an infant until now.

Sometimes children and teenagers get physically hurt by an adult who is supposed ot be supervising or taking care of them. The adult might be a parent, a step-parent, or a foster parent. Or it might be another relative or a parent's boyfriend or girlfriend. It could even be a teacher, a coach, or someone like that. Sometimes it's because of discipline that is too rough or hard. Other times, adults can lose their tempers and hit, or slap, or kick, or do something like that. Sometimes adults do these things to other adults.

Looking back to your whole life, has a parent, another adult who was supposed to be supervising or taking care of you or any other adult EVER done something to you like:

	Before turning age 14		Throughout age 14, 15, 16, and 17		Age 18 and older	
	No	Yes	No	Yes	No	Yes
Hit you with something dangerous like a baseball bat, a shovel, or something else that	○	○	○	○	○	○
Kicked or punched you?	○	○	○	○	○	○
Bitten you?	○	○	○	○	○	○
Pushed or thrown you around, like against a wall or down stairs/	○	○	○	○	○	○
Tried to choke, drown or smother you?	○	○	○	○	○	○
Shot at you with a gun,	○	○	○	○	○	○

but didn't hit you?						
Burned or scalded you on purpose?	○	○	○	○	○	○
Cut or stabbed you with a knife, razor, fork or something sharp like that?	○	○	○	○	○	○
Done something else that badly physically hurt you or put you in danger of being hurt?	○	○	○	○	○	○
Bruised you, or given you a black eye?	○	○	○	○	○	○
Broken one of your bones?	○	○	○	○	○	○
Cut you in a way that caused you to bleed or need stitches?	○	○	○	○	○	○
Knocked you out, or made you unconscious?	○	○	○	○	○	○

Caused an injury to your eyes, ears, nose or teeth?	○	○	○	○	○	○
Wounded you by shooting you with a gun?	○	○	○	○	○	○
Please demonstrate that you're paying attention by marking "no" in all three columns.	○	○	○	○	○	○

APPENDIX H

SEXUAL EXPERIENCES QUESTIONNAIRE

During these periods of your life, have you been in situations where people did any of the following:
[Author's note: Participants answered each question for the following age ranges: "How frequently before turning 14?" [shown]; "How frequently while age 14, 15, 16, and 17?" [shown] and "Age 18 and older". Due to space constraints, only the first two age ranges are depicted here.]

	How frequently before turning age 14?					**How frequently while age 14, 15, 16, and 17?**				
	1 (Never)	**2**	**3**	**4**	**5 (Very Often)**	**1 (Never)**	**2**	**3**	**4**	**5 (Very Often)**
Treated you "differently" because of your sex?	○	○	○	○	○	○	○	○	○	○
Displayed, used, or distributed sexist or suggestive materials?	○	○	○	○	○	○	○	○	○	○
Made offensive sexist remarks?	○	○	○	○	○	○	○	○	○	○
Put you down or was condescending to you because of your sex?	○	○	○	○	○	○	○	○	○	○
Repeatedly told sexual stories or jokes that were offensive to you?	○	○	○	○	○	○	○	○	○	○
Made unwelcome attempts to draw you into a discussion of sexual matters?	○	○	○	○	○	○	○	○	○	○

Made offensive remarks about your appearance, body, or sexual activities?	○	○	○	○	○	○	○	○	○	○
Made gestures or used body language of a sexual nature which embarrassed or offended you?	○	○	○	○	○	○	○	○	○	○
Made unwanted attempts to establish a romantic sexual relationship with you despite your efforts to discourage it?	○	○	○	○	○	○	○	○	○	○
Continued to ask you for dates, drinks, dinner, etc., even though you said "No"?	○	○	○	○	○	○	○	○	○	○
Touched you in a way that made you feel uncomfortable?	○	○	○	○	○	○	○	○	○	○
Made unwanted attempts to stroke, fondle, or kiss you?	○	○	○	○	○	○	○	○	○	○
Made you feel like you were being bribed with a reward to engage in sexual behavior?	○	○	○	○	○	○	○	○	○	○

Made you feel threatened with some sort of retaliation for not being sexually cooperative?	○	○	○	○	○	○	○	○	○	○
Treated you badly for refusing to have sex?	○	○	○	○	○	○	○	○	○	○
Implied better treatment if you were sexually cooperative?	○	○	○	○	○	○	○	○	○	○
Sent or posted unwelcome sexual comments, jokes or pictures by text, email, Facebook or other electronic means?	○	○	○	○	○	○	○	○	○	○
Spread unwelcome sexual rumors about you by text, email, Facebook or other electronic means?	○	○	○	○	○	○	○	○	○	○

APPENDIX I

BRIEF BETRAYAL TRAUMA SURVEY

Your Experiences

Please indicate whether each of the following events happened to you during childhood or adulthood, and how often. For each item below, mark one response in the columns labeled "Before Age 14," "Age 14 through age 17," AND one response in the columns labeled "Age 18 or Older."

[Author's note: Due to space constraints, only the first age range is depicted here.]

	How many times before turning age 14?		
	Never	1 or 2 times	More than that
You were in a major earthquake, fire, flood, hurricane, or tornado that resulted in significant loss of personal property, serious injury to yourself or a significant other, the death of a significant other, or the fear of your own death.	○	○	○
You were in a major automobile, boat, motorcycle, plane, train, or industrial accident that resulted in similar consequences.	○	○	○
You were deliberately attacked so severely as to result in marks, bruises, blood, broken bones, or broken teeth by someone with whom you were very close (such as a parent or lover).	○	○	○
You were deliberately attacked that severely by someone with whom you were not close.	○	○	○
You were made to have some form of sexual contact (e.g., touching or penetration) or participate in sexual activity (e.g., masturbate or watch) by someone with whom you were very close.	○	○	○
You were made to have such sexual contact or participate in such sexual activity by someone with whom you were not close.	○	○	○

You were emotionally or psychologically mistreated (e.g., threatened, terrorized, confined, isolated, or regularly belittled, demeaned, humiliated, rejected, ignored, scapegoated, blamed, yelled at, or harshly criticized) by someone with whom you were very close.	○	○	○
You were emotionally or psychologically mistreated in this way by someone with whom you were not close.	○	○	○
You were neglected or had basic essential needs or resources (e.g., psychological: caring, attention, love, concern; physical: food, clothing, shelter, medical care; or financial) withheld from you by someone with whom you were very close. This neglect or withdrawal of basic needs could have been willful or not, as is often the case when a parent or guardian uses alcohol or drugs or suffers from depression or other serious mental illness.	○	○	○
You were neglected or had such basic essential needs or resources withheld from you by someone with whom you were not close.	○	○	○
Because I am paying attention, I will mark "1 or 2 times" in all three columns to the right.	○	○	○

APPENDIX J

SEXUAL EXPERIENCES SURVEY

The following questions concern sexual experiences that you may have had that were unwanted. We know that these are personal questions, so your information is completely confidential. We hope that this helps you to feel comfortable answering each question honestly. Place a check mark in the box showing the number of times each experience has happened to you. If several experiences occurred on the same occasion--for example, if one night someone told you some lies and had sex with you when you were drunk, you would check both boxes a and c. The past 12 months refers to the past year going back from today. Before age 14 refers to birth up until your 14th birthday; age 14-18 refers to your 14th birthday up until your 18th birthday; age 18 and older refers to your life starting on your 18th birthday and stopping one year ago from today.

[Author's note: Participants answered each question for the following age ranges: "How frequently before turning 14?"; "How frequently while age 14, 15, 16, and 17?" [shown] and "How many times at age 18 or older?". Due to space constraints, no age ranges are depicted here.]

1. Someone fondled, kissed, or rubbed up against the private areas of my body (lips, breast/chest, crotch or butt) or removed some of my clothes without my consent (but did not attempt sexual penetration) by:

    a. Telling lies, threatening to end the relationship, threatening to spread rumors about me,
    making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.
    b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but not using physical force, after I said I didn't want to.
    c. Taking advantage of me when I was too drunk or out of it to stop what was happening.
    d. Threatening to physically harm me or someone close to me.
    e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

2. Someone had oral sex with me or made me have oral sex with them without my consent by:

    a. Telling lies, threatening to end the relationship, threatening to spread rumors about me,
    making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.
    b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but not
    using physical force, after I said I didn't want to.
    c. Taking advantage of me when I was too drunk or out of it to stop what was happening.

d. Threatening to physically harm me or someone close to me.
e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

3. A man put his penis into my vagina, or someone inserted fingers or objects without my consent by:

a. Telling lies, threatening to end the relationship, threatening to spread rumors about me, making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.
b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but not using physical force, after I said I didn't want to.
c. Taking advantage of me when I was too drunk or out of it to stop what was happening.
d. Threatening to physically harm me or someone close to me.
e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

4. A man put his penis into my butt, or someone inserted fingers or objects without my consent by:

a. Telling lies, threatening to end the relationship, threatening to spread rumors about me,
making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.
b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but
not using physical force, after I said I didn't want to.
c. Taking advantage of me when I was too drunk or out of it to stop what was happening.
d. Threatening to physically harm me or someone close to me.
e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

5. Even though it didn't happen, someone TRIED to have oral sex with me, or make me have oral sex with them without my consent by:

a. Telling lies, threatening to end the relationship, threatening to spread rumors about me,
making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.
b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but
not using physical force, after I said I didn't want to.
c. Taking advantage of me when I was too drunk or out of it to stop what was happening.
d. Threatening to physically harm me or someone close to me.
e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

6. Even though it didn't happen, a man TRIED to put his penis into my vagina, or someone tried to stick in fingers or objects without my consent by:

a. Telling lies, threatening to end the relationship, threatening to spread rumors about me, making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.

b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but not using physical force, after I said I didn't want to.

c. Taking advantage of me when I was too drunk or out of it to stop what was happening.

d. Threatening to physically harm me or someone close to me.

e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

7. Even though it didn't happen, a man TRIED to put his penis into my butt, or someone tried to stick in objects or fingers without my consent by:

a. Telling lies, threatening to end the relationship, threatening to spread rumors about me,
making promises I knew were untrue, or continually verbally pressuring me after I said I didn't want to.

b. Showing displeasure, criticizing my sexuality or attractiveness, getting angry but
not using physical force, after I said I didn't want to.

c. Taking advantage of me when I was too drunk or out of it to stop what was happening.

d. Threatening to physically harm me or someone close to me.

e. Using force, for example holding me down with their body weight, pinning my arms, or having a weapon.

8. Have you ever been raped? Yes No

APPENDIX K

TRAUMA SYMPTOM CHECKLIST-40

How often have you experienced each of the following in the last two months	0 = Never	1	2	3 = Always
Headaches	○	○	○	○
Insomnia (trouble getting to sleep)	○	○	○	○
Weight loss (without dieting)	○	○	○	○
Stomach problems	○	○	○	○
Feeling isolated from others	○	○	○	○
"Flashbacks" (sudden, vivid, distracting memories)	○	○	○	○
Restless sleep	○	○	○	○
Low sex drive	○	○	○	○
Anxiety attacks	○	○	○	○
Sexual overactivity	○	○	○	○
Loneliness	○	○	○	○
Nightmares	○	○	○	○
"Spacing out" (going away in your mind)	○	○	○	○
Sadness	○	○	○	○
Dizziness	○	○	○	○
Not feeling satisfied with your sex life	○	○	○	○
Trouble controlling your temper	○	○	○	○
Waking up early in the morning and can't get back to sleep	○	○	○	○
Uncontrollable crying	○	○	○	○
Fear of men	○	○	○	○
Not feeling rested in the morning	○	○	○	○
Having sex that you didn't enjoy	○	○	○	○
Trouble getting along with others	○	○	○	○
Memory problems	○	○	○	○
Desire to physically hurt yourself	○	○	○	○

Fear of women	○	○	○	○
Waking up in the middle of the night	○	○	○	○
Bad thoughts or feelings during sex	○	○	○	○
Passing out	○	○	○	○
Feeling that things are "unreal"	○	○	○	○
Unnecessary or over-frequent washing	○	○	○	○
Feelings of inferiority	○	○	○	○
Feeling tense all the time	○	○	○	○
Being confused about your sexual feelings	○	○	○	○
Desire to physically hurt others	○	○	○	○
Feelings of guilt	○	○	○	○
Feelings that you are not always in your body	○	○	○	○
Having trouble breathing	○	○	○	○
Sexual feelings when you shouldn't have them	○	○	○	○

APPENDIX L

POSTTRAUMATIC CHECKLIST 5

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month. In the PAST MONTH how often were you bothered by:					
	Not at all	A little bit	Moderately	Quite a bit	Extremely
Repeated, disturbing, and unwanted memories of the stressful experience?	○	○	○	○	○
Repeated, disturbing dreams of the stressful experience?	○	○	○	○	○
Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there living it)?	○	○	○	○	○
Feeling very upset when something reminded you of the experience?	○	○	○	○	○
Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	○	○	○	○	○

Avoiding memories, thoughts, or feelings related to the stressful experience?	○	○	○	○	○
Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations?	○	○	○	○	○
Trouble remembering important parts of the stressful experience?	○	○	○	○	○
Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	○	○	○	○	○
Blaming yourself or someone else for the stressful experience or what happened after it?	○	○	○	○	○
Having strong negative feelings such as fear, horror, anger, guilt, or shame?	○	○	○	○	○
Loss of interest in activities that you used to enjoy?	○	○	○	○	○
Feeling distant or cut off from other people?	○	○	○	○	○
Trouble experiencing positive feelings (for example, being unable to feel happiness or having loving feelings for people close to you)?	○	○	○	○	○
Irritable behavior,	○	○	○	○	○

angry outbursts, or acting aggressively?					
Taking too many risks or doing things that could cause you harm?	○	○	○	○	○
Being “superalert” or watchful or on guard?	○	○	○	○	○
Feeling jumpy or easily startled?	○	○	○	○	○
Having difficulty concentrating?	○	○	○	○	○
Trouble falling or staying asleep?	○	○	○	○	○

APPENDIX M

WESSEX DISSOCIATION SCALE

This questionnaire asks about experiences that you may have in your daily life. Please indicate, by ticking one of the boxes, how often you have experiences like these. It is important that your answers state how often you have these experiences when you are **not** under the influence of alcohol or drugs.

	Never	Rarely	Some-times	Often	Very Often	All the time
Unwanted images from my past come into my head.	○	○	○	○	○	○
I hear voices when no-one has actually said anything.	○	○	○	○	○	○
Other people describe meetings that we have had but that I cannot remember.	○	○	○	○	○	○
Unwanted memories come into my head.	○	○	○	○	○	○
My personality is very different in different situations.	○	○	○	○	○	○
My mood can change very rapidly.	○	○	○	○	○	○
I have vivid and realistic nightmares	○	○	○	○	○	○
I don't always remember what people have said to me.	○	○	○	○	○	○
I feel physical pain, but it does not seem to bother me as much as other people.	○	○	○	○	○	○
I smell things that are not actually there.	○	○	○	○	○	○
I remember bits of past experiences, but cannot fit them together	○	○	○	○	○	○
I have arguments with myself	○	○	○	○	○	○
I do not seem to be as upset by things as I should be	○	○	○	○	○	○
I act without thinking	○	○	○	○	○	○
I do not really seem to get angry	○	○	○	○	○	○
I just feel numb and empty inside	○	○	○	○	○	○
I notice myself doing things that do not make sense	○	○	○	○	○	○

Sometimes I feel relaxed and sometimes I feel very tense, even though the situation is the same	○	○	○	○	○	○
Even though it makes no sense, I believe that doing certain things can prevent disaster	○	○	○	○	○	○
I have unexplained aches and pains	○	○	○	○	○	○
It feels as if there is more than one of me	○	○	○	○	○	○
Unwanted thoughts come into my head	○	○	○	○	○	○
My mind just goes blank	○	○	○	○	○	○
I feel touched by something that is not actually there	○	○	○	○	○	○
I have big gaps in my memory	○	○	○	○	○	○
I see something that is not actually there	○	○	○	○	○	○
My body does not feel like my own	○	○	○	○	○	○
I cannot control my urges	○	○	○	○	○	○
I feel detached from reality	○	○	○	○	○	○
Chunks of time seem to disappear without my being able to account for them	○	○	○	○	○	○
I sometimes look at myself as though I were another person	○	○	○	○	○	○
Things around me do not seem real	○	○	○	○	○	○
I do not seem to feel anything at all	○	○	○	○	○	○
I taste something that I have not eaten	○	○	○	○	○	○
I find myself unable to think about things however hard I try.	○	○	○	○	○	○
I talk to myself as if I was another person	○	○	○	○	○	○
I do not feel physical pain as much as other people	○	○	○	○	○	○
I hear things that are not actually there.	○	○	○	○	○	○
I find myself in situations or places with no memory of how I got there	○	○	○	○	○	○

It is absolutely essential that I do some things in a certain way.	○	○	○	○	○	○
Please mark ‘sometimes’ to show that you’re paying attention.	○	○	○	○	○	○

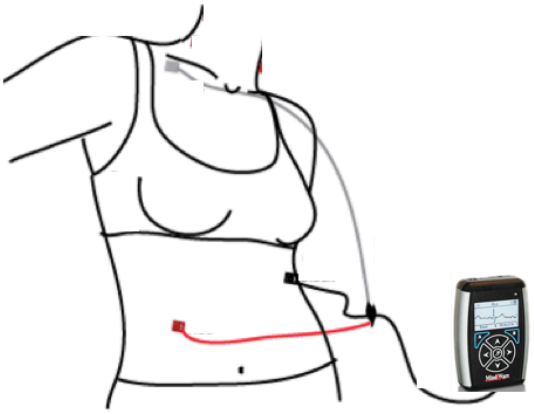
APPENDIX N

OPEN-ENDED QUESTIONS

How aware are you of your internal body sensations (e.g., heartbeat, breathing, digestion) on a day-to-day basis? For example, do you frequently notice your breathing? If so, in what situations? Another example, do you ever notice that you are frequently not aware of your heartbeat? Or are you always aware of your heartbeat? What situations increase or decrease such awareness? Please feel free to add any of your related thoughts to your answer to these questions.
How aware are you of your internal body sensations (e.g., heartbeat, breathing, digestion) during sexual experiences? For example, do you frequently notice your heart beating during sexual experiences? If so, are there specific sexual experiences during which you are more or less aware of your heartbeat? Another example, do you ever notice that you are frequently not aware of your breathing during sexual experiences? Or are you always aware of your breathing during sexual experiences? What situations increase or decrease such awareness? Please feel free to add any of your related thoughts to your answer to these questions.
When are you most aware of your internal body sensations (e.g., heartbeat, breathing, digestion)? Please given an example. The example could include situations or times of day during which you're most aware of your internal body sensations. Please feel free to add any of your related thoughts to your answer to these questions.
When are you least aware of your internal body sensations (e.g., heartbeat, breathing, digestion)? Please give an example. The example could include situations or times of day during which you're most aware of your internal body sensations. Please feel free to add any of your related thoughts to your answer to these questions.

APPENDIX O

ELECTROCARDIOGRAM LEAD-II MONTAGE



APPENDIX P

KNOWLEDGE OF RESTING HEARTRATE QUESTION

What do you believe your resting heart rate is over 60 seconds? In other words, how many times do you believe your heart beats during one minute while you are resting? Please type your answer here, in numbers: _____

APPENDIX Q

HEARTBEAT PERCEPTION TASK INSTRUCTIONS (BLOCK 1) AUDIO

Hi – my name is Kristen Reinhardt and I'm the lead researcher on this study. Thanks for your willingness to participate. I'll be leading you through most of this study procedure, so all you need to do is follow along with my verbal instructions. If during the procedure you have any questions, just press the clicker and the researcher who you just met with will come in and answer your questions.

I'll give you instructions for a new task. After you hear the 'go' cue, please relax and concentrate on your body.
Listen to your body and try to silently count your own heartbeats.
You are not allowed to take your pulse or look at any time devices – like watches or cell phones – while you do this.
Following the 'stop' signal you will be asked to report the number of heartbeats you have counted. Please say the number of heartbeats out loud, and type the number on the laptop. If you have any questions, please press the clicker and the researcher will come in and answer your questions.

There will now be a practice trial so you can get used to the procedure.
Remember, after you hear the 'go' cue, please relax and concentrate on your body.
Listen to your body and try to silently count your own heartbeats.
You are not allowed to take your pulse or look at any time devices while you do this.
Following the 'stop' signal you will be asked to report the number of heartbeats you have counted. Please say the number of heartbeats out loud, and use the keyboard to type the number on the iPad.

3, 2, 1, GO:

[12s practice trial]

STOP

Please say the number of heartbeats out loud, and use the keyboard to type the number on the iPad.
Please press the clicker if you have any questions for the researcher.

[15 second pause]

There will now be three counting periods with brief resting periods in between. You will begin after you hear a countdown and then the word 'go'. Please pay attention for the countdown followed by the word 'go'. There will be a brief period of rest before we begin.

[60 second pause]

3, 2, 1, GO

[35 second, Heart Beat Perception Task, Block 1, Trial 1]

STOP

Please say the number of heartbeats out loud, and use the keyboard to type the number on the iPad. There will be a brief period of rest before we begin again.
[30 seconds rest]

3, 2, 1, GO

[25 seconds, Heart Beat Perception Task, Block 1, Trial 2]

STOP

Please say the number of heartbeats out loud, and use the keyboard to type the number on the iPad. There will be a brief period of rest before we begin again.
[30 seconds rest]

3, 2, 1, GO

[45 seconds, Heart Beat Perception Task, Block 1, Trial 3]

STOP

Please say the number of heartbeats out loud, and use the keyboard to type the number on the iPad. Please do not advance to the next screen yet. There will be a brief period of rest before we move on to a new task.

[60 seconds rest]

Please press the green button to advance to the next screen.

APPENDIX R

HEARTBEAT PERCEPTION TASK INSTRUCTIONS (BLOCK 1) WRITTEN

After you hear the 'go' cue, please relax and concentrate on your body. Listen to your body and try to silently count your own heartbeats. You are not allowed to take your pulse or look at any time devices – like watches or cell phones – while you do this. Following the 'stop' signal, you will be asked to report the number of heartbeats you have counted.

Please say the number of heartbeats you perceived out loud, and type the number here:
_____

Please say the number of heartbeats you perceived out loud, and type the number here:
_____

Please say the number of heartbeats you perceived out loud, and type the number here:
_____

APPENDIX S

TIME ESTIMATION ACCURACY TASK INSTRUCTIONS AUDIO

I will now tell you how to do a different kind of task. I'd like you to estimate the number of seconds that go by between two tones. Please do not count the number of seconds between tones. Instead, please simply estimate how many seconds pass between the two tones. There will not be a practice trial. If you have any questions, please press the clicker and the researcher will come in and answer your questions.

There will now be three time estimation periods with brief resting periods in between. You will begin after you hear the tone.

[60 seconds rest]

3, 2, 1, tone:

[23s, Time Estimation Task, Trial 1]

tone

Please say the number of seconds you estimate passed between those two tones out loud, and type the number on the laptop. [30s rest]
3, 2, 1, tone:

[56s, Time Estimation Task, Trial 2]

tone

Please say the number of seconds you estimate passed between those two tones out loud, and type the number on the laptop. [30s rest]

3, 2, 1, tone:

[40s, Time Estimation Task, Trial 3]

tone

Please say the number of seconds you estimate passed between those two tones out loud, and type the number on the laptop. [60s rest]

APPENDIX T

TIME ESTIMATION ACCURACY TASK INSTRUCTIONS WRITTEN

I'd like you to estimate the number of seconds that go by between two tones. Please do not count the number of seconds between tones. Instead, please simply estimate how many seconds pass between the two tones. There will not be a practice trial. If you have any questions, please press the clicker and the researcher will come in and answer your questions.

There will not be three time estimation periods with brief resting periods in between. You will begin after you heard the tone (but not right now). Please just wait for the tone.

Please say the number of seconds you estimate passed between those two tones out loud, and type the number here: _____

Please say the number of seconds you estimate passed between those two tones out loud, and type the number here: _____

Please say the number of seconds you estimate passed between those two tones out loud, and type the number here: _____

APPENDIX U

HEARTBEAT PERCEPTION TASK INSTRUCTIONS (BLOCK 2) AUDIO

I will now ask you to repeat the first task you did about your heartbeats. Here are the instructions again: After you hear the 'go' cue, please relax and concentrate on your body. Listen to your body and try to silently count your own heartbeats. You are not allowed to take your pulse or look at any time devices – like watches or cell phones - while you do this. Following the 'stop' signal you will be asked to report the number of heartbeats you have counted. Please say the number of heartbeats out loud, and type the number on the laptop. This time there will not be a practice trial.

[60 seconds] There will now be three counting periods with brief resting periods in between. You will begin after you hear the word 'go' (but not now). Please pay attention for the word 'go'.

3, 2, 1, GO

[35 seconds, Heart Beat Perception Task, Block 2, Trial 1]

STOP

Please say the number of heartbeats out loud, and type the number on the laptop.
[30 seconds]

3, 2, 1, GO

[25 seconds, Heart Beat Perception Task, Block 2, Trial 2]

STOP

Please say the number of heartbeats out loud, and type the number on the laptop.
[30 seconds]

3, 2, 1, GO

[45 seconds, Heart Beat Perception Task, Block 2, Trial 3]

STOP

Please say the number of heartbeats out loud, and type the number on the laptop.
[60 seconds]

Excellent work! Thanks for your participation. The researcher will be in to offer you a break momentarily.

APPENDIX V

HEARTBEAT PERCEPTION TASK INSTRUCTIONS (BLOCK 2) WRITTEN

I will now ask you to repeat the first task you did about your heartbeats. Here are the instructions again: After you hear the "go" cue, please relax and concentrate on your body. Listen to your body and try to silently count your own heartbeats. You are not allowed to take your pulse or look at any time devices – like watches or cell phones – while you do this. Following the 'stop' signal, you will be asked to report the number of heartbeats you have counted. This time there will not be a practice trial.

Please say the number of heartbeats you perceived out loud, and type the number here:

_____

Please say the number of heartbeats you perceived out loud, and type the number here:

_____

Please say the number of heartbeats you perceived out loud, and type the number here:

_____

APPENDIX W

DEBREIFING FORM

Thank you for your participation in this study!

The purpose of this study is to better understand awareness of internal body sensations among women who have experienced emotional or physical abuse or have had unwanted sexual experiences. Through this research, we hope to better understand women's awareness of their bodies and their lives, as they are impacted by experiences like those. We also hope to use this information to determine how to provide the most effective care for women recovering from the effects of those experiences. In order to help us understand this topic, you were asked several questions about emotional and physical abuse, and unwanted sexual experiences, as well as thoughts and reactions to different experiences. The electrocardiogram recording that we had you participate in gave us a measure of how you respond to stress. We asked you to count your heart beats in order to learn more about how you can sense your internal body sensations.

Your participation is extremely valuable because it will provide insight into an area of research that has been understudied. The specific information you provided will give us valuable information.

There are no known or foreseeable risks associated with the study you just participated in. However, participation in this study involves thinking about situations that might be sensitive or even upsetting for some participants. If you would like to discuss any feelings that may have arisen during your participation, please feel free to contact any of the counselors or mental health professionals listed below.

The results of this participation will be confidential. No one other than the research team will have access to your responses. We will keep the identifying information that we have collected from you (i.e. your name) separate from the data.

Should you be interested in the results of this study, feel free to contact Kristen Reinhardt, kreinha5@uoregon.edu or Dr. Jennifer Freyd at jjf@uoregon.edu. If you have any questions concerning your rights as a research participant, please contact Research Compliance Services. You can also email the Human Subjects Coordinator for psychology and linguistics research.

Research Compliance
5237 University of Oregon
Eugene, OR 97403
541-346-2510
researchcompliance@uoregon.edu

Human Subjects Coordinator
hscoord@uoregon.edu

For campus support for sexual harassment, sexual assault, domestic/dating violence, or stalking, please feel free to contact:

1. The UO Crisis Intervention and Sexual Violence Support Services Program
    a. http://safe.uoregon.edu/Options/HelpfromtheUniversity.aspx
    b. (541) 346-8194, (541) 346-6796

For counseling services, please feel free to contact the following:

1. Center for Community Counseling (541) 344-0620
   **Please note, this resource is available to UO student and community participants.

2. University of Oregon Psychology Clinic (541) 346-4954
   **Please note, this resource is available to UO student and community participants.

3. University Counseling and Testing Center (541) 346-3227
   **Please note, this resource is only available to UO student participants.

4. Sexual Assault Support Services (541) 484-9791
   (541) 343-7277
   (Crisis/Support Line)
   **Please note, this resource is available to UO student and community participants.

5. White Bird (541) 342-8255
   (Counseling Program)
   (541) 687-4000 (Crisis Line)
   **Please note, this resource is available to UO student and community participants.

6. SAFE 24/7 Hotline (541) 346-SAFE
   (Crisis Line)
   **Please note, this resource is available to UO student and community participants

APPENDIX X

FIGURES

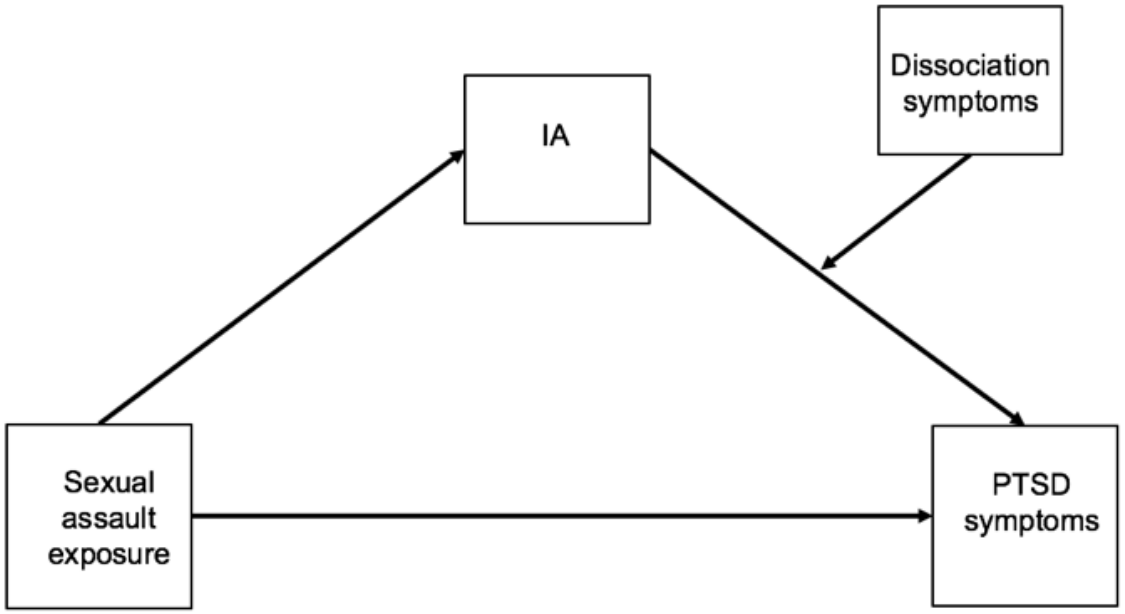


Figure 1. Aim 3 moderated mediation conceptual model

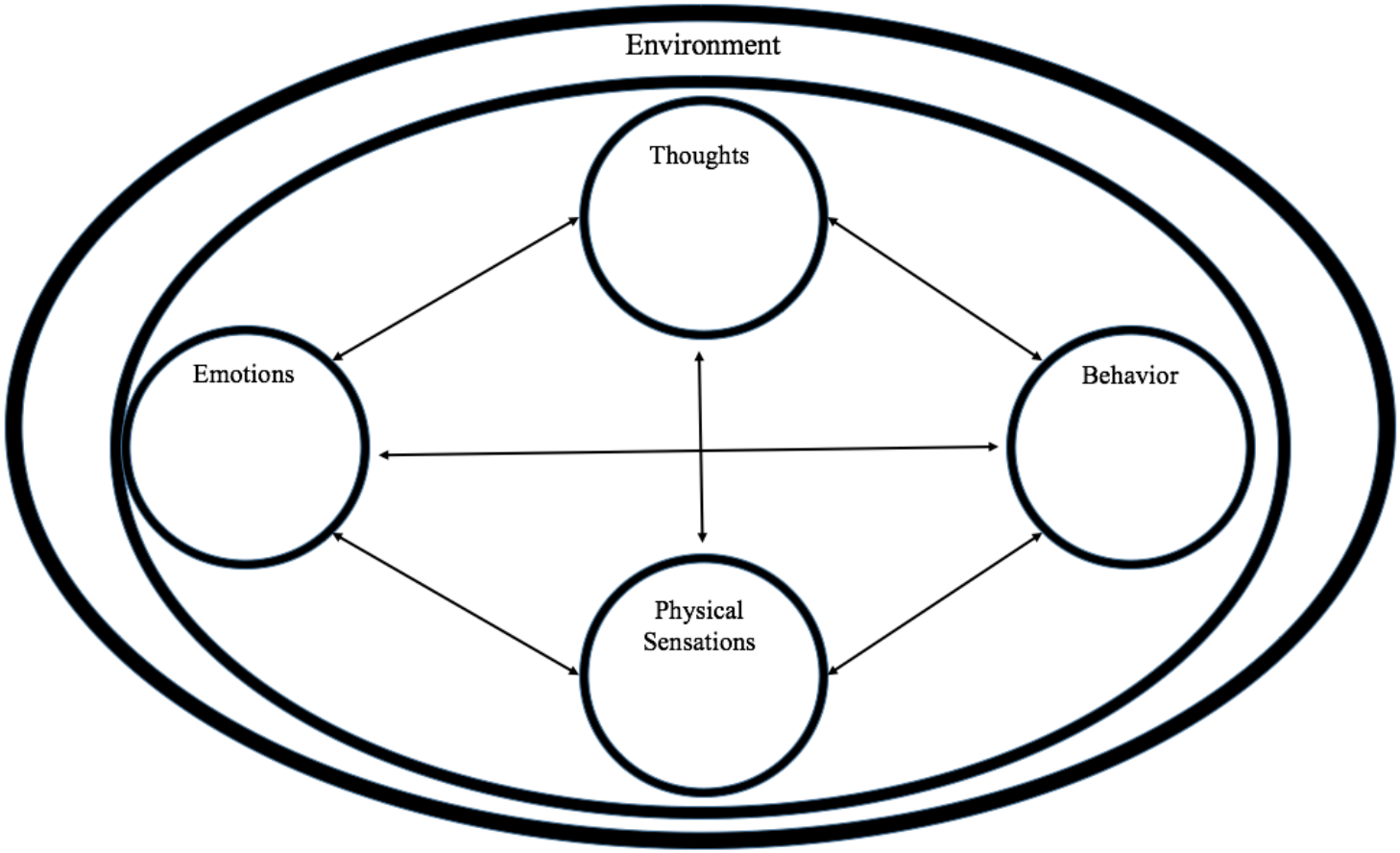


Figure 2. Five aspects of life experiences (Greenberger & Padesky, 1995, p. 4). This illustrates how within the context of the environment, physical sensations interplay with emotions, thoughts and behavior to facilitate emotion dysregulation and regulation.

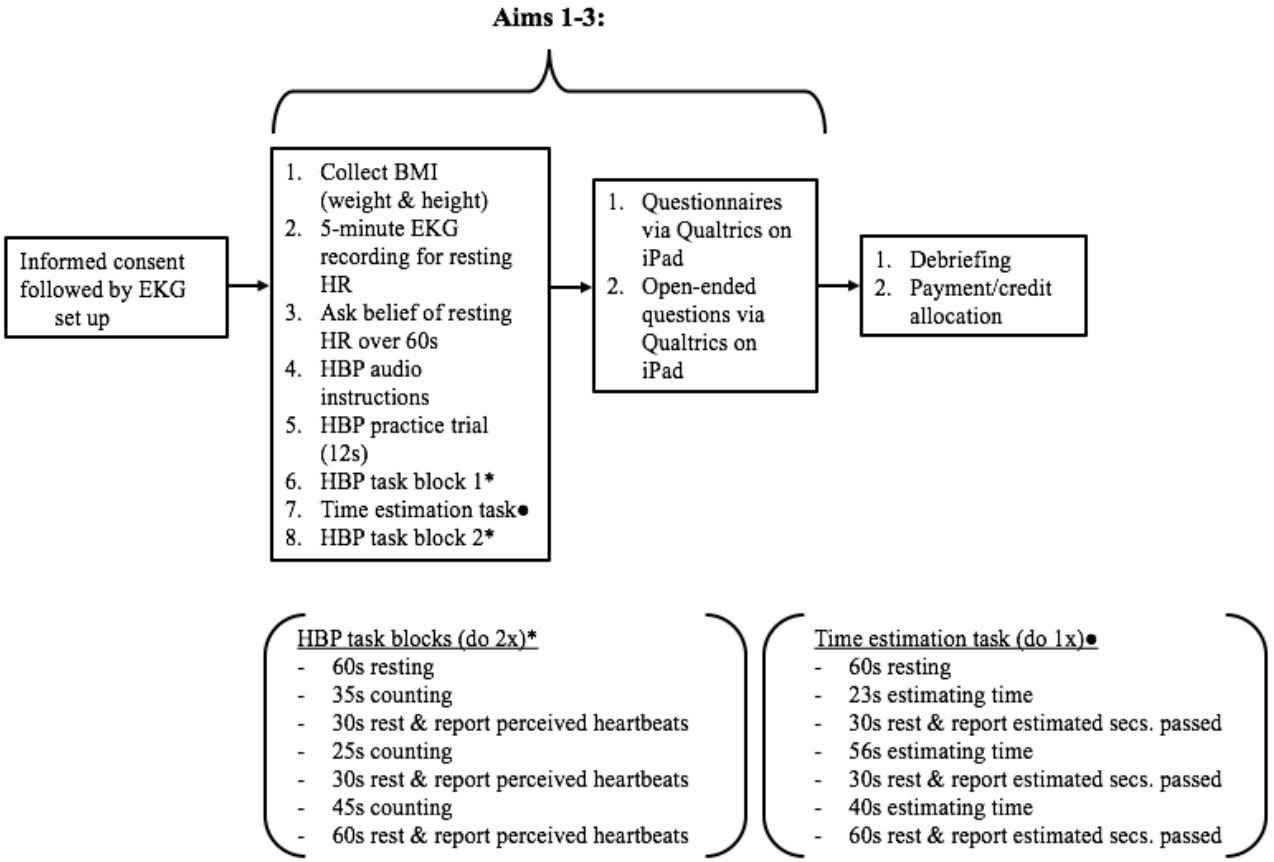


Figure 3. Study aims overlaid on study procedure.

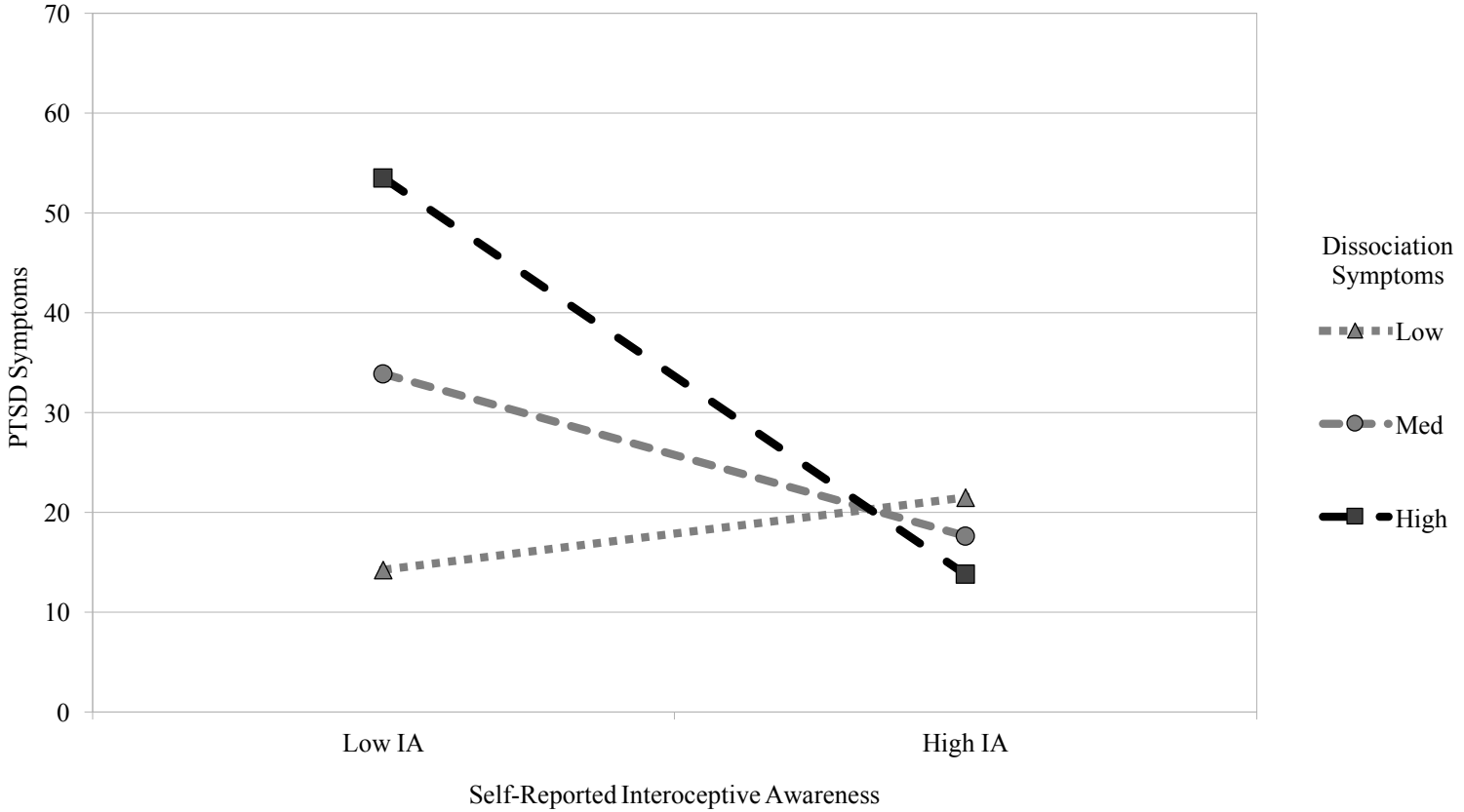


Figure 4. Aim 2 interaction between self-reported interoceptive awareness (measured by the Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012) total score) and dissociation symptoms (measured by the Wessex Dissociation scale (WDS; Kennedy et al., 2004). Both predictor variables are mean centered; the x-axis is the low (-1.53) through high (1.73) range of the MAIA total score centered. Dissociation symptoms are low (-0.72; 1 SD below the centered mean), moderate (0; centered mean), and high (0.72; 1 SD above the centered mean). In model calculations, PTSD symptoms (measured by the PCL-5; Weathers et al., 2013) was centered. However, here PTSD symptoms are depicted as not mean centered for ease of interpretation. On the y-axis, higher scores indicate higher PTSD symptoms. On the x-axis, higher scores mean more awareness of internal body sensations.

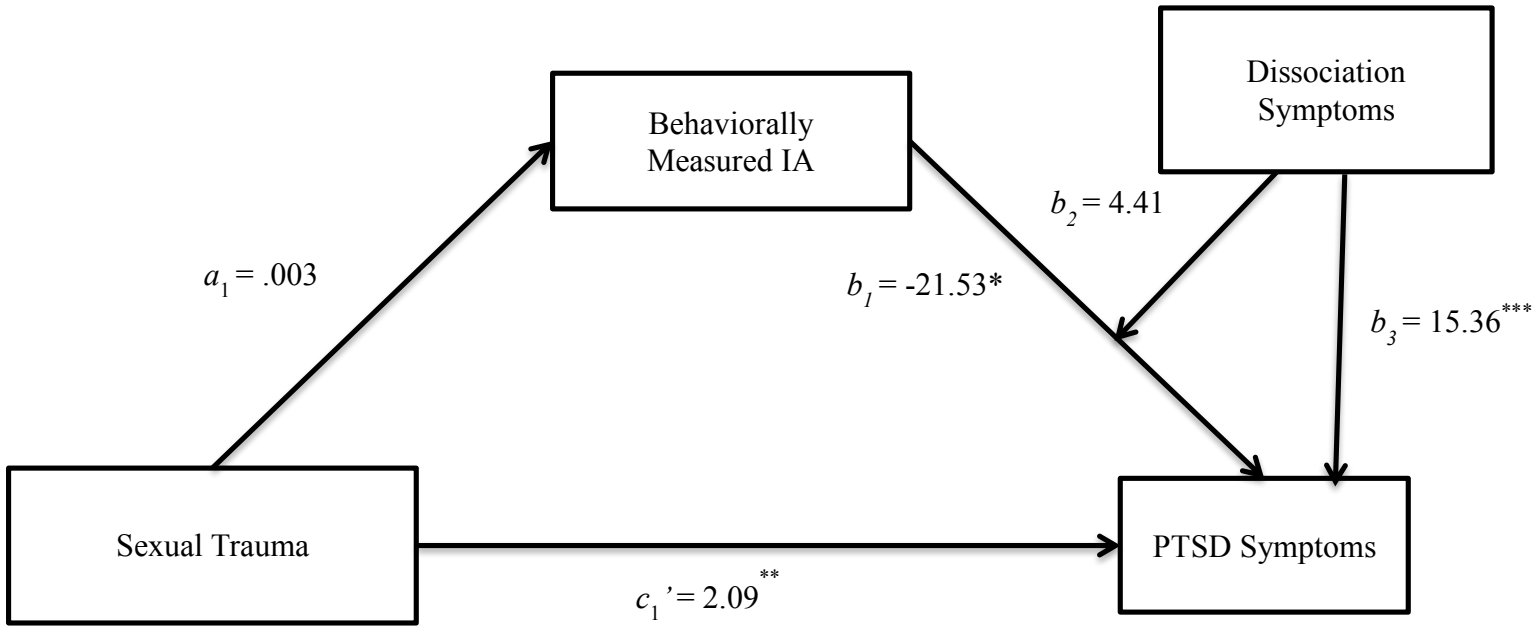


Figure 5. Effect of sexual trauma on PTSD symptoms mediated by behaviorally measured IA (Bx-IA) and moderated by dissociation symptoms; * $p < .05$; **$p<.005$; $p < .001$. These results indicate that Bx-IA did not mediate the association between sexual trauma and PTSD symptoms. Results indicated that Bx-IA predicted a significant amount of variance in PTSD symptoms. There was no significant interaction between Bx-IA and dissociation symptoms. Sexual trauma is measured as number of types of distinct sexual traumas across the lifespan (measured by the SES; Koss et al., 2007). Self-reported interoceptive awareness measured by the MAIA (Mehling et al., 2012). Dissociation symptoms measured by the WDS (Kennedy, 2004). PTSD symptoms measured by the PCL-5 (Weathers et al., 2013).

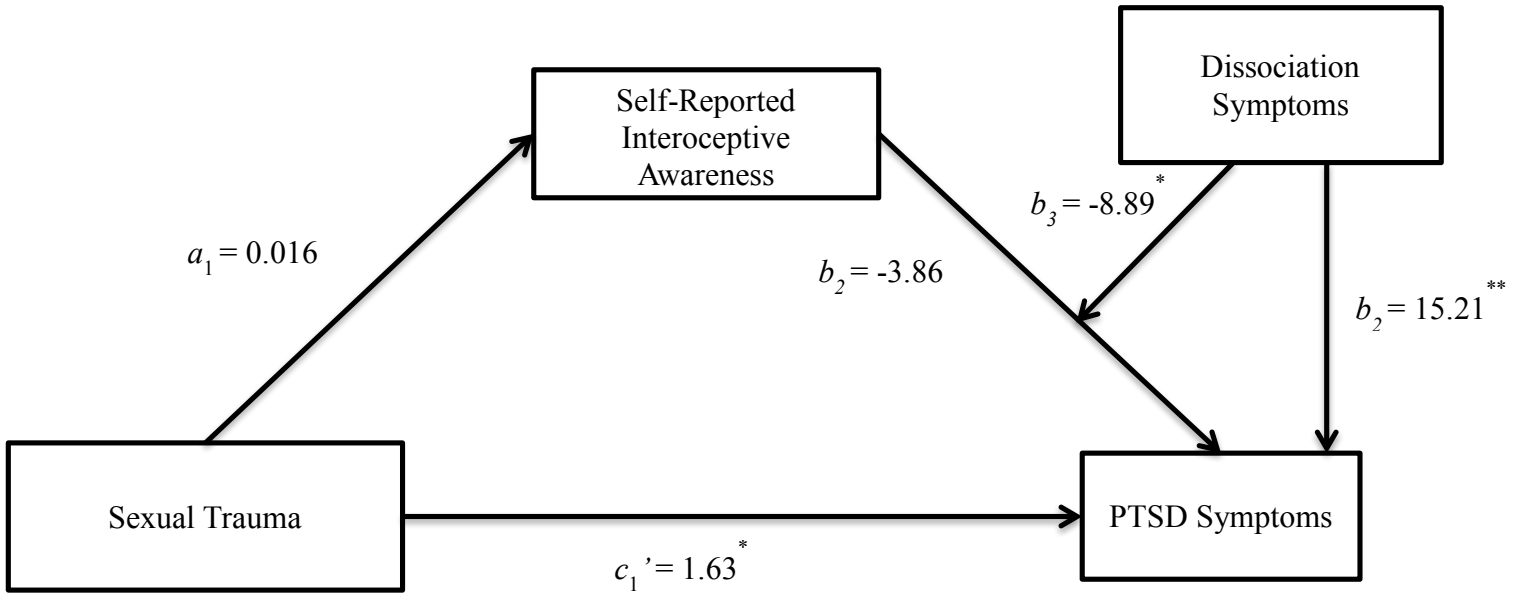


Figure 6. Effect of sexual trauma on PTSD symptoms mediated by self-reported interoceptive awareness (IA) and moderated by dissociation symptoms; * $p < .05$; **$p<.001$. These results indicated that self-reported IA did not mediate the association between sexual trauma and PTSD symptoms. This model does indicate that there was a significant interaction between self-reported IA and dissociation symptoms in predicting PTSD symptoms. Sexual trauma is measured as number of types of distinct sexual traumas across the lifespan (measured by the SES; Koss et al., 2007). Self-reported interoceptive awareness measured by the MAIA (Mehling et al., 2012). Dissociation symptoms measured by the WDS (Kennedy, 2004). PTSD symptoms measured by the PCL-5 (Weathers et al., 2013).

APPENDIX Y

TABLES

Table 1. *Pilot Study Bivariate Correlations between Sexual Trauma and MAIA Subscales*

Variable	Sexual trauma
MAIA subscales	
Noticing	.31*
Not-Distracting	-.17
Not-Worrying	.04
Attention Regulation	.05
Emotional Awareness	.12
Self-Regulation	.02
Body Listening	.05
Trusting	-.08
Total	.08

*p<.01, n = 77

Table 2. *Pilot Study Partial Correlations between MAIA and Sexual Trauma, Controlling for Non-Sexual Trauma*

Variable	Sexual trauma
MAIA subscales	
Noticing	.30*
Not-Distracting	-.14
Not-Worrying	.02
Attention Regulation	.03
Emotional Awareness	.09
Self-Regulation	-.02
Body Listening	.01
Trusting	-.05
MAIA Total	.08

*p<.01; n= 77

Table 3. *Pilot Study Mean Scores and T-Test Comparisons for Sexual Trauma, Chronic Pain and Healthy Mind-Body Samples*

Variable	Sexual Trauma (n = 77)	Chronic pain (n = 304-435)	Healthy mind-body (n = 318-325)
MAIA subscales			
Noticing	3.26 (.82)	3.58 (1.16)	3.94 (.59)
Not-Distracting	2.13 (.86)	1.19 (1.00)	3.20 (.87)
Not-Worrying	2.57 (.88)	2.91 (1.08)	3.27 (.84)
Attention Regulation	2.74 (.85)	3.04 (1.05)	3.79 (.64)
Emotional Awareness	3.05 (.92)	3.42 (1.20)	4.16 (.64)
Self-Regulation	2.52 (1.01)	2.93 (1.19)	3.86 (.74)
Body Listening	2.12 (1.11)	2.15 (1.28)	3.50 (.87)
Trusting	3.12 (1.01)	3.91 (.97)	4.13 (.74)
MAIA Total	2.74 (0.46)	***	***

Note: All means for the chronic pain sample were significantly lower than the healthy mind-body sample, $p < 0.001$; All means for the trauma sample were significantly lower than both the chronic pain and healthy mind-body sample ($p < .05$), with one exception. There was no significant difference between the average Body Listening score between the trauma and chronic pain samples. Chronic pain and health mind-body sample means from Mehling et al., 2013; Trauma sample means from Pilot Study 1. ***MAIA total scores not computed for these studies.

Table 4. *Pilot Study Bivariate Correlations between MAIA Subscales and Total Score, and TSC-40 Subscales and Total Score*

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Noticing	1															
2. Not-Distracting	-.21	1														
3. Not-Worrying	-.16	-.22	1													
4. Attention Regulation	.38**	-.29*	.10	1												
5 Emotional Awareness	.50**	-.29*	-.27	.29*	1											
6. Self-Regulation	.25*	-.18	-.14	.26*	.51**	1										
7. Body Listening	.19	-.02	-.17	.14	.45**	.71**	1									
8. Trusting	.07	-.07	-.23*	.08	.38**	.37**	.26*	1								
9. MAIA Total	.56**	-.13	-.07	.65**	.72**	.74**	.65**	.46**	1							
10. Anxiety	.30**	-.05	-.09	.06	.21	-.09	.15	-.22	.05	1						
11. Dissociation	.26*	-.15	-.15	.05	.21	-.08	.08	-.23*	.02	.75**	1					
12. Depression	.30**	-.30**	.00	.13	.13	-.22	-.05	-.19	-.03	.74**	.75**	1				
13. SATI	.28*	-.14	-.08	.17	.25*	-.04	.11	-.24*	.12	.75**	.86**	.73**	1			
14. Sleep Disturbance	.45**	-.29*	.11	.17	.31**	-.01	.09	-.12	.19	.55**	.48**	.61**	.50**	1		
15. Sexual Problems	.14	-.09	-.02	.17	.11	-.05	.05	-.30**	.03	.56**	.63**	.62**	.79**	.36**	1	
16. TSC-40 Total	.32**	-.21	-.04	.15	.22	-.13	.05	-.22	.04	.88**	.85**	.91**	.86**	.68**	.75**	1

Note: **p<.01; *p<.05; n = 77; Variables 1-8 are subscales of the Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012); Variables 10-15 are subscales of the Trauma Symptom Checklist-40 (TSC-40; Elliot & Briere, 1996)). SATI = sexual abuse trauma index.

Table 5. *Demographic Information: University and Community Participants*

Variable	University Participants		Community Participants	
Age	*M* = 19.89	(*SD* = 3.57)	*M* = 40.43	(*SD* = 15.51)
Body Mass Index	*M* = 24.10	(*SD* = 4.74)	*M* = 30.31	(*SD* = 9.13)
Race	*N*	% / 152	*N*	% / 21
African American / Black	1	.7	0	0
Hispanic / Latina	6	3.9	0	0
Native American / American Indian	2	1.3	1	4.8
White / Caucasian / European American	111	73	0	0
Asian American	7	4.6	0	0
Pacific Islander	0	0	0	0
Other	5	3.3	1	4.8
Multiracial	20	13.2	7	33.3
Gender Identity	N	% / 153	N	% / 21
Woman	148	97.4	21	100
Gender Queer	4	2.6	0	0

Table 6. *Interoceptive Awareness Descriptive Statistics – University and Community Samples*

		University Participants				Community Participants			
	# Items	*alpha*	*M*	*SD*	Skewness	*alpha*	*M*	*SD*	Skewness
MAIA[1]									
Noticing	4	.62	2.37	.76		.73	3.65	.89	
Not Distracting	3	.74	3.13	.90		.57	1.87	1.01	
Not Worrying	3	.63	2.71	.89		.52	2.90	1.03	
Attention Regulation	7	.85	1.61	.81		.91	3.13	1.01	
Emotional Awareness	5	.81	2.54	.93		.87	3.82	1.01	
Self-Regulation	4	.80	1.82	.92		.87	3.03	.96	
Body Listening	3	.85	1.43	1.05		.91	2.76	1.47	
Trusting	3	.89	2.22	1.15		.73	3.22	.97	
MAIA Total	32	.90	2.15	.57		.91	3.15	.68	
Behavioral IA	-	-	.75	.18	-.80		.72	.18	-.64

[1] MAIA = Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012)

Table 7. *Abuse History Descriptive Statistics – Number of Lifetime Events – University and Community Samples*

	University Participants			Community Participants		
	alpha	*M*	*SD*	*alpha*	*M*	*SD*
PMS[1]						
Number of Lifetime Psychological Abuse Events	.97	13.37	6.47	.96	18.33	4.13
LONGSCAN						
Number of Lifetime Physical Abuse Events	.91	1.77	3.56		Not Reported[7]	
SEQ[3]						
Number of Lifetime Sexual Harassment Events	.96	28.59	11.25	.98	32.86	14.64
BBTS[4]						
Number of Lifetime LBT[5] Events	.73	2.28	2.30	.79	5.81	3.48
Number of Lifetime HBT[6] Events	.81	3.22	2.58	.92	6.81	3.92

[1]PMS = Psychological Maltreatment Scale (Briere & Runtz, 1988; [2] LONGSCAN = LONGSCAN Measure of Physical Abuse (Barnett, Manly, & Cicchetti, 1993; [3]SEQ = Sexual Experiences Questionnaire (Fitzgerald, Gelfand, & Drasgow, 1997); [4]BBTS = Brief Betrayal Trauma Survey (Goldberg & Freyd, 2006); [5]LBT = Lower Betrayal Trauma; [6]HBT = Higher Betrayal Trauma; [7]There was an error in data collection for the community participants LONGSCAN data, thus it is not reported.

Table 8. *Frequency*[1] *of Participants Experiencing Types of Unwanted Sexual Contact, as Measured by the Sexual Experiences Survey (Koss et al., 2007)*

Variable	University Participants		Community Participants	
Lifespan number of types of sexual trauma	*M* = 3.45	*SD* = 1.90	*M* = 4.43	*SD* = 2.18
Type of sexual trauma	Count	*%*	Count	*%*
Someone fondled, kissed, or rubbed up against the private areas of my body (lips, breast/chest, crotch or butt) or removed some of my clothes without my consent (*but did not attempt sexual penetration*)	130	85	18	82
Someone had oral sex with me or made me have oral sex with them without my consent	76	50	14	67
A man put his penis into my vagina, or someone inserted fingers or objects without my consent	100	65	20	95
A man put his penis into my butt, or someone inserted fingers or objects without my consent	31	20	13	62
Even though it didn't happen, someone TRIED to have oral sex with me or made me have oral sex with them without my consent	84	55	11	52
Even though it didn't happen, a man TRIED to put his penis into my vagina, or someone tried to stick in fingers or objects without my consent	27	18	11	52
Even though it didn't happen, a man TRIED to put his penis into my butt, or someone tried to stick in fingers or objects without my consent	27	18	6	29
Have you been raped?	49	32	17	81
Missing	1	1	0	0

[1]Please note that one participant may be represented in multiple event types, as we did not treat the events as mutually exclusive. Therefore, percentages do not equal 100%. This type of frequency reporting is common with this measure (Koss et al., 2007; Hollander, 2014)

Table 9. *Psychological Symptom Descriptive Statistics – University and Community Samples*

	University Participants			Community Participants		
	alpha	*M*	*SD*	*alpha*	*M*	*SD*
Trauma Symptom Checklist-40 Total	.94	40.67	21.44	.93	62.62	24.05
PTSD Checklist for DSM-5						
Cluster B Sx[1] – Intrusion		5.38	4.57		5.90	5.49
Cluster C Sx – Avoidance		3.35	2.61		4.00	2.96
Cluster D Sx - Negative alterations in cognitions & moods		8.59	7.50		12.26	7.77
Cluster E Sx - Arousal/reactivity		6.27	6.06		8.85	7.29
Total	.95	24.01	18.39	.96	32.24	22.24
Wessex Dissociation Scale						
Level 1		1.08	0.71		1.51	0.79
Level 2		1.36	0.83		1.90	0.87
Level 3		1.07	0.75		1.75	0.97
Total	.95	1.18	0.71	.94	1.75	0.72

[1]Sx = symptom

Table 10. *Correlations Between Behavioral Interoceptive Awareness and Potential Confounding Variables.*

Variables	1	2	3	4	5	6
1. Bx-IA[1]	1					
2. TET Acc[2]	.08	1				
3. HR Belief Acc[3]	-.02	.10	1			
4. BMI[4]	-.10	-.17*	-.13	1		
5. Age	.05	.10	.05	.12	1	
6. Physical Activity	.10	-.06	-.11	-.06	-.08	1

*$p < 0.05$; [1] Behavioral Interoceptive Awareness (Bx-IA); [2] Time Estimation Accuracy (TET Acc); [3] Heart Rate Belief Accuracy (HR Belief Acc); [4] Body Mass Index (BMI)

Table 11. *Correlations Between IA Variables, Potential Traumas, and Posttrauma Symptoms. * p<0.05; ** p<0.01*

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. Bx-IA	1											
2. Noticing	-0.06	1										
3. MAIA T	-0.03	0.69**	1									
4. SES Sum	0.08	0.03	0.06	1								
5. HBT	0.21	0.14	0.03	0.26**	1							
6. LBT	0.11	0.17*	0.04	0.32**	0.35**	1						
7. Phys Abuse	0.08	0.03	-0.00	0.19*	0.32**	0.37**	1					
8. Emo Abuse	0.01	0.00	-0.13	0.23**	0.55**	0.22**	0.23**	1				
9. Sexual H	0.01	0.15	0.09	0.44**	0.46**	0.23**	0.14	0.30**	1			
10. WDS T	-0.00	0.12	-0.09	0.24**	0.53**	0.44**	0.31**	0.31**	0.51**	1		
11. PCL-5 T	-0.14	0.01	-0.15	0.32**	0.45**	0.35**	0.21*	0.27**	0.36**	0.66**	1	
12. TSC40 T	-0.09	0.09	-0.15	0.30**	0.51**	0.36**	0.20*	0.32**	0.51**	0.79**	0.80**	1

Table 12. *Mean Scores for Trauma (Pilot Study), Chronic Pain and Healthy Mind-Body Samples (Aim 1)*

Variable	Present Study (n = 143-153)	Pilot Study (n = 77)	Chronic pain (n = 304-435)	Healthy mind-body (n = 318-325)
MAIA subscales				
Noticing	2.37 (0.76)	3.26 (0.82)	3.58 (1.16)	3.94 (0.59)
Not-Distracting	3.13 (0.91)	2.13 (0.86)	1.19 (1.00)	3.20 (0.87)
Not-Worrying	2.71 (0.89)	2.57 (0.88)	2.91 (1.08)	3.27 (0.84)
Attention	1.62 (0.81)	2.74 (0.85)	3.04 (1.05)	3.79 (0.64)
Regulation				
Emotional	2.54 (0.93)	3.05 (0.92)	3.42 (1.20)	4.16 (0.64)
Awareness				
Self-Regulation	1.81 (0.92)	2.52 (1.01)	2.93 (1.19)	3.86 (0.74)
Body Listening	1.43 (1.06)	2.12 (1.11)	2.15 (1.28)	3.50 (0.87)
Trusting	2.22 (1.56)	3.12 (1.01)	3.91 (0.97)	4.13 (0.74)
MAIA Total	2.15 (0.57)	2.74 (0.46)	***	***

Note: All chronic pain sample means were significantly lower than the healthy mind-body sample, $p < 0.001$; All trauma sample pilot study means were significantly lower than both the chronic pain and healthy mind-body samples ($p < .05$), with one exception. There was no significant difference between the average Body Listening score between the trauma and chronic pain samples. Chronic pain and health mind-body sample means from Mehling et al., 2013; Trauma sample means from Pilot Study 1. ***MAIA total scores not computed for these studies.

Table 13. *Bivariate correlations between MAIA subscales and total score, and TSC-40 subscales and total score (Aim 1)*

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Noticing	1															
2. Not-Distracting	-.03	1														
3. Not-Worrying	.90	.01	1													
4. Attention Regulation	.57**	-.00	.21*	1												
5 Emotional Awareness	.52**	-.08	-.06	.38**	1											
6. Self-Regulation	.45**	-.10	.00	.56**	.61**	1										
7. Body Listening	.40**	.07	-.01	.52**	.59**	.60**	1									
8. Trusting	.26**	.14	.10	.42**	.39**	.44**	.41**	1								
9. MAIA Total	.69**	.13	.24**	.79**	.72**	.77**	.75**	.64**	1							
10. Anxiety	.06	**-.35****	-.02	**-.12**	-.01	-.05	**-.11**	**-.36****	**-.16**	1						
11. Dissociation	**.10**	**-.24****	**-.10**	**-.10**	.09	.02	-.05	**-.32****	-.09	.77**	1					
12. Depression	.07	**-.27****	-.03	**-.10**	.04	**-.12**	-.09	**-.45****	**-.16**	.74**	.72**	1				
13. SATI	.06	**-.32****	**-.12**	**-.14**	.05	.03	-.03	**-.41****	**-.14**	.76**	.86**	.73**	1			
14. Sleep Disturbance	-.01	**-.19***	-.00	-.09	**-.11**	**-.12**	**-.18***	**-.33****	**-.18***	.58**	.54**	.74**	.58**	1		
15. Sexual Problems	.09	**-.30****	-.02	-.01	.07	**.11**	.04	**-.31****	-.04	.52**	.50**	.53**	.69**	.33**	1	
16. TSC-40 Total	.09	**-.36****	-.04	**-.10**	.02	-.03	-.08	**-.43****	-.15	.87**	.86**	.91**	.89**	.74**	.71**	1

Note: ***p*<.01; **p*<.05; Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012; Trauma Symptom Checklist-40 (TSC-40; Elliot & Briere, 1996); SATI = sexual abuse trauma index; **bolded** indicates correlation coefficient > .1 (i.e., small = .10; moderate = .30 per Cohen, 1988); underlined numbers indicates a coefficient that is in the opposite direction from the correlation coefficient between those two variables in the pilot study.

Table 14. *Hierarchical Regression Results: Behavioral IA[1], Dissociation[2] and covariates predicting PTSD symptoms (Aim 2)*

	Model 1	Model 2	Model 3			Model 4
Variable	ß	ß	ß	95% CI	Tolerance	ß
Constant (Unstandardized B)	30.54	20.56	26.75	[11.65, 41.85]		26.51
Age	-.16*	-.15*	-.10	[-1.09, .15]	.88	-.10
Psychological Abuse[3]	-.14	-.17	-.12	[-.78, .09]	.64	-.12
Physical Abuse[3]	.21*	.22*	.13	[-.20, 2.00]	.64	.13
Lower Betrayal Trauma[3]	.19*	.15	.08	[-.53, 1.82]	.72	.08
Higher Betrayal Trauma[3]	.38***	.32**	.19*	[.08, 2.50]	.51	.19*
Sexual Harassment[3]		.09	-.06	[-.37, .16]	.59	-.07
Unwanted Sexual Contact[3]		.22**	.23**	[.88, 3.64]	.77	.24**
Bx-IA[1]			-.20**	[-35.29, -7.71]	.98	-.19**
Dissociation[2]			.46***	[7.52, 16.07]	.56	.46***
Dissociation*Bx-IA						.04
R^2	.32	.40	.55			.55
F	11.83***	11.03**	15.60***			13.99***
ΔR^2	.33	.07	.15			.00
ΔF	11.83	6.36	19.42			.33

[1]Behavioral IA (Bx-IA) = Heartbeat perception task (Schandry, 1981); [2] Dissociation = Wessex Dissociation Scale (Kennedy et al., 2004); [3]All abuse variables are indicative of # of lifetime abuse events experienced by category; *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15. *Hierarchical Regression Results: Self-Report IA[1], Dissociation[2] and covariates predicting PTSD symptoms (Aim 2)*

	Model 1	Model 2	Model 3	Model 4		
Variable	ß	ß	ß	ß	95% CI	Tolerance
Constant (Unstandardized B)	30.12	20.56	23.06	26.22	[10.23, 42.20]	
Age	-.16	-.16	-.07	-.08	[-1.02, .28]	.82
Psychological Abuse	-.13	-.16	-.13	-.13	[-.81, .08]	.64
Physical Abuse	.23*	.24*	.16	.20*	[.25, 2.53]	.62
Lower Betrayal Trauma	.18*	.13	.06	.03	[-.99, 1.44]	.70
Higher Betrayal Trauma	.36***	.28**	.17	.15	[-.16, 2.30]	.52
Sexual Harassment		.14	-.01	-.05	[-.35, .20]	.56
Unwanted Sexual Contact		.18*	.20*	.19*	[.44, 3.25]	.77
MAIA Total[1]			-.12	-.15*	[-9.49, -.47]	.83
Dissociation[2]			.45***	.46***	[8.30, 17.54]	.54
Dissociation*MAIA Total				-.17*	[-18.27, -1.73]	.82
R^2	.32	.38	.52	.55		
F	10.92***	9.96***	13.57***	13.31***		
ΔR^2	.32	.06	.14	.02		
ΔF	10.93	5.44	16.65	5.75		

[1]Self-report IA = Multidimensional Assessment of Interoceptive Awareness (MAIA T; Mehling et al., 2012); [2]Dissociation = Wessex Dissociation Scale (Kennedy et al., 2004).

Table 16. *Zero-Order Correlations between EKG Recorded and Participant Counted Heartbeats*

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. HBP* - trial 1	1											
2. HBR* - trial 1	.32	1										
3. HBP - trial 2	.83	.31	1									
4. HBR – trial 2	.39	.91	.33	1								
5. HBP - trial 3	.77	.25	.82	.29	1							
6. HBR - trial 3	.38	.90	.35	.90	.29	1						
7. HBP - trial 4	.58	.30	.54	.37	.66	.36	1					
8. HBR - trial 4	.34	.86	.31	.88	.24	.90	.35	1				
9. HBP - trial 5	.58	.28	.62	.33	.67	.33	.76	.33	1			
10. HBR - trial 5	.43	.85	.41	.91	.36	.87	.41	.90	.40	1		
11. HBP - trial 6	.64	.28	.61	.34	.74	.30	.76	.32	.77	.39	1	
12. HBR - trial 6	.37	.89	.35	.87	.29	.92	.36	.92	.35	.90	.33	1

Note: All correlation coefficients in this table significant at $p < .01$; HBP = heartbeats perceived by the participant; HBR = heartbeats recorded by the EKG machine.

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