UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

DIPARTIMENTO DI PSICOLOGIA
Dottorato di Ricerca in Psicologia Sociale, Cognitiva e Clinica
XXII Ciclo

ANTECEDENTS AND CONSEQUENCES OF SOCIAL AND PHYSICAL PAIN

Tutor: Dott. Lorenzo Montali

Tesi di dottorato di

Paolo Riva

Anno Accademico 2009/2010

“La imagen de Remedios […] le quedó doliendo en alguna parte del cuerpo.
Era una sensación física que casi le molestaba para caminar,
como una piedrecita en el zapato.”

Gabriel Garcia Marquez

Cien años de soledad - (1968, p. 57)

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SUMMARY

Pain overlap theories (Eisenberger & Lieberman, 2004; MacDonald & Leary, 2005) suggest that the detection of social threats has mapped onto the pre-existing neurological circuitry used to signal physical pain. Supporting this assumption, several studies have found that social pain activates brain regions known for their role in processing the unpleasantness of physical pain (e.g., Eisenberger, Lieberman & Williams, 2003). In this dissertation, considering the amount of physiological evidence for common brain responses to social and physical pain, I examine whether and how social and physical pain overlap in their psychological antecedents and consequences.

I first consider fear of pain as a *common antecedent*. In the medical literature on physical pain, the fear of pain—compared with other potential variables—emerges as one of the most relevant predictors of the perception of pain. Study 1a assesses whether fear of social and physical pain reflect unitary psychological dimensions related to, but still distinct from, each other. Study 1b investigates whether both fear of social and physical pain are associated with measures conceptually related to one of them. The findings show that fears of social and physical pain are two related—yet distinct—psychological dimensions. Likewise, I show that dimensions traditionally associated with fear of one type of pain have some degree of overlap with fear of the other type of pain. Then, to test a *common antecedents hypothesis*, Study 1c replicates previous findings, showing that the fear of physical pain can enhance the perception of physical pain. Likewise, I examine whether fear of social pain can enhance the perception of social pain. Study 1d shows that individuals with higher fear of social pain perceive social

threats as more painful. Aside from supporting the *common antecedents hypothesis*, the present results also suggest a *specificity effect* in that each fear is able to predict its associated type of pain. Indeed, it emerges that fear of social and physical pain uniquely predict the perception of their associated pain. Taken together, these studies suggest that fear of pain play a significant role in accounting for why individuals vary in pain perception of social and physical threats.

Second, I examine whether social and physical pain overlap in the *psychological consequences*, specifically the threat of basic human needs (i.e., belonging, control, meaningful existence, self-esteem). Study 2a shows that recalling a past physical pain episode can be associated with memories of low self-esteem, poor control, and greater aggressive temptations, similar to recalling a socially painful episode. In Study 2b, a currently inflicted experience of pain results in lowering satisfaction on all the four needs tested for both physical and social pain and worsening affect, besides confirming the increase in aggressive temptations. It also emerges that both social and physical pain lead to feeling ignored and excluded. I also test a *differential strength hypothesis* which argues a greater need threat effect of social versus physical pain on the basic needs tested. In Study 2a, the intensity of pain associated with episodes of social and physical pain does not differ; nevertheless, social pain is associated with lower need satisfaction than physical pain. In Study 2b, even though participants in the physical pain condition report higher pain scores than those in the social pain condition, social pain still has a greater impact on need satisfaction. Moreover—providing convergent evidence of the specific tenacity of social pain—participants assigned to the social pain conditions not only report higher feeling of needs frustration, but they are also more

tempted to act in ways to restore their frustrated needs. These results add evidence to the pain overlap theories, and suggest new ways to understand and manage pain.

Finally, moving from the empirical evidence provided across these six studies, I contend the overlap between social and physical pain extends beyond acute episodes, by proposing an integrative theoretical model that outlines the most relevant antecedents and consequences of the experiences of chronic social and physical pain. In terms of antecedents, my model suggests that both frequent and/or intense past painful events and insecure attachment styles are associated with the insurgence of persistent social and physical pain. Then, I propose that the same pattern of overlapping cognitive, affective and behavioral processes is involved in the maintenance of both types of pain. Specifically, I show how—at both the social and physical level—catastrophic appraisals of pain can give rise to pain-related fears that may in turn be associated with avoidance and disuse. In terms of consequences, the model focuses on the detrimental effect chronic pain has on individuals' ability to self-regulate. Both forms of pain impair self-regulation on four fundamental domains: cognition, emotion, motivation, and interpersonal regulation. Additionally, both forms of pain persistently threaten four fundamental human needs: belonging, control, self-esteem, and meaningful existence. Implications for chronic pain conditions, as well as for the social psychological research and theories on pain are discussed.

CHAPTER 1

GENERAL INTRODUCTION
THE PAIN OVERLAP THEORIES

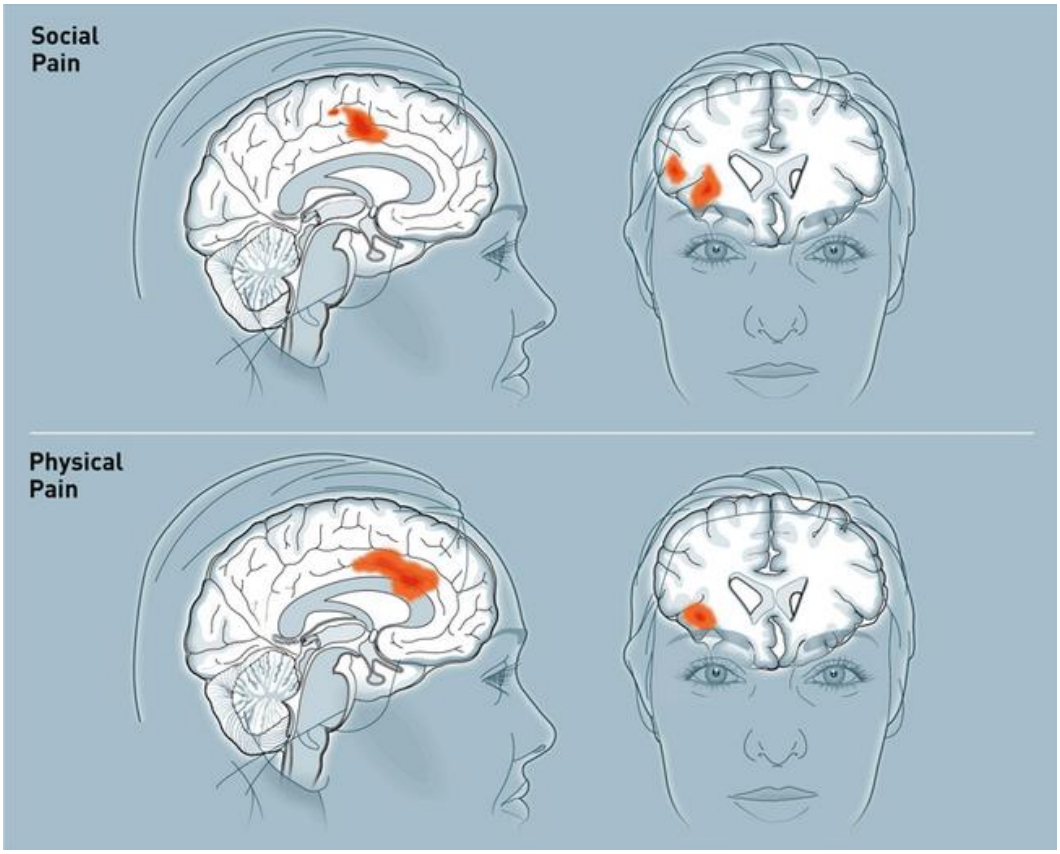
For more than a century, psychologists have argued that human beings are essentially social beings, that is, they are inherently driven by a desire to form and maintain social connections (James, 1890; McClelland, 1951; Murray, 1954; Maslow, 1968; Bowlby, 1969, 1973; Stevens & Fiske, 1995; Baumeister & Leary, 1995). Meanwhile, dozens of empirical studies have found that social connections are vital to our health (e.g., Cacioppo & Patrick, 2008; Williams, 2009). Individuals who are more socially connected exhibit better physical and psychological health than people who experience loneliness, ostracism, or social exclusion (Berkman et al., 1992; Cacioppo et al., 2006). In keeping with this knowledge, recent research has also found that disruption of social relationships triggers a pain response (Eisenberger, Lieberman, & Williams, 2003). This research has given rise to *pain overlap theories* (Eisenberger & Lieberman, 2005; MacDonald & Leary, 2005), according to which individuals process social separation similarly to experiences of physical threat. The most common explanation for this phenomenon refers to the need to belong (Baumeister & Leary, 1995): because belonging is so crucial for survival and reproduction among social animals, a system that uses similar signals for threats to social belongingness or physical damage may have been evolutionarily advantageous.

The hypothesis that individuals process social separation similarly to experiences of physical threat was tested in a seminal study published in *Science* by Eisenberger, Lieberman,

and Williams (2003). These researchers wanted to know whether the distress caused by social separation was mediated by the activation of some of the same neural circuits responsible for the detection of physical pain stimuli. To do this, they obtained functional magnetic resonance imaging (fMRI) scans of participants while playing an on-line game called Cyberball (Williams, Cheung, & Choi, 2000). This game has been extensively used in the ostracism and social exclusion literature because it allows for experimental manipulation of the inclusionary status of individuals, by having them included or excluded in an on-line game. In a typical Cyberball manipulation, participants are told that they had to take part in a ball-tossing game with two other players. These other players are in fact computer players programmed to either throw the ball equally to everyone for the entire game (inclusion condition), or to do that for a short time but then to only throw the ball to each other, leaving the real participant excluded from the game from that point on (exclusion condition). Adopting this manipulation while looking at the participant's brain, Eisenberger et al. (2003) found that participants showed greater activity in the dorsal anterior cingulate cortex (dACC) and the right ventral pre-frontal cortex (PFC)—brain regions known to be part of the pain detection network—when they were excluded than when they were included. Moreover, participants who reported feeling more social distress also showed greater activity in the dACC during the exclusion phase of the game. This was the first empirical evidence that social threats may be detected and processed similarly to physical pain (see Figure 1). Furthermore, it gave rise to the notion of "social pain," that is, the pain experience arising from the perception of social separation rather than a physical damage. Moving from these findings, Eisenberger and Lieberman (see also MacDonald & Leary, 2005) proposed the Pain Overlap Theory (2005) which suggested that social pain was built upon the

existing pain circuitry that was originally developed to signal bodily threat or harm in order to keep individuals alive.

Figure 1. Brain scans captured through fMRI show the neural overlap of social and physical pain. The dACC (highlighted at left) is associated with the degree of distress; the right ventral PFC (highlighted at right) is associated with regulating the distress.



Note. From "Does Rejection Hurt? An fMRI Study of Social Exclusion," by N. Eisenberger et al., 2003, Science, 302, 290-292 (social pain image) and "The neural Correlates of Placebo Effects: A disruption Account," by Lieberman et al., 2004, Neuroimage, (physical pain image). Illustration created by Samuel Velasco. Retrieved from http://www.strategy-business.com/article/09306

After its appearance, work by Eisenberger et al. (2003) (whose pattern of results has been replicated in numerous subsequent studies; e.g., Eisenberger et al., 2007; Onoda et al., 2009; Krill & Platek, 2009; Masten et al., 2009) inspired a line of research investigating the similarities and differences between the experiences of social and physical pain. The present investigation is embedded within this theoretical and empirical perspective.

1.1. Defining Social and Physical Pain

Before continuing, I will briefly review definitions of social and physical pain.

Physical pain is designed to warn of potential harm; it is usually provoked by a physical aversive stimulus and it typically results in an avoidance motivation (e.g., removing one's self from the aversive situation). The International Association for Study on Pain defines physical pain as the "unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP, 1979). Crucially for the understanding of the social/physical overlap, the experience of physical pain involves two discernible physiological systems (Craig, 1999; Price, 2000; Price, Harkins, & Baker, 1987; Rainville et al., 1997; Sawamoto et al., 2000). There is a *sensory component* that refers to the intensity of the painful stimulation and an *affective component* that refers to the unpleasantness of that stimulation. The common analogy used to illustrate the difference between the sensory and the affective components refers to the sound of a radio (see Price et al., 1983; Duncan et al., 1989). Indeed, while the pain intensity can be seen as the volume of the radio (e.g., how intense the pain feels) the pain unpleasantness matches how that volume bothers the individual (e.g., how disturbing or distressing the pain is). Although the two

components are often strongly associated (i.e., high pain intensity is linked to high pain unpleasantness) they are distinct from each other. For instance, patients suffering chronic pain who undergoing cingulotomy—a procedure aimed to remove a portion of the ACC (i.e., the affective component of pain)—report that they can perceive the intensity of painful stimulations, but that the pain does not bother them anymore (Foltz & White, 1968).

Social pain consists of the activation of the *affective* (rather than the sensory) *component* of pain following the perception of social separation from close others. Instances of social pain include feelings caused by relational devaluation, bereavement, betrayal, ostracism, rejection, exclusion, non-inclusion, relocation, humiliation, conflict, discrimination, stigma, and embarrassment. Although some of these phenomena might appear very disparate, to date, most of the attempts to delineate empirically or conceptually meaningful distinctions between ostracism, social exclusion, rejection, betrayal or other forms of social pain have not been successfully (Leary 2001; Williams, 2007). Even when a conceptual model accounts for some meaningful differences in long-term reactions, it has been recognized that across several forms of perceived social separation, individuals' immediate reactions are quite similar (Richman & Leary, 2009). They consist of negative affect and diminished feelings of belongingness, self-esteem, control, and meaningful existence (Gerber & Wheeler, 2009). Thus, beyond the differences in long-term responses and in the appraisals of the different forms of perceived social separation (e.g., betrayal vs. ostracism), they are united by the immediate painful response elicited by all. Panksepp and colleagues first described social pain as the emotional distress resulting from social separation in animals (Nelson & Panksepp, 1998; Panksepp, 1998). Eisenberger and Lieberman (2004) extended this definition to human beings considering social

pain to be “the distressing experience arising from the perception of actual or potential psychological distance from close others or a social group.” In a similar fashion, MacDonald and Leary (2005) referred to social pain as an emotional reaction to the perception that one is being excluded from desired relationships or being devalued by desired relationship partners or groups. According to Chen and Williams (2010), these definitions share at least two underlying assumptions: (1) human beings have an innate need to form and maintain positive relationships with others; (2) being separated from, or excluded by, close others is the decisive cue that causes social pain.

1.2. The protective function of Social and Physical Pain

Overall, pain has a valuable function: by signaling danger, it protects the individual from injuries and damages. The crucial adaptive function of *physical* pain is clear if one considers a living organism with no ability to detect a physical threat (e.g., the proximity to fire). Accordingly, individuals who suffer from congenital analgesia are at constant risk of undetected injury or damage and they have a significantly reduced life expectancy. Children with this condition can inadvertently engage in self-injurious behaviors, such as gnawing their own tongue, lips and fingers to the point of mutilation; they also experience more unnoticed infections and other diseases. Thus, physical pain represents an adaptation which protects the individual from physical threats. By rapidly and aversively signaling that something is wrong and that a proper action (e.g., fight, flight, freeze) should be taken, the pain system constitutes a very efficient alarm system that could be used to detect threats to inclusionary status as well.

1.2.1. The evolution of a social/physical shared pain system

Similar to physical pain, social pain is hypothesized to be an adaptive mechanism, evolved to facilitate survival and reproduction. Human psychology is a product of natural selection; accordingly, each cognitive, affective or behavioral process (conscious or unconscious) has been designed along the course of human evolutionary history. For instance, the reflexive withdrawal of a hand immediately after touching a hot stove was designed to protect the individual from tissue damage; likewise, painful feelings elicited by social separation might have evolved to motivate social animals to maintain proximity with their attachment figures (Nelson & Panksepp, 1998). The emerging field of evolutionary psychology (Tooby & Cosmides, 2005; Buss, 2004; Buss, 1995; Haselton, & Nettle, 2006) provided the conceptual framework in which the perspective of the social/physical pain overlap emerged (MacDonald & Learly, 2005). Furthermore, because social pain has been observed in most social species and across ages and cultures, it seems appropriate to consider an evolutionary perspective of its function and existence. Evolutionary psychologists investigate psychological mechanisms by considering the survival and reproductive advantages they may have served over the course of evolutionary history. By doing this, they consider how human ancestral habitats and environments may have forged human cognitions, emotions, and behaviors (Buss, 2004).

Thus, similar to physical pain, scholars have argued that a system that detects threats to one's inclusionary status would be advantageous for survival for social animals (MacDonald & Learly, 2005). As already mentioned, Panksepp and colleagues first suggested the concept of social pain. Specifically, these authors argued that "it is conceivable that brain circuits for

separation distress represent an evolutionary elaboration of an endorphin-based pain network" (Herman & Panksepp, 1978, p. 219). Later, they noted that "the pain components made stronger contributions to the subcomponents which aroused emotional distress during social absence" (Nelson & Panksepp, 1998, p. 438). Subsequent research has expanded these ideas. The rationale supporting the concept of social pain is based on the evolutionary advantage of living in a group of social animals. In particular, over the course of evolutionary history, living in supportive and cohesive groups was beneficial for an individual's chances to satisfy basic needs such as food, shelter, and reproduction. Thus, being included in a group meant higher chances to survive and reproduce than living in social isolation. These are the reasons why, from an evolutionary standpoint, it seems advantageous for social species to possess a system that signals threats to the individual's inclusionary status (Leary & Springer, 2001). Specifically, those organisms that excelled at detecting or foreseeing instances of social pain (e.g., ostracism) would have been better able to act in ways that either prevent the loss of group membership, or serve to regain membership within the group following ostracism (Williams & Zadro, 2005; Spoor & Williams, 2006). According to an evolutionary perspective, even subtle reproductive advantages can become dominant in the genetic heritage of a specific population. Indeed, it is calculated that—compared to other adaptations—an adaptation (e.g., feeling the pain of social separation) that affords a mere 1% reproductive advantage can become prevalent within a population over the course of several generations (Allman, 1994). Moreover, Williams (2007) argued that the cost of a missing a social threat (e.g., ostracism) was greater than the cost of a false alarm (e.g., detecting an ostracism when it was not happening). Therefore, a detection system for social threats was probably selectively biased to over-detect any sign of ostracism or

exclusion, thus biasing the system toward false alarms over misses (see Haselton & Buss 2000; Spoor & Williams, 2006). Indeed, missing a threat to the individual's inclusionary status could result in the loss of access to the resources and protection that only inclusion within a group could provide, ultimately leading to the death of the individual. Thus, other survival threats, such as social separation, might have been built onto a pre-existing alarm system in order to direct attention to any threats to the inclusionary status (MacDonald & Learly, 2005). The possibility that part of the physical pain system may have been co-opted to motivate social animals to respond to inclusionary threats is compatible with Darwin's idea of co-option, by which the function of an adaptation can shift during its evolutionary history (Darwin, 1859). This possibility, as noted by MacDonald and Leary (2005), would also be similar to other preadaptations. For instance, psychological and physical reactions to moral violations (such as incest) are consider to be piggybacked onto the physical disgust response (Rozin et al., 1993). Thus, because the physical pain alarm system was already in place when humans grouped together in social entities, and because it was a very efficient way to immediately disrupt and demand the individual's attention (Eccleston, 1994; Price, 1988), it might have been a good candidate for the detection of social pain.

Therefore, scholars have argued for the evolution of a shared system that would be responsible for detecting cues harmful for survival, including physical danger or social separation. If the hypothesis of a shared alarm system is true, the social animal's brain should process social and physical injuries in some of the same neural circuits and employ similar computational mechanisms.

1.3. Overlaps Between Social Pain and Physical Pain

The overlap between social and physical pain can be found at several levels. The first level that is manifest is the linguistic one, that is, how people describe painful experiences in everyday language. In English, as well as in Italian and in many other languages, we often describe an experience of social pain using terms that are related to physical injury. People say "hurt," "wounded," or "crushed" to describe both social and physical pain. Furthermore, metaphors that people use to describe hurt feelings caused by social pain are often linked to physical injuries. A rejected lover can complain about having a "broken heart," and someone who has been betrayed by a friend could say that "s/he was stabbed in the back." As noted by MacDonald and Leary (2005), such a linguistic overlap can be found across many languages and cultures. However, as already noted, the similarities between these two kinds of pain extend far beyond the linguistic level. Thus, in the following section I will summarize the evidence focused on the *physiological* overlap between social pain and physical pain (e.g., the existence of a shared neural pain system).

1.3.1. Physiological evidence for the social/physical pain overlap theory

During the last decade, a considerable amount of findings indicating shared brain region and neural functions have emerged. Again, the physiological overlap underlying physical and social pain was initially proposed by Panksepp (1998). Panksepp found that, besides reducing the experience of pain, the administration of opiate also reduced crying behavior in animals that were socially isolated (Panksepp, Herman, Conner, Bishop, & Scott, 1978). Thus, more than three decades ago scholars have already found evidence that in animals opioid mechanisms

could be a common neural substrate that regulate both physical and social pain (Nelson & Panksepp, 1998).

Brain regions associated with social and physical pain. Following the Panksepp's and colleagues' early suggestion, several authors have investigated whether similar neural brain regions are delegated to detect, process and regulate both social and physical pain in social animals and humans (Eisenberger et al., 2007; Onoda et al., 2009; Krill & Platek, 2009; Masten et al., 2009). This research was able to identify three main brain structures that are implicated in the pain network and that seemed to be involved in the experience of both social and physical pain: the dorsal anterior cingulated cortex (dACC), the right ventrolateral prefrontal cortex (rVLPFC) and the periaqueductal gray (PAG).

The dACC is a neural structure that is known for its role in signaling distress during processing the affective component of pain (Price, 2000). By contrast, other neural regions (such as the somatosensory cortex and the insula) are known to be involved in processing the intensity of painful stimulation (Aziz, Schnitzler, & Enck, 2000). The above mentioned notion that patients who had cingulotomy are still able to perceive the sensory but not the affective component of pain first indicated the role that this structure plays in registering the distressing, rather than the purely sensory, dimension of the pain experience (Foltz & White, 1968). After that, subsequent neuroimaging studies have found that the activity of the dACC corresponds to perceived pain unpleasantness rather than perceived pain intensity (Rainville, Duncan, Price, Carrier, & Bushnell, 1997; Sawamoto et al., 2000).

Besides its role in affective responses to physical pain, the dACC is also involved in reactions to social separation in nonhuman mammals. Research indicated that the abscission of the dACC in monkeys exclusively reduced distress vocalization caused by social separation but not other types of vocalizations (MacLean & Newman, 1988). Conversely, the electric stimulation of the dACC specifically induced the distress vocalizations of similar monkeys (Jürgens & Ploog, 1970). This pattern of results supports the role of the dACC in processing affective distress resulting from social separation in nonhuman mammalians.

The activation of the dACC during social separation has been found in humans as well. Studies based on the functional magnetic resonance imaging indicated that the dACC is activated when social threats are detecting. As already mentioned, Eisenberger et al. (2003) found that the dACC was more active when participants were excluded rather than included during an on-line ball tossing game (see Figure 2). Further studies continue to provide support to the role of the dACC in the social pain detection (Eisenberger et al., 2007; Onoda et al., 2009; Krill & Platek, 2009; Masten et al., 2009). For instance, suggesting individual differences in pain perception, Eisenberger, Gable & Lieberman (2007) found that individual high in rejection sensitivity (Downey & Feldman, 1996) showed greater dACC activity when rejected in the Cyberball social exclusion task. A similar pattern of results was found in a study that showed "disapproving" facial expressions to participants (Burklund, Eisenberger & Lieberman, 2007). According to the authors, a disapproving face should be associated with high chances of social rejection. Participants who were more rejection-sensitive showed greater dACC activity while viewing disapproving faces. Moreover, this pattern of neural activation was specifically related to the disapproving faces but not to the control expressions (anger or disgusted faces). A final

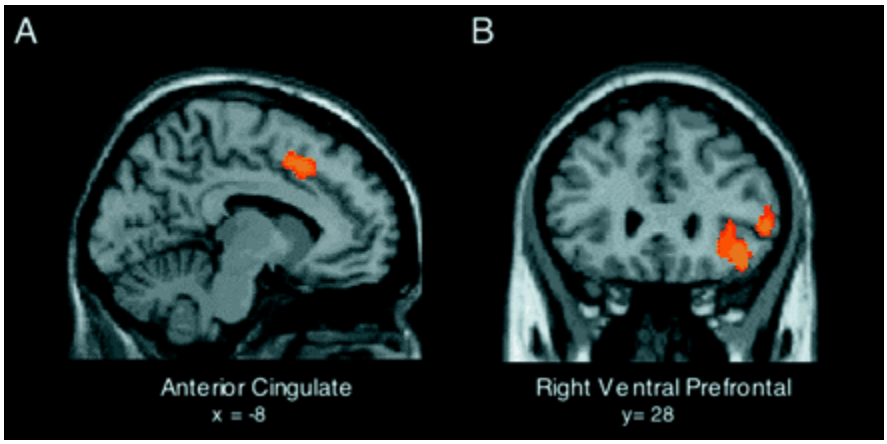
evidence that support the crucial role of the dACC in the detection of social pain instances comes from research on bereavement, that found that bereaved individuals displayed increased dACC activation when watching pictures of a lost loved one compared to watching pictures of a stranger (Gündel et al., 2003; O'Connor et al., 2008).

The PAG is another neural structure included in the brain pain network that seems to be involved both in physical pain processing and attachment-related behaviors (Bandler & Shipley, 1994; Dunckley et al., 2005). Research showed that stimulation of the PAG regulates physical pain responses in rats (Price, 1988). In terms of social pain, it has been shown that the abscission of the PAG causes a reduction of separation distress cries in rats (Wiedenmayer, Goodwin, & Barr, 2000) whereas its stimulation is associated with an increment of these cries (Panksepp, 1998). Eisenberger, Gable, & Lieberman (2006) found that human subjects who were socially excluded using the Cyberball paradigm (Williams, Cheung, & Choi, 2000) showed greater PAG and amygdala activity (besides the dACC). Moreover, they found that individuals who showed high dACC and PAG responses to a single episode of social rejection in the scanner were more likely to report also feeling socially disconnected during their daily social life.

The rVLPFC is another brain region included in the pain network and known for its role in the regulation of physical pain and negative affect (Wager, Davidson, Hughes, Lindquist, & Ochsner, 2008). In a parallel fashion, neuroimaging studies suggest that rVLPFC might be directly involved in the regulation or inhibition of the distress resulting from social exclusion (Eisenberger, Lieberman, & Williams, 2003; Kross, Egner, Ochsner, Hirsch, & Downey, 2007; Onoda et al., 2009). For instance, the study by Eisenberger et al., (2003) found that participants

who showed higher rVLPFC activity while being excluded in the fMRI scanner using Cyerball, also provided low self-reported social distress, initially suggesting the regulatory function of the rVLPFC on social pain. The authors also found that the dACC activity mediated the relationship between the rVLPFC activity and the self-reported social distress, suggesting that the rVLPFC might directly down-regulate the dACC activity. Finally, studies that investigated individual differences in social pain perception showed that—compared to people who are high in rejection sensitivity—people low in rejection sensitivity display high levels of rVLPFC activation while being excluded during Cyberball, (Kross et al., 2007; Onoda et al., 2009; Yanagisawa et al., 2010). This pattern of results further suggests that the rVLPFC is involved in the regulation of both social and physical pain.

Figure 2. (A) Increased activity in anterior cingulate cortex (ACC) during exclusion relative to inclusion. (B) Increased activity in right ventral prefrontal cortex (RVPFC) during exclusion relative to inclusion.



Note. From “Does Rejection Hurt? An fMRI Study of Social Exclusion,” by N. Eisenberger et al., 2003, Science, 302, 290-292. Copyright 2010 by American Association for the Advancement of Science.

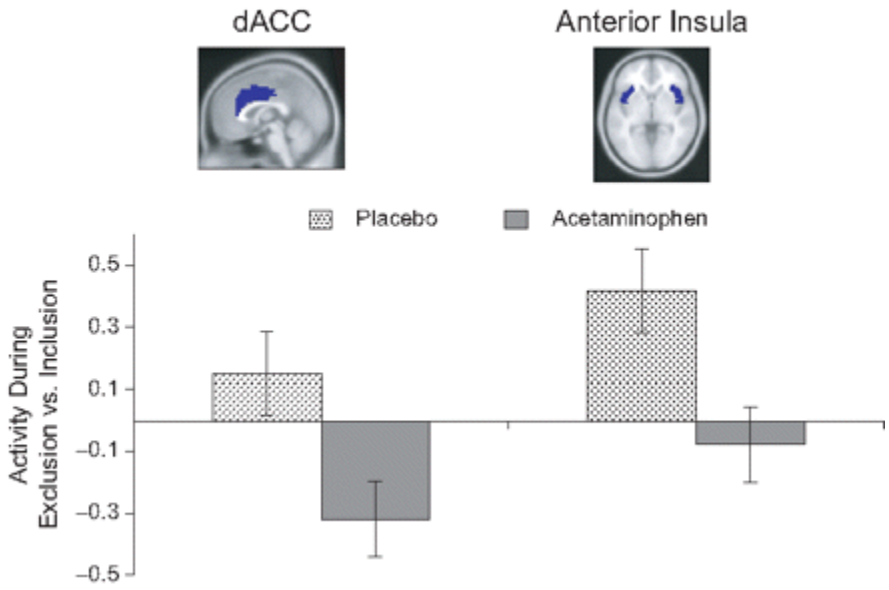
Other physiological overlaps supporting the pain overlap theories. Other studies—besides those focused on brain mapping—found physiological overlaps between the affective or unpleasant component of physical pain and emotional reactions to social exclusion.

Way, Taylor & Eisenberger (2009) investigated whether a variation of OPRM-1—a gene that helps govern the function of mu-opioid receptors—is linked to the sensitivity of both social and physical pain. These receptors are known for their role in pain regulation when one of the body's own painkillers or an opiate drug appears in their midst. Past research have already shown that people who have a rare variation of the OPRM-1 gene are highly sensitive to physical pain. The authors found that the same variation of the OPRM-1 gene is associate with high sensitivity to social rejection.

Finally, in a very recent test of a shared social/physical pain system, Dewall, Macdonald, Webster, et al., (2010) investigated whether acetaminophen, a painkiller commonly used to reduce physical pain, would also reduce feelings of social pain. Moving from the hypothesis that social and physical pain are processed in part of the same regions of the brain the authors predicted that a physical pain suppressant should also buffer the negative effects of social rejection. Providing support to this prediction, across two studies the authors showed that acetaminophen actually reduced the pain of social rejection, at both behavioral and neural levels. In Experiment 1, participants were randomly assigned to take acetaminophen or placebo for each day for 3 weeks and they had to report their hurt feelings daily. Hurt feelings were assessed using the Hurt Feelings Scale (Leary & Springer, 2001), which was specifically developed to assess reactions to experiences of social exclusion and cannot be reduced to

other negative emotions. Participants were also asked to provide a daily measure of general positive emotions (e.g., happy, content; Mayer & Gaschke, 1988), in order to test whether the effect of acetaminophen was specific to feelings of social pain or included other emotional states. As expected, participants' hurt feelings decreased significantly over time in participants who took acetaminophen but not in those who took the placebo. The acetaminophen and placebo groups were not different at Day 1, whereas at Day 21, the acetaminophen group had significantly lower hurt feeling scores than those in the placebo group. The results also showed that acetaminophen did not affect positive emotions, suggesting that pain suppressant specifically acted on emotions associated with feelings of social pain. In experiment 2, participants took 2,000 milligrams daily of either acetaminophen or a placebo. After three weeks of taking the medication, subjects played Cyberball (Williams, Cheung, & Choi, 2000) while in fMRI scanners. Data revealed that acetaminophen reduced dACC and anterior insula activation to social exclusion (vs. social inclusion) (see Figure 3). These findings provided further support to the hypothesis that physical and social pain rely on shared neurological substrates.

Figure 3. Results from the region-of-interest analysis in Experiment 2: change in neural activity (parameter estimates during social exclusion vs.



Note. From "Acetaminophen Reduces Social Pain : Behavioral and Neural Evidence," by C.N. DeWall et al., 2010, Psychological Science, 21(7):931-7. Copyright © 2010 by Association for Psychological Science

1.3.2. Psychological Overlap between Social Pain and Physical Pain

Despite the aforementioned substantial research that suggests a physiological overlap between social and physical pain, to date little research has investigated whether or how social and physical pain overlap at the psychological level. An investigation over the psychological overlap between social and physical pain would provide convergent validity to the concept of a shared social and physical pain alarm system. Indeed, some researchers have noted that the neural activation of specific brain regions did not support the existence of a functional overlap between social and physical pain (Somerville, Heatherton, & Kelley, 2006; see also Vul, Harris, Winkielman, & Pashler, 2009). For instance, activation of the dACC has been shown in response

to detection of discrepancy between actual and expected events (Botvinick et al., 2001). Hence, it might be that activation of the dACC while being excluded in a Cyberball game could result not because of the mediation of the pain system, but because of the detected discrepancy between expectations (i.e., being included in a ball-tossing game) and actual events (i.e., not receiving the ball). Even though the amount of convergent physiological evidence supporting the social and physical pain overlap has grown, psychological evidence that supports the pain overlap theory would provide convergent validity.

However, previous theory and research seem to support the idea that the shared neural pain system should result in common psychological antecedents and consequences for social and physical pain. Indeed, according to Eisenberger (2010), the social/physical pain neural overlap should produce several functional consequences. First, variables that are known for their role in regulating or potentiating one type of pain should produce similar effects on the other type of pain. Indeed, research has shown that social support—a factor that plays a role in counteracting the negative effects of a social pain experience such as loneliness (Cacioppo & Patrick, 2008)—can regulate or reduce the experience of physical pain as well (Brown, Sheffield, Leary, & Robinson, 2003). This effect is so powerful that merely viewing a picture of one's significant other during a painful heat stimulus led to lower self-reports of pain unpleasantness than did viewing a picture of a stranger or neutral object (Master et al., 2009). Second, again according to Eisenberger (2010), a shared pain system also implies that individual differences related to one type of pain are related to the other. In other words, we should expect that individuals who are more sensitive to one kind of pain will also be more sensitive to the other. Past research seems to support this hypothesis as well. For instance, Eisenberger, Jarcho,

Lieberman, and Naliboff (2006) showed that individuals who reported greater sensitivity to physical pain (e.g., a heat pain stimulus) also rated an unrelated social rejection experience (i.e., being excluded during Cyberball) as being more distressing. From the opposite perspective, MacDonald, Kingsbury, and Shaw (2005), analyzing individuals with chronic physical pain as well as people from a community sample, found that reports of physical pain were associated with proneness to hurt feelings. This result further indicated that when people are highly sensitive to one type of pain type, they are also highly sensitive to the other.

1.4. Differences between Social Pain and Physical Pain

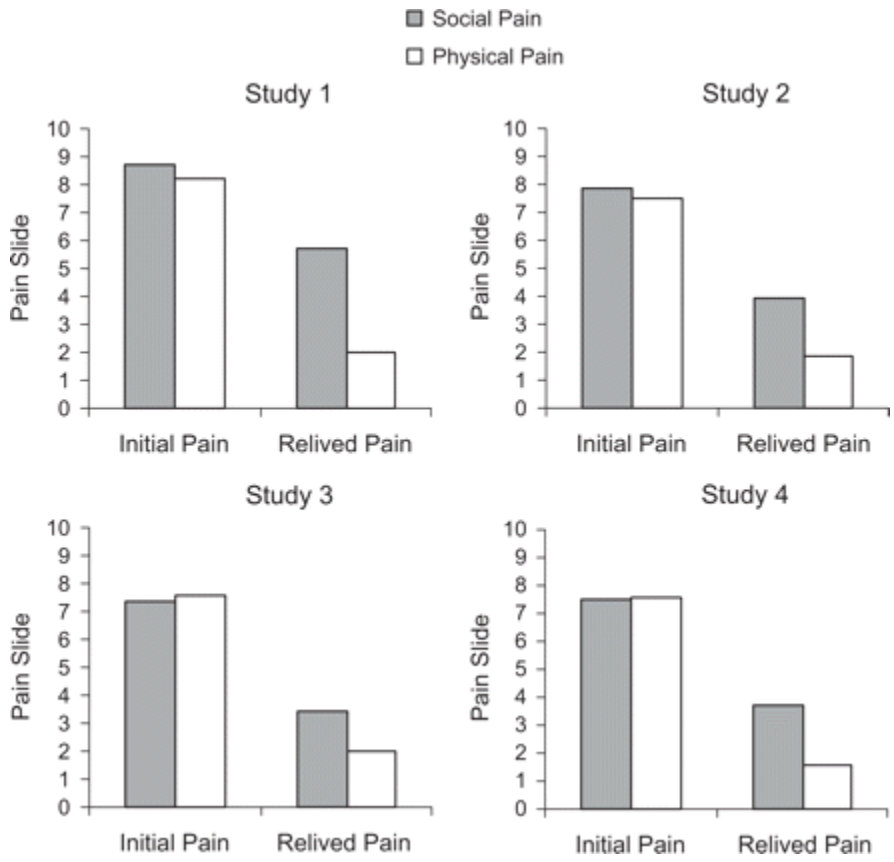
Converging evidence of physiological and psychological similarities between social and physical pain does not necessarily imply that they are equivalent constructs with identical sensory and psychological features and consequences. Thus, it is important to note that, despite the large amount of evidence suggesting overlap between social and physical pain, distinctions between the two experiences have been identified as well, at both the theoretical and empirical levels.

First, by definition, the experience of physical pain includes both an affective and a sensory component, but the experience of social pain consists only of the affective component. Thus, although it has been suggested that the affective component of social and physical pain in isolation would be the same (MacDonald & Learly, 2005), the sensory experience of the two kinds of pain is likely to be very different.

Second, from an empirical standpoint, the responses to social and physical pain appear to differ in strength. In a series of studies, Chen, Williams, Fitness and Newton (2008) tested the

hypothesis that social pain could be easily and more intensely relived and pre-lived than physical pain (see also Chen & Williams, 2010). Participants were asked to recall (or imagine) either a social pain experience or a physical pain experience and to rate the level of pain that they initially felt (or would feel) when the event happened. Then they wrote in detail about what they recalled. Then the participants were asked to indicate their feelings of pain on both a Pain Slide and the McGill Pain Questionnaire (Melzack, 1975, 1983). Social and physical pain did not elicit different levels of pain when they were initially experienced. However, participants reported higher levels of pain after recalling social than physical pain episodes (see Figure 4).

Figure 4. Participants' initial and relived pain as a function of pain-reliving condition (social vs. physical).



Note. From “When Hurt Will Not Heal: Exploring the Capacity to Relive Social and Physical Pain,” by Z. Chen et al., 2008, Psychological Science, 19, 789-795. Copyright © 2010 by Association for Psychological Science

Furthermore, several researchers used physical pain as a control condition to investigate the effects of specific distress conditions, such as social exclusion or mortality salience, finding effects for the latter. For instance, empirical investigation of terror management theory (Pyszczynski, Greenberg, & Solomon, 1999; Greenberg, Pyszczynski, & Solomon, 1986) compared the effect of the induction of mortality salience (e. g., thinking of one's death) with those of a physically painful experience (e. g., thinking of a painful dental visit). Researchers generally found that mortality salience increased self-esteem and worldviews whereas physical pain did not. Moreover, social exclusion research (Baumeister, DeWall, Ciarocco, & Twenge, 2005; Baumeister, Twenge, & Nuss, 2002; Twenge, Catanese, & Baumeister, 2003) compared the consequences of imagining physical pain with those of imagining social exclusion, finding only the latter to induce a deconstructed state and to impair cognition and self-regulation. Overall, this research indicates that the consequences of physical pain might differ from those of social pain. In this sense, when comparing antecedents and consequences of social and physical pain, distinctions as well as similarities can be expected between the two experiences.

1.5. Overview of the Present Research

In this dissertation, in a novel test of pain overlap theories (Eisenberger & Lieberman, 2005; MacDonald & Leary, 2005), I tested whether social and physical pain overlap in their antecedents and consequences. Indeed, as suggested by Eisenberger (2010) an overlap in the neural circuitry that underlies physical and social pain should have several functional or psychological implications. Specifically, Eisenberger (2010) argued that if the social pain system is mapped onto the physical pain system, then the same factors that enhance one type of pain

should enhance the other. Following the Eisenberger's (2010) rationale, I propose a second point: psychological consequences that result from the experience of one type of pain should result from the experience of the other type of pain as well. Preliminary evidence that seems to support this prediction was documented by DeWall and Baumeister (2006). Based on the fact that extreme physical pain can lead to temporary analgesia (Gear, Aley, & Levine, 1999), the authors hypothesized that pre-living an extreme social pain condition (i.e., a life alone) would result in analgesia as well. More specifically, the authors found that a prediction of an ostensibly lonesome future life reduced sensitivity to physical pain, in both threshold and tolerance. Furthermore, the extreme exclusion condition also produced emotional insensitivity, as indicated by reductions in affective forecasting of future reactions to positive or negative events, and by exhibiting less empathy for the pain of others, compared to participants who received no prediction of a lonely future life. Thus, I expect that the shared neural system implies (1) that the same factors known to enhance one type of pain should also enhance the other type, and (2) that psychological consequences that are known to be produced by one type of pain would also result from the induction of the other type of pain.

To test these predictions I formulated two major sets of aims with related hypotheses.

1. I first considered fear of pain to be a common antecedent. Medical literature shows that fear of pain—a state designed to protect the individual from a perceived threat (Asmundson, Vlaeyen, & Crombez, 2004)—predicts the experience of physical pain. I tested a *common antecedents hypothesis*, that is, fear of pain should be an antecedent of both social and physical pain. Within this

main hypothesis, based on the notion that fears are structurally related, yet distinct from each other (Taylor, 1998), I also predicted a *specificity effect,* namely, I expected fears of each pain type (e.g., physical) to be a stronger predictor of the perception of the same kind of pain (e.g., physical) rather than the other kind of pain (e.g., social).

2. I investigated the threat of basic human needs as a common consequence (*common consequences hypothesis*). Literature on social exclusion (for a meta-analysis, see Gerber, & Wheeler, 2009) shows that social pain threatens four basic social needs (i.e., belonging, control, meaningful existence, and self-esteem) and induces aggression. I tested the hypothesis that physical pain can threaten basic social need satisfaction and induce aggression. However, considering the greater impact of social over physical pain on the psychological self (Chen et al., 2008; Baumeister et al., 2005), I also investigated the differential strength of social and physical pain in threatening the four social human needs (*differential strength hypothesis*). Specifically, I predicted that social pain should more negatively affect need satisfaction and increase aggressive tendencies than physical pain.

In Study 1a, I analyzed the dimensionality of a set of items generated to assess the construct of the fear of social pain. In Study 1b, I investigated the convergent validity of the fear of social pain, comparing it with other concurrent psychological constructs, such as rejection sensitivity (Downey & Feldman, 1996) and pain catastrophizing (Sullivan et al., 1995). Study 1c attempted to replicate previous findings suggesting that fear of physical pain can predict

physical pain perception. Finally, Study 1d tested the predictive validity of the fear of social pain. After completing the Fear of Social Pain scale, participants are ostracized during an on-line game (Cyberball; Williams, Cheung, & Choi, 2000) and then rate a series of pain measures (NRS-11; Hartrick, Kovan, Shapiro, 2003). I anticipated that fear of social pain would predict social pain perception as well.

Study 2a instructed participants to relive social pain (i.e., to recall a severe social-pain experience) or physical pain (i.e., to recall a severe physical-pain experience) or a typical Wednesday afternoon (control condition), and compared their on-going feelings of pain. In Study 2b, I sought to further replicate this pattern of results by inducing actual experiences of social and physical pain and measuring their psychological consequences.

These results would add evidence evaluating the pain overlap theories, and suggest new ways to understand and manage social and physical pain.

CHAPTER 2

THE ANTECEDENTS OF PAIN:

EFFECT OF FEAR OF PAIN ON SOCIAL AND PHYSICAL PAIN PERCEPTION

"*There is nothing to fear but fear itself*" ~

Franklin D. Roosevelt

By definition, pain is a subjective experience. Common sense and scientific research converge in recognizing that each individual perceives and responds differently to the same aversive stimulation (Fillingim, 2005). The remarkable inter-individual variability that characterizes human pain responses has been explained via the combination of sensory, cognitive, affective, and behavioral processes. Indeed, a much research has shown that the perception of pain is much more than a straightforward response to an objective physical painful stimulation (bottom-up signal detection). Top-down psychological processes play a substantial role in enhancing and regulating the degree of suffering that one experiences. Within this framework, emotions—in particular fear and anxiety—have proven to be critical in predicting individual differences in pain perception.

Fear is a negatively-valenced emotion characterized by a high level of arousal of the sympathetic nervous system. When individuals experience high levels of fear, their body reacts

by activating their *fight, flight* or *freeze* response, instantiated at the physiological level as increased heart rate, increased blood pressure, increased sweating, and dilation of the pupils (Vanin, 2008). Fear is strongly associated with anxiety, but they remain two distinct constructs. Anxiety is a future-oriented cognitive and emotional state that is usually triggered by a vague threat, whereas fear is a present-oriented state triggered by a more defined threat (Asmundson, Norton, & Vlaeyen, 2004). Despite these differences, fear and anxiety both play a similar role in the present investigation, namely, they both lead to increased pain perception (see Asmundson, Norton, & Vlaeyen, 2004). Thus, for the purposes of the current work, however, I will restrict my focus to the former.

Generally, fear has been defined as an emotional response to a specific perceived threat or danger (Öhman, 2000). It is usually considered an adaptive response that protects the organism from danger and even death. Yet, as I will discuss, excessive or disproportionate levels of fear may become dysfunctional (Asmundson, Norton, & Vlaeyen, 2004). Finally, fear can be object-specific (e.g., snakes, death, public speaking) or general (e.g., general feeling of fear that can embrace the entire existence) (Taylor, 1998).

2.1. The Fear of Pain: Fear-Avoidance Theoretical Models

Fear of pain can be defined as a negative emotional response evoked by elements or events associated with pain (Vlaeyen & Linton, 2000; Asmundson, Norton & Vlaeyen 2004). Similar to many other fears, fear of pain is thought to be an adaptive response to possible threats: after an organism learns to associate certain situational cues with pain, these cues trigger strong avoidance responses (i.e., fear) such that painful experiences will be avoided or

minimized in the future. Ultimately, by virtue of its aversiveness, fear of pain protects the individual from engaging in behaviors or actions that have resulted in painful experiences.

Despite the key role of fear of pain in promoting the individual's safety and survival, it has been shown that high or excessive levels of fear of pain can significantly increase the perception of pain-related stimuli (McNeil & Rainwater, 1998). When fear is excessive or chronic, it can boost the perception of pain related stimuli, leading the individual to avoid any activity that might evoke that degree of pain (e.g., avoidance of physical movements). This process is likely to give rise to a fear-avoidance cycle, whereby fear of pain increasingly leads to the abnormal perception of pain that, in turn, leads to progressively extreme avoidance tendencies. Thus, if normal levels of fear of pain are considered adaptive responses, the onset of a vicious cycle of growing fears, pain perception and avoidance may be dysfunctional, especially over an extended period of time (see Crombez, Vlaeyen, Heuts, & Lysens, 1999).

The relationship between fear or anxiety and the experience of pain is not novel. Half a century ago, researchers found that pain was strongly related to anxiety (Rowbotham, 1946) which, as previously mentioned, is correlated with fear. However, such negative emotions were considered to be caused by pain, that is, individuals were believed to become anxious as a result of their experience of pain. The process by which fear of pain enhances pain perception and leads to avoidance has only been fully accounted for by more recent Fear-Avoidance models of pain (Asmundson, Norton, & Vlaeyen 2004). These models differ subtly from each other, but they are all based upon early works by McCracken, Zayfert, and Gross, (1992), Asmundson and Taylor (1996) and Vlaeyen and Linton (2000), and all share the assumption that

perception of injury is associated with an appraisal of the meaning of pain. Many individuals consider the pain resulting from an acute injury as an unpleasant experience, but not as an overwhelming, insurmountable or ultimately destructive experience. However, other individuals might consider pain to be suggestive of a major calamity (i.e., impossible to tolerate or overcome), and this distorted cognitive appraisal is thought to induce greater affective responses of fear. Consequently, Fear-Avoidance models of pain provide a general account for variability in the individual pain perception, that is, why some people experience the same aversive stimuli as more painful than others, and why they recover more quickly from it when others develop long-term pain and disabilities.

2.2. Empirical studies that investigated the effect of fear of pain on pain perception

In the medical empirical literature on physical pain, the fear of pain—compared with other potential variables—emerges consistently as one of the most relevant predictors of the perception of pain and the disability that follows from it.

For instance, a prospective study by Linton et al. (2000) showed that individuals from a community sample with higher baseline levels of fear of pain were twice as likely to report back pain during the following year. A subsequent correlational study on patients with chronic low back pain investigated the contribution of physical pathology and psychological variables (e.g., pain-related fear and catastrophizing) to pain intensity and pain-related disability (Peters, Vlaeyen, & Weber, 2005). The authors found that objectively assessed physical pathology, pain catastrophizing and fear of pain emerged as significant positive predictors, and age as a significant negative predictor, of self-reported pain intensity. Among these, fear of pain and age

appeared to be the strongest predictors, each explaining approximately 10% of the variance in pain intensity.

An experimental investigation found that fear of pain, but not pain catastrophizing, predicted acute pain intensity in pain-free individuals (George, Dannecker, & Robinson, 2006). The study analyzed the influence of fear of pain and pain catastrophizing on acute pain perception (induced by the cold pressor procedure), as well as considering the influence of factors such as sex, gender and anxiety. Among these factors, fear of pain was the only statistically significant predictor for pain intensity at threshold (β = 0.31, p = 0.021) and tolerance (β = 0.40, p = 0.004). These results suggest that fear of pain was the only significant individual predictor of pain intensity. Similarly, George, Dover, and Fillingim (2007) investigated whether fear of pain, anxiety or pain catastrophizing were predictive of pain-related outcomes in healthy participants undergoing a standard fatigue protocol to induce pain (i.e., DOMS, delayed onset muscle soreness). They found that fear of pain alone explained 16% of the variance in clinical pain and 10% evoked pressure pain intensity, suggesting that fear of pain is the most relevant psychological factor in clinical pain studies. Another more recent study by Katz, Martin, Pagé, and Calleri (2009) found that factors related to emotion regulation, such as fear of pain and alexithymia, were—along with sex—the only significant predictors of average heat self-reported pain intensity. Among these predictors, fear of pain was the most relevant one, accounting for 20% of unique variance, whereas alexithymia and sex accounted for only 9.6% and 6.8% of unique variance, respectively. Overall, this study showed that impaired emotional regulation, either through heightened emotional awareness (i.e., fear of pain) or reduced emotional awareness (i.e., alexithymia), increases pain intensity ratings.

Brain imaging technology has now begun to provide insight into the complex intertwining of cognitive and emotional factors that affect the perception of pain. Ochsner, et al. (2006) examined the influence of fear of pain on the experience of pain by actually looking at the associated neural activity in the brain. Using fMRI, the authors were able to identify the areas in the brain responsible for fear related to physical pain. Participants completed the fear of pain questionnaire (FPQ III; McNeil & Rainwater, 1998) and then experienced experimentally-induced aversive thermal stimulation and neutral thermal stimulation (non-painful) while in the fMRI scanner. The authors found that activation in pain processing regions, including the anterior cingulate, correlated with FPQ scores. Previous research has shown that pain affect is encoded in the anterior cingulate (Rainville, Duncan, Price, Carrier, & Bushnell 1997), and this same region is involved in the detection and regulation of social threats (e.g., Eisenberger et al., 2003). According to the authors, this indicates that the psychological interpretation or appraisal of pain, eventually resulting in the subjective experience of pain, is strongly associated with pain-related fear.

2.3. Framing fear of pain within the pain overlap theories

The recent focus on understanding the role of emotional processes—rather than sensory features—on pain perception dovetails nicely with the theoretical framework in which the present contribution is embedded (i.e., pain overlap theories). Indeed, as already noted, while physical pain can be regarded as both a sensory and an emotional experience, social pain is only an emotional experience. Thus, social pain and physical pain share the affective but not the sensory component of the pain system. Fear of (physical) pain is known to enhance physical

pain perception, possibly by activating pathways associated with the processing of the affective component of pain perception. According to Eisenberger's (2010) rationale, emotions known to regulate one type of pain should also regulate the other type. Thus, fear of social threats might act similarly to fear of physical pain, by increasing the perception social pain. Several conceptualizations and empirical data corroborate this hypothesis.

Conceptually, in the same manner in which abnormal and persistent levels of fear of physical pain can promote a state of hyper-vigilance toward physical pain-related stimuli, fear of social threats and social anxiety might bias the individual's attention toward social threats, potentially leading to avoidant responses. This would suggest a possible role of fear of social pain in perception of social pain too. Several empirical studies have shown that people high in social anxiety tend to avoid attending new social encounters, compared to low social anxiety individuals, for fear that they will be negatively evaluated (Heimberg, Lebowitz, Hope, & Schneirer, 1995). Thus, rather than pursue novel potential sources of social acceptance (Maner, DeWall, Baumeister, & Schaller, 2007), socially anxious individual might tend to avoid new contacts, further perpetuating their social isolation and pain.

Furthermore, individual differences might result in an attentional bias toward social threat-related stimuli. A study by Öhman, Lundqvist, and Esteves (2001) found a general attentional bias of responders toward social threat-related stimuli (i.e., angry faces) compared to other non-threat-related stimuli with a comparable negative valence (i.e., sad faces). Specifically, threatening angry faces were more quickly and accurately detected than were other negative faces. However, other studies have shown that social anxiety might be

associated with a greater attentional bias toward social threat cues. Mattia, Heimberg, and Hope (1993) analyzed Information-processing in a sample of social phobic individuals using a modified version of the Stroop task. The authors compared participants' reaction times for socially threatening words, physically threatening words and color words. They found that social phobic individuals had greater interference in color-naming social threat words compared to the control group, supporting the hypothesis that some individuals' attention can be automatically captured to a greater extent by social threat cues. Another study by Mogg and Bradley (2002) examined the relationship between measures of social anxiety and attentional bias toward threatening faces. This study showed that highly anxious individuals were faster to respond to probes occurring in the spatial location of a threat rather than in the location of a neutral face. Garner, Mogg and Bradley (2006) provided further evidence of the relationship between social anxiety and vigilant-avoidant tendencies. The authors found that individuals high in social anxiety—compared to those low in social anxiety—were faster at looking at emotional faces than neutral faces. However, they also looked at emotional faces for shorter duration than individuals low in social anxiety. This evidence, in light of pain overlap theories, suggests that a construct related to social anxiety, such as fear of social pain, might act similarly to fear of physical pain, increasing perception of social threats.

2.4. Framing fear of social and physical pain within Taylor's hierarchic model

According to Taylor's (1998) hierarchic structural model of fears, there is a hierarchy of general and specific mechanisms that affect one's tendency to develop fears. General factors are those that play a role in the acquisition of most fears (i.e., fear-proneness), whereas specific

factors are particular to a given type of fear-evoking stimulus (i.e., learning experiences with a particular type of stimulus). Thus, at the lowest level of the hierarchy, there are factors that are exclusively related to specific elements (e.g., blood, dogs, and elevators). Conversely, at the intermediate level, there are vulnerabilities associated with a set of less specific fears. For instance, fears of dogs, snakes, and cockroaches might be associated to a common vulnerability factor representing "fear of animals." Taylor identified four of these intermediate-level fear subtypes: social, animal, blood–injury–illness and situational fears. Finally, these lower-order factors load on a general higher-order factor that seems to be related to a negative affectivity factor (e.g., neuroticism).

This broader conceptualization of fears has implications for the understanding of fear of social and physical pain. First, fear of specific kind of pain (e.g., social) should be associated with, but distinct from, other pain-related fears (e.g., physical). This is also compatible with the notion that intense and repeated past experiences of one type of pain might selectively sensitize the individual toward that specific type of pain (see Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004). The second implication concerns the hierarchical structure of fears. Taylor's notion that, aside from general and specific factors, fears may also be caused by factors of intermediate specificity dimensions, implies that fear of pain might represent an intermediate level between more general factors (e.g., neuroticism) and more specific fears (e.g., fear of physical pain, fear of social pain, fear of material pain). Thus, it may well be the case that fear of social and physical pain are distinct fears, while both being related to a superordinate general "fear of pain" factor. Several recent findings seem to lend credibility to this hypothesis. MacDonald and Leary (2005) argue that people who score high on measures of neuroticism

have lower thresholds for both social and physical pain than those who are less anxious. Consistent with this argument, Eisenberger and colleagues (Eisenberger & Lieberman, 2005), showed that sensitivity to both social and physical pain are linked with common personality traits, such as neuroticism. Taken together, these findings suggest that neuroticism might constitute the general factor associated with more specific vulnerability toward social and physical pain (aside from other fears).

2.5. Instruments aimed to assess fears of physical and social pain

Following the growing relevance attributed to Fear-Avoidance models, a number of questionnaires have been developed to quantify physical pain-related fears, including the Fear of Pain Questionnaire (FPQ III, McNeil & Rainwater, 1998), the Fear-Avoidance Beliefs Questionnaire (FABQ), the Tampa Scale for Kinesiophobia (TSK), and the Pain Anxiety Symptoms Scale (PASS). Minor differences aside, these pain-related fear measures have been found to be highly correlated (Crombez, Vlaeyen, Heuts, & Lysens, 1999). However, no such measure has been developed in the broad context of social pain. Indeed, to date, no comprehensive instrument has been developed to assess individuals' fears toward a large variety of instances of social pain. Nevertheless, several conceptually similar instruments, or more specific scales (e.g., related to a specific instance of social pain), have been already validated.

For instance, the *Rejection Sensitivity Questionnaire* (RSQ) assesses the degree to which a person is sensitive to social rejection by others. The RSQ inquires about a series of social encounters that are neither positive nor negative, but that may or may not involve rejection,

depending upon the responder's typical anticipation of the course of such a social interaction. In the RSQ, individuals are asked to rate both their levels of concern and their expectations about several ambiguous social situations. Examples of items include: "You ask your parents or other family members to come to an occasion important to you"; "At a party, you notice someone on the other side of the room that you'd like to get to know, and you approach him or her to try to start a conversation."

There are several reasons why the construct of rejection sensitivity and the construct of fear of social pain would tap into different (yet related) psychological constructs. Indeed, rejection sensitivity focuses on the anticipation of outcomes of a series of ambiguous social situations. By contrast, fear of social pain focuses on the anticipation of clearly painful situations that can range from being betrayed by one's partner to feeling ignored by one's significant other. Therefore, fear of social pain focuses on a variety of explicitly painful experiences, rather than neutral social situations that may or may not be painful (based on the responders' expectations of the course of events). The focus is on the emotional reaction of the anticipation of a pain experience, rather than on the anticipation of a potentially ambiguous social situation, the outcome of which can expected to be either good (acceptance) or bad (rejection). Furthermore, the construct of social pain should be relatively broad to provide an overall score representing general fear of social pain. Such a construct should thus include experiences that are not limited to social rejection, such as relational devaluation, betrayal, ostracism, exclusion, humiliation and verbal abuse. Fear of social pain should be regarded as a broader concept than just rejection (e.g., rejection sensitivity), including events such as interpersonal loss and betrayal.

2.6. Overview of the present research

In the present set of studies, I assessed whether fear of social and physical pain reflect unitary psychological dimensions related to, but still distinct from, each other (see Study 1a), and whether both were associated with measures conceptually related to one of them (see Study 1b). Then, I tried to replicate previous findings that showed that the fear of physical pain could enhance the perception of physical pain (see Study 1c). Finally, I investigated whether fear of social pain could enhance the perception of social pain (see Study 1d).

Overall, these studies were designed to test the *common antecedents hypothesis* derived from pain overlap theories which posit an overlap between the affective components of social and physical pain (Eisenberger & Lieberman, 2005; Eisenberger, Lieberman & Williams, 2003; MacDonald & Learly, 2005). Thus, fear of pain should affect the pain perception of both types of pain in a similar way. This prediction is also in keeping with one postulate of pain overlap theory, that is, factors that regulate or potentiate one type of pain should have similar effect on the other type of pain (Eisenberger, 2010). I tested the hypothesis that, just as fear of physical pain enhances the perception of physical pain, fear of social pain should enhance the perception of social pain.

However, based on the hypothesis that fears are structurally related, yet distinct from each other (Taylor, 1998), and the premise that intense and repeated past experiences of one type of pain might selectively sensitize the individual toward a specific type of pain (see Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004), I predicted a *specificity effect* of each fear linked to a type of pain. First, I expected the two constructs (i.e., fear of social pain, fear of

physical pain) to be distinct psychological constructs. Furthermore, because of the specificity of the past experiences that might selectively enhance fear toward one type of pain, I expected fears of each pain type (e.g., physical) to be a stronger predictor of the perception of the same kind of pain (e.g., physical) rather than the other kind of pain (e.g., social).

More specifically, within the two main hypotheses (i.e., *common antecedents hypothesis* and the *specificity effect hypothesis*) the current set of studies was designed to test the following predictions:

1. Fears of one kind of pain are related to, yet distinct from, fears of the other type of pain. That is, individuals with high fear on one type of pain should also exhibit high fear on the other type of pain, but these two dimensions should be psychometrically distinguishable.
2. Variables related to one type of pain are also related to the other type of pain (e.g., rejection sensitivity will relate to both fear of social pain and fear of physical pain).
3. Individuals high in fear of one type of pain would be selectively more likely to suffer from that type of pain.

In order to test these hypotheses and predictions, and given the lack of an instrument aimed to assess fear of social pain, I developed and validated an ad hoc scale. Thus, across these studies, I also assessed different aspects of the validity of this ad hoc scale: internal validity (Study 1a), concurrent validity (Study 1b) and predictive validity (Studies 1c and 1d).

2.7. STUDY 1a

The aim of Study 1a was twofold. First, I investigated the internal validity of the construct of fear of social pain by generating a set of items conceptually related to this construct and assessing its psychometric quality (e.g., dimensionality). I also examined the degree of overlap between fear of social and physical pain. Based on pain overlap theories, I predicted that fear of social pain would be positively related to fear of physical pain. However, based on past distinctions between the two types of pain (Chen et al., 2008) and hierarchical conceptualizations of fears (Taylor, 1998), I also expected these two constructs to be psychometrically distinct from each other.

2.7.1. Method

Participants

Two-hundred and seventy-two students (135 women) at Purdue University volunteered to take part in the study to exchange course credits. The average age of the sample was 19.48 years (SD = 2.92).

Procedure and Materials

Participants were tested in individual cubicles in sessions lasting approximately 30 minutes. All the materials were presented via MediaLab (Jarvis, 2005), a computer program. Each participant completed a written informed consent form and a brief demographic questionnaire (e.g., including gender and age). Then participants completed a questionnaire

that included a set of items developed to assess fear of social pain and a subset of items taken from the Fear of Pain Questionnaire (FPP; McNeil & Rainwater, 1998).

Fear Of Social Pain Scale (FSP). Given the lack of a tool specifically aimed to assess the fear of social pain, items potentially related to this constructs were generated. An in deep investigation of topics related to social pain was performed by the author by reviewing the pertinent literature, examining instruments that evaluate similar constructs, and consulting with scholars who have written about the experience of social pain. Then, drawing on the item structure of the Fear of (physical) Pain Questionnaire (McNeil & Rainwater, 1998), I constructed a self-report scale that incorporated a variety of instances of social painful events (see Appendix A, item 1-15). Similar to the Fear of (physical) Pain Questionnaire (McNeil & Rainwater, 1998), items were structured as a sentence stem followed by a number of response options and utilizing a seven-point Likert scale format. Items content included feeling interpersonally devalued (Leary, Springer, Negel, Ansell, & Evans, 1998; Leary & Springer, 2001; Leary & Leder 2009); ostracism (Williams, 2001; Williams, 2009); social exclusion (Abrams, Hogg, & Marques, 2005); humiliation (Hartling, 2005; Oravecz, Hárdi, & Lajtai, 2004); betrayal (Fitness, 2001; Leary, Springer, Negel, Ansell, & Evans, 1998) and verbal abuse (i.e., being harmed by others with words; Björkqvist, 1994). The main aim was not to explore sub-dimensions in fears related to these instances of social pain, rather, to build a short scale that could provide a valid and reliable index of the fear of social pain.

Fear of Pain Questionnaire (FPP; McNeil & Rainwater, 1998). The FPQ-III is a 30 item self report instrument measuring fear of a variety of pain-related stimuli, grouped across three

painful stimulus situations: fear related to severe pain, fear related to minor pain, and fear related to medical pain. Items on this instrument are scored on a 7-point scale, ranging from 1 (not at all) to 7 (extreme). The instructions and the items presented to the participants are reported in Appendix A. As already mentioned, I decided to shorten the FPP scale for time constrain. I included in the present and in the following studies only a subset of 9 items from the original 30 items FFP questionnaire. The selection was obtained by retaining the three items that in the original validation study (McNeil & Rainwater, 1998) showed the highest factor loadings on each of the three domains of the Fear of Pain Questionnaire, obtaining a short version of the Fear of Pain Scale (9 items; see Appendix A, item 16-24). It has to be noted that for the purpose of the present project, I was interested in the use of the overall index of fear of physical pain (in order to compare it with fear of social pain) rather than in its specific sub-dimensions (e.g., severe pain, minor pain, medical pain). Different indices can be obtained from the Fear of Pain Questionnaire, nevertheless, the primary focus of this study is the overall fear of pain scores, which reflects the level of physical pain-related fear reported by participants. The overall score is obtained by averaging all the 9 item selected for each of the sub-dimensions (severe pain, minor pain, medical pain).

2.7.2. Results

Item Reduction. A pilot study was conducted to identify a set of items from the twenty five items initially generated. Forty-five students (21 women; 19.76 years (SD = 2.34) at Purdue University took part in a preliminary study to exchange course credits. Ten items were dropped from the original set of twenty-five items. Specifically, three items were removed because they

demonstrated a ceiling effect (they included items related to the fear of social pain caused by the death of a loved one), whereas the remaining seven items were dropped because of conceptual overlap and varying degrees of redundancy with the content in other items. The final FSP scale consisted of 15 items, with four items related to relational devaluation (e.g., "your partner forgetting your birthday"), three items related to ostracism (e.g., "feeling ignored by someone who is important to you"), two items related to rejection (e.g., "being left out of a group"), two items related to betrayal (e.g., "being betrayed by someone who is important to you"), two items related to humiliation (e.g., "being embarrassed in front of your classmates by your professor"), and two items related to verbal abuse (e.g., "being verbally abused by your boss") (see Appendix A). A version of the Fear of Social Pain scale is available from the author.

Data management. The sum of both scales was calculated and then divided by the number of items to yield a mean fear of social pain and a fear of physical pain score. The means, standard deviations, and corrected item total correlations of the items are presented in Table 1 & 2. The two subscales also were tested for normality. The Fear of Social Pain Scale had a skewness of -.437 (SE = .148), kurtosis of −.288 (SE = .294). The Kolmogorov-Smirnov test has come out as nearly significant ($D(272) = .51$, $p = .082$), suggesting a tendency of a deviation from normality. However, the Fear of Physical Pain Scale had a skewness of .365 (SE = .148), kurtosis of −.218 (SE = .294) and the Kolmogorov-Smirnov test was significant ($D(272) = .58$, $p < .026$), indicating that it was significantly non-normal. Therefore, the following analyses were conducted with both the original data and with log-transformed data (Tabachinick & Fidell, 2005). The results were equivalent in both cases, thus the original form was kept for ease of interpretation.

Table 1. Means, standard deviations, and corrected item total correlations of the 15 items of the Fear of Social Pain Scale.

	Mean	Std. Deviation	Corrected Item-Total Correlation
FSP1	3.94	1.762	.680
FSP2	3.62	1.771	.716
FSP3	3.54	1.723	.712
FSP4	3.54	1.699	.717
FSP5	5.61	1.673	.658
FSP6	5.01	1.691	.786
FSP7	4.96	1.905	.749
FSP8	4.02	1.898	.686
FSP9	4.15	2.050	.619
FSP10	4.23	2.092	.711
FSP11	4.15	2.076	.694
FSP12	5.45	1.900	.721
FSP13	4.02	1.864	.703
FSP14	4.36	2.052	.693
FSP15	3.98	1.941	.747

Table 2. Means, standard deviations, and corrected item total correlations of the 9 items of the Fear of Physical Pain.

	Mean	Std. Deviation	Corrected Item-Total Correlation
FPP1	3.75	1.967	.805
FPP2	3.93	1.980	.807
FPP3	5.14	2.012	.824
FPP4	2.14	1.483	.819
FPP5	2.04	1.495	.819
FPP6	2.38	1.584	.818
FPP7	3.03	2.086	.820
FPP8	2.72	1.968	.812
FPP9	2.99	1.917	.820

Factor Analysis. To investigate the dimensionality of the two subscales, a Principal Axis Factors was performed on the scores of the 24 items (resulting from the 15 fear of social pain items and the 9 fear of physical pain items). Two indices suggested that the overall set of items from this sample were appropriate for Principal Axis Factors (Tabachnick & Fidell, 2001): Kaiser's Measure of Sampling Adequacy was 0.897 and Bartlett's test of sphericity was significant, $\chi 2(276) = 4846.73$, $p < .001$. Principal Axis Factors was chosen based on early guidelines on exploratory factor analytic techniques (Fabrigar, Wegener, MacCallum, Strahan, 1999; Costello & Osborne, 2005) which recommend this extraction technique (in Spss known as Principal Axis Factors) when data are not normally distributed. Data were then subjected to an oblimin (oblique) rotation, (Tabachnick & Fidell, 2001), requiring two factors, and allowing the factors to correlate with each other. These methodological choices (i.e., principal-axis factoring with oblimin rotations) were highly consistent with those adopted in the validation process of the Fear of (physical) pain questionnaire (Osman, Breitenstein, Barrios, Gutierrez & Kopper, 2002).

The requested two-factor solution accounted for 51.77% of the variance. As shown by Table 3, the two-factor solution can be interpreted as comprising factors related to Fear of Social Pain (factor 1) and Fear of Physical Pain (factor 2). Simple structure was good, with no cross-loading items. Indeed, if items with factor loadings greater than .40 can be considered significant (Hatcher, 1994), in the case of the present scale, all items had a factor loading greater than .50 on one factor and less than .20 on the other factor, suggesting good internal validity of the two factors solution.

Internal consistency. To determine the internal consistency of the fear of pain subscales, based on the items that loaded on each factor, Cronbach's alpha was calculated to estimate the internal reliability of the two scale. The 15 items set of fear of social pain had an excellent alpha reliability coefficient, 0.943. The 9 items set of the fear of physical pain had a good alpha reliability coefficient of .833. Indeed, according to Nunnally (1978), alpha coefficients greater than .90 are considered indicative of an excellent level of internal consistency, whereas alpha coefficients greater than .80 are considered indicative of a good level of internal consistency, suggesting that a satisfactory level of internal consistency was reached on both the adopted scales .

Correlation between fear of social and physical pain. As predicted, supporting my hypothesis, the two scales correlated well with each other, $r = .436$, $p < .001$, (two tailed). Thus, high fears of one type of pain are related to high fear of the other type of pain. The alpha coefficient for the Fear of Pain total (24 items) was 0.928, further corroborating the reliability of this measure. Therefore, considered together, these findings suggest that fear of social and physical pain are distinct dimensions of a more general, underlying, fear of pain.

Table 3. Factor loads obtained from PAF of the 24 fear of social and physical pain items.

		Factor 1	Factor 2
1	being left out of a group.	**.774**	-.105
2	being ignored during a party.	**.843**	-.173
3	being ignored during a conversation.	**.842**	-.167
4	being excluded from a conversation.	**.837**	-.147
5	being betrayed by someone who is important to you.	**.655**	.031
6	feeling ignored by someone who is important to you.	**.801**	.004
7	someone who is important to you stops talking to you.	**.736**	.061
8	not being invited to a party organized by your friends.	**.665**	.095
9	being verbally abused by a family member.	**.552**	.160
10	your partner forgetting your birthday.	**.671**	.111
11	your spouse/partner forgetting your anniversary.	**.667**	.068
12	being betrayed by your partner.	**.690**	.101
13	being embarrassed in front of your classmates by your professor.	**.657**	.122
14	your professor telling at you that you are an incompetent student.	**.629**	.156
15	being verbally abused by your boss.	**.707**	.111
16	breaking your arm.	.013	**.724**
17	breaking your leg.	.065	**.683**
18	breaking your neck.	.133	**.503**
19	hitting a sensitive bone in your elbow - your "funny bone".	-.005	**.603**
20	getting a paper-cut on your finger.	-.066	**.614**
21	getting strong soap in both eyes while bathing or showering.	.063	**.575**
22	having a blood sample drawn with a hypodermic needle.	-.006	**.508**
23	receiving an injection in your arm.	-.015	**.556**
24	receiving an injection in your hip/buttocks.	.006	**.476**

2.7.3. Discussion

Study 1a had two main objectives. First, it was meant to investigate the internal validity of the construct of fear of social pain. Second, by testing whether fear of social pain and fear of physical pain were related to each other, it represented the first test of the *common antecedents hypothesis*.

Analysis of alpha reliability coefficients showed that the present item set of the fear of social pain represented a one-dimensional construct. Scores obtained for those items support cross-situational consistency of fear-related reactions to a variety of situations involving social pain. The same analysis on the short version of the fear of physical pain scale indicated good internal validity as well. Furthermore, principal-axes factoring on the responses indicated that the items related to fear of social pain and those related to fear of physical pain yielded two distinct, yet correlated, dimensions.

Furthermore, the association between scores on fear of social pain and scores on fear of physical pain provided initial support for the *common antecedents hypothesis*: individuals' fears of one type of pain were related to fears of the other type of pain. This finding is compatible with the set of predictions posited by pain overlap theories. However, the results of this study indicated they were factorially distinct from each other. This is consistent with hierarchical conceptualizations of different types of fears (Taylor, 1998).

2.8. STUDY 1b

Study 1b aimed to evaluate convergent and discriminant validity of the construct of fear of social pain. In doing so, I examined the degree to which the present operationalization of fear of social pain is similar to other operationalizations that should be conceptually related to it (e.g., rejection sensitivity; Downey & Feldman, 1996). At the same time, I investigated the degree to which the fear of social pain represents a psychometrically distinct—rather than redundant—measure of these pre-existing constructs that are theoretically related to it. Therefore, I tested whether the fear of social pain is related to, but not fully redundant with, similar constructs. Significant, but moderately low, correlations would be evidence of both convergent and divergent validity.

Furthermore, by examining whether fear of social pain is associated with known scales for their relationship to fear of physical pain and vice versa (i.e., fear of physical pain associated with scales theoretically related to fear of social pain), I further tested the idea that fears of these two types of pain are intertwined with one another and with their conceptually-related constructs. Once again, I also expected a *specificity effect*: variables known to be more related to one type of pain should be more related to it than to the other type of pain.

2.8.1. Method

Participants

A total of 146 undergraduates (90 women) at Purdue University participated in exchange for course credit. Mean age was 19.41 (SD = 3.71).

Procedure and Materials

After completing the written informed consent form and demographic information, participants were asked to fill out a questionnaire package composed of the following self-report measures.

Fear Of Social Pain Scale. The 15-item set developed in Study 1a aimed to assess fear of social pain instances (see Appendix A, items 1-15). Cronbach's α was .936.

Fear of Pain Questionnaire (FPP; McNeil & Rainwater, 1998). The FPP is a 30-item instrument aimed at detecting fear of physical pain among individuals. For the present study the same subset of 9 items used in Study 1a was selected (see Appendix A, items 16-24). Cronbach's α was .847.

Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996). The RSQ is an 18-item self-report measure that assesses individuals' level of rejection sensitivity. It consists in a series of 18 scenarios each of which is rated on two dimensions: the degree of anxiety or concern about the outcome and the expectations of acceptance or rejection (see Appendix B). Cronbach's α was .819.

Short Scale for Measuring Loneliness (SSML; Hughes, Waite, Hawkley, & Cacioppo, 2004). The SSML consist in a simplified version of the loneliness scale (Russell, 1996), it has 3 items and a simplified set of response categories (see Appendix C). It has been shown that the SSML has satisfactory reliability and both convergent and discriminant validity (Hughes, Waite, Hawkley, & Cacioppo, 2004). Cronbach's α was .864.

Beck Depression Inventory (Second Edition; BDI-II; Beck, 1996). The BDI is a 21-item self-report instrument projected to assess the existence and severity of symptoms of depression. When presented with the BDI-II, responders are asked to consider each statement as it relates to the way they have felt for the past two weeks (see Appendix D). Cronbach's α was .874.

Pain Catastrophizing Scale (PCS; Sullivan et al., 1995). The PCS is a 13-item measure of designed to assess the catastrophising cognitions of individuals. Responders are asked to think on past painful experiences and to rate the degree to which they experienced each of the 13 thoughts or feelings during pain (see Appendix E). Cronbach's α was .917.

Pain History Social. The PHS is a three items ad-hoc composed index of past experience of social pain. It has a six category response scale (from "Completely untrue of me" to "Describes me perfectly") and it contains the following items: "In the past, people have not been there to give me warmth, comfort, and affection"; "In the past, I often felt excluded and ignored"; "In the past, I haven't felt that I am special to someone" (see Appendix F). Cronbach's α was .714.

Pain History Physical. The PHP is a three items ad-hoc composed index of past experiences of physical pain. It has the same six category response scale of PHS, and it contains the following items: "In the past, I have suffered a lot from illness and injury"; "In the past, I have suffered much physical pain"; "In the past, I often had pain in my body" (see Appendix F). Cronbach's α was .882.

2.8.2. Results

Correlations Among Measures. I first computed zero-order correlations among measures to determine the relation the relation between these theoretically-relevant measures. The results generally indicated significant (positive) relations between measures. The correlation matrix is provided in Table 4.

Fear of Social Pain. In keeping with findings of Study 1a, fear of social pain and fear of physical pain were significantly correlated ($r = .434$, $p < .001$). Moreover, fear of social pain was significantly correlated with social measures, such as rejection sensitivity ($r = .278$, $p < .05$), loneliness ($r = .332$, $p < .001$), and depression ($r = .306$, $p < .001$). Fear of social pain was also significantly correlated with pain measures, such as pain catastrophizing ($r = .340$, $p < .001$), and past experiences of social pain ($r =.234$, $p < .001$). However, the association between fear of social pain and past experiences of physical pain was only marginally significant ($r = . 127$, $p = .070$)

Fear of physical pain. In keeping with findings on fear of social pain, fear of physical pain was significantly correlated with social measures, such as rejection sensitivity ($r = .306$, $p < .05$), loneliness ($r = .153$, $p < .05$), and depression ($r = .223$, $p < .05$). Fear of physical pain was also significantly correlated with pain measures, such as pain catastrophizing ($r = .303$, $p < .001$), and both past experiences of social pain ($r = .151$, $p < .05$) and past experiences of physical pain ($r =.140$, $p < .05$).

Table 4. Variables assessed in the present study: Means, standard deviations and zero-order correlations between variables.

	Fear Of Social Pain	Fear Of Physical Pain
Fear Of Social Pain Scale	-	.434**
Fear Of Physical Pain Scale	.434**	-
Rejection Sensitivity Questionnaire	.278*	.306*
Short Scale for Measuring Loneliness	.332**	.153*
Beck Depression Inventory II	.306**	.223**
Pain Catastrophizing Scale	.340**	.303**
Pain History Social	.234**	.151*
Pain History Physical	.127	.140*

Notes: Significance levels of correlations are denoted by **, $p < 0.01$ (two tailed) and *, $p < 0.05$ (two tailed).

2.8.3. Discussion

The aims of Study 1b were to (a) investigate convergent and discriminant validity of the construct of fear of social pain and to (b) further test the *common antecedents hypothesis*.

First, evidence for the convergent and discriminant validity of the Fear of Social Pain scale and other theoretically relevant constructs (e.g., rejection sensitivity) can be gleaned by assessing whether fear of social pain was significantly correlated with these constructs but not fully overlapping with them. Scores on the Fear of Social Pain scale were significantly correlated with scores on the Rejection Sensitivity Questionnaire, the Short Scale for Measuring Loneliness and the Beck Depression Inventory, indicating a certain degree of overlap between these conceptually-related constructs. However, the strength of coefficients between variables

ranged from low to moderate, suggesting that the Fear of Social Pain Scale, rather than being a redundant construct with already existing ones, taps into a distinct psychological dimension.

Second, examination of the correlation matrix reveals a significant degree of overlap among fear of social and physical pain with social pain (e.g., rejection sensitivity) and physical pain (e.g., pain catastophyzing) measures. First, similar to what I found in Study 1a, fear of social pain and fear of physical pain correlated with each other, accounting for 19% of the variance. Furthermore, constructs that were associated with fears of one type of pain were also related to fears of the other type of pain. For instance, tendency toward pain catastophyzing, a construct traditionally associated with fear of physical pain, was also related to fear of social pain. Likewise, rejection sensitivity, a construct seemingly related to fear of social pain, was also related to fear of physical pain. These findings provide further support for the *common antecedent hypothesis*.

2.9. STUDY 1c

Study 1a found that fears of social and physical pain are two related—yet distinct—psychological dimensions. Study 2a found that these two relates to one another as conceptually similar constructs. Finally, Studies 1c and 1d were designed to test the ability of the two dimensions to predict self-reported pain experienced during an actual experience of physical or social pain.

Study 1c was designed to replicate patterns of findings reported in the medical literature (e.g., George, Dannecker & Robinson, 2006; Katz, Martin, Pagé & Calleri, 2009).

Specifically, I tested the hypothesis that high levels of fear of physical pain would predict greater perception of physical pain.

2.9.1. Method

Participants

Sixty-three students in an introductory psychology course at Purdue University (30 females; mean age = 18.87; SD = 1.14) took part in physical pain manipulation. Participants volunteered to take part in the experimental procedures in exchange for course credit.

Procedure and Materials

Participants were tested individually in sessions lasting approximately 45 minutes. All the materials were presented via the MediaLab computer program (Jarvis, 2005).

In keeping with previous paradigms developed to study the effects of social pain (Williams et al., 2000), participants were told that the study was investigating the effects of mental visualization. They were informed that they would be asked to fill out some personality measures, take part in a mental visualization exercise, and then evaluate their mental visualization experience.

Pre-manipulation measures. Participants were asked to complete their demographic information and a package of questionnaires, which included the 15-item set of the Fear of Social Pain (Cronbach's α .923), the 9-item subset related to the Fear of Physical Pain Questionnaire (FPP; McNeil & Rainwater, 1998; Cronbach's α .871), the Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996; Cronbach's α .786) and a personality measure

(included as a filler immediately before the experimental manipulation). The Rejection Sensitivity questionnaire was included in order to assess the specificity of the predictive ability of the construct of fear of social pain. The personality measure was included as a filler, in order to reduce the number of items related to social or physical pain (e.g., fear of pain, rejection sensitivity) that were included in the pre-manipulation package in both experimental procedures. The order of the presentation of items in each questionnaire was randomized. The order of these four measures was counterbalanced, except for the personality measure that came always as last, right before each manipulation.

Physical pain manipulation. During an ostensibly separate study, participants completed a standard physical pain induction manipulation (i.e., *cold pressor task*; Mitchell, MacDonald, & Brodie, 2004). Participants were told that the task was aimed at practice their mental visualization abilities. To engage mental visualization processes, participants were instructed to create in their mind a complete mental picture of what might be going on if they were doing the task (e.g., having their hand in a bucked of water) in real life. Participants were randomly assigned to place the non-dominant hand up to their wrist into a bucket of water maintained either at a cold temperature (41°F-42°F; the physical pain induction) or to room temperature (75°F-80°F; the physical pain control). Subjects were told they could remove the hand at any time if the distress of the experience became too intense. The duration of exposure to the water was recorded (a video surveillance allowed the experimenter, without being in the same room, to register the amount of time participants kept their hand in the water). However, in order to standardize the amount of physical stimulation, participants were asked to try to keep their hand inside the cold water for one minute, an amount of time usually well tolerated by

subjects. Indeed, most studies use up to five minutes as the maximum exposure time (e.g., von Baeyer et al., 2005; Williams and Thorn, 2005; Turk, Meichenbaum, & Genest, 1987), so the duration of 1 minute is well within the commonly used time limit to prevent an excessive discomfort.

Post-manipulation measure. After performing the physical pain manipulation, participants were asked to fill the Numerical Rating Scale (NRS-11, Hartrick, Kovan, Shapiro, 2003). The NRS-11 is a 11-point numerical scale upon which participants rate the unpleasantness (0 = not unpleasant, 10 = most unpleasant experience imaginable) and the intensity (0 = not at all intense, 10 = most intense imaginable) of the noxious stimulation they had received.

Following the completion of the experiment, participants were thoroughly thanked and debriefed.

2.9.2. Results

First, the independence between levels of fear of physical pain from the experimental manipulation (i.e., cold pressor task) was checked. As expected on the basis of random assignment of participants to the experimental condition, the main effect of the water temperature on levels of fear of physical pain was not significant, $t(61) = .54$, $p = .585$. Therefore, the average levels of hypothesized predictor (i.e., fear of physical pain) were roughly the same across the subsequent experimental manipulations.

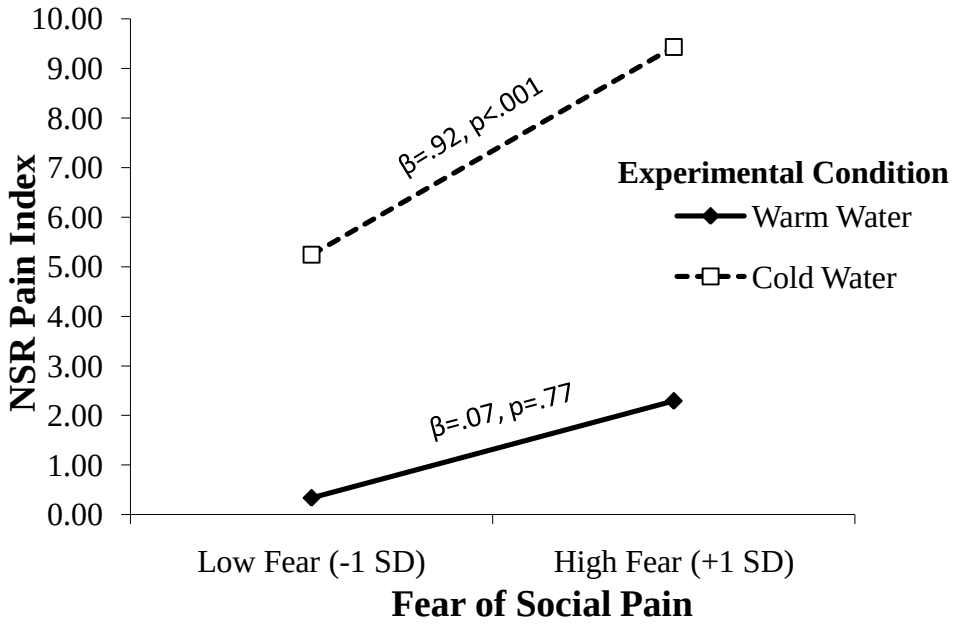
The influence of the physical pain manipulation (warm water vs. cold water; recoded as 0 and 1 respectively) and of the fear of physical pain on reported pain was explored with a series of hierarchical multiple regressions. Physical pain manipulation and fear of physical pain were entered at a first step; in the second step, a product term representing physical pain manipulation × fear of physical pain interaction was introduce. The continuous variable fear of physical pain was centered before the analyses computation. Table 5 summarizes the results of the regression analysis for the dependent variable. As revealed by the analyses, while the physical pain manipulation proved to be a predictor of the participants' pain report, the fear of physical pain per se did not. Hence, confirming my manipulation of physical pain, induction of physical pain resulted in high levels of self-reported pain compared to the control condition. However, the analyses revealed a significant interaction physical pain manipulation × fear of physical pain. The slope analysis for unstandardized solution plotted in Figure 1 showed that, in cold water condition, the fear of physical pain was significantly related to the reported pain (β=.92, p<.001) whereas in control condition (i.e., warm water) it was not (β=.07, p=.77).

Then, the specificity of the effect (i.e., fear of physical pain in predicting the experience of physical pain) was controlled by considering other predictors in the series of hierarchical multiple regressions. The same procedure of the previous analyses was adopted. When fear of social pain or rejection sensitivity—rather than fear of physical pain—were included in the analyses, the physical pain manipulation remained the only significant predictor of the participants' pain report (see Table 6 & 7).

Table 5. Fear of physical pain predicting the experience of physical pain (dependent variable: NRS-11)

	Physical Pain					
Predictors	R^2	F (Sig)	β	*β*	t	Sig
First step	.75	95.104(.001)				
Physical Pain Manipulation			6.01	.83	13.12	.001
Fear of Physical Pain			.57	.20	3.29	.002
Second step	.77	71.188(.001)				
Physical Pain Manipulation			6.02	.83	13.74	.001
Fear of Physical Pain			.07	.02	.28	.774
Physical Pain Manipulation X Fear of Social Pain			.84	.23	2.52	.014

Figure 1. The effect of fear of physical pain in the perception of physical pain



Study 1c: Participants high in fear of physical pain perceived high levels of pain intensity and unpleasantness when physical pain was inducted. When physical pain was absent, fear of social pain did not affect the pain perception.

Table 6. Fear of social pain predicting the experience of physical pain (dependent variable: NRS-11)

	Physical Pain					
Predictors	R^2	F (Sig)	β	*β*	t	Sig
First step	.71	79.991(.001)				
Physical Pain Manipulation			6.07	.84	12.46	.001
Fear of Social Pain			.34	.10	1.51	.135
Second step	.71	53.770(.001)				
Physical Pain Manipulation			6.07	.84	12.47	.001
Fear of Social Pain			.09	.02	.29	.769
Physical Pain Manipulation X Fear of Social Pain			.47	.10	1.04	.301

Table 7. Rejection Sensitivity predicting the experience of physical pain (dependent variable: NRS-11)

Predictors	R^2	F (Sig)	β	*β*	t	Sig
First step	.73	82.711(.001)				
Physical Pain Manipulation			5.91	.81	12.02	.001
Rejection Sensitivity			.15	.13	1.95	.055
Second step	.74	56.271(.001)				
Physical Pain Manipulation			6.01	.83	12.14	.001
Rejection Sensitivity			-.02	-.02	-.16	.872
Physical Pain Manipulation X Rejection Sensitivity			.23	.17	1.27	.206

2.9.3. Discussion

In the present experiment, participants were randomly assigned to submerge their hand in either cold water or room temperature water. In line with previous studies (e.g., George, Dannecker & Robinson, 2006; Katz, Martin, Pagé & Calleri, 2009), I found that greater fear of physical pain predicted higher self-reported pain during the procedure. This effect was specific to fear of physical pain: when concurrent predictors, such as fear of social pain or rejection sensitivity, were entered into the regression analyses, they were not significant predictors of physical pain perception.

2.10. STUDY 1d

Study 1d tested the hypothesis that—similar to what happens in physical pain—high levels of fear of social pain would predict greater perception of social pain. In doing so, Study 1d represents the ultimate test of the *common antecedents hypothesis*: factors that are known to regulate the perception of one type of pain should also regulate the perception of the other type of pain.

2.10.1. Method

<u>Participants</u>

One hundred and thirty-six students in an introductory psychology course at Purdue University (58 female, mean age = 19.16; SD = 1.39) volunteered to take part in social pain manipulation in exchange for course credit.

Procedure and Materials

Participants were tested in individual cubicles in sessions lasting approximately 45 minutes. All materials were presented via the MediaLab computer program (Jarvis, 2005). Similar to Study 1c and previous studies that used the present social pain manipulation (i.e., Cyberball; Williams et al., 2000), participants were told that the study was investigating the effects of mental visualization. They were informed that they would be asked to fill out some personality measures, take part in a mental visualization exercise, and then evaluate their mental visualization experience.

Pre-manipulation measures. The same measures adopted in Study 1c were adopted in the present study. Participants completed the 15-item subset of the Fear of Social Pain scale (Cronbach's α = .923), the 9-item subset of the Fear of Physical Pain Questionnaire (FPP; McNeil & Rainwater, 1998; Cronbach's α = .859), the Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996; Cronbach's α = .839) and a personality measure (included as a filler immediately before the experimental manipulation).

Social pain manipulation. During an ostensibly separate study, participants completed a standard social pain induction manipulation (i.e., Cyberball; Williams, Cheung, & Choi, 2000). As in Study 1c, participants were told that the task was designed to practice their mental visualization abilities. To engage mental visualization processes, participants were instructed to create in their mind a complete mental picture of what might be going on if they were doing the task (e.g., playing Cyberball) in real life. Cyberball is designed to resemble an on-line game that users access through a network connection. Participants are told that they will engage in a

ball-throwing game with two players, ostensibly real participants (Williams et al., 2000). In actuality, the two computer characters that appear on the screen are computer players, programmed to either to include or exclude the real participant from the game. In the ostracism condition, after a few throws, the two computer players stop throwing the ball to the actual participant for the remainder of the game. In the inclusion condition, the computer players throw the ball to the actual participant for approximately one-third of the total tosses (Williams et al., 2000). Cyberball has been validated as a social pain manipulation in many different studies (e.g., Eisenberger et al., 2003), and was used in this study in the same manner (Williams & Jarvis, 2006).

Post-manipulation measure. After performing the social pain manipulation, participants completed the Numerical Rating Scale (NRS-11, Hartrick, Kovan, & Shapiro, 2003).

2.10.2. Results

The independence between levels of fear of social pain from the experimental manipulation (i.e., Cyberball) was checked. The main effect of inclusionary status on levels of fear of social pain was not significant, $F(134) = .645$, $p = .520$. Therefore, the average levels of participants' hypothesized predictor (i.e., fear of social pain) were equivalent across the subsequent experimental manipulations.

The influence of fear of social pain and the social pain manipulation (social inclusion vs. social exclusion, coded as 0 and 1, respectively) on reported pain was explored with a series of hierarchical multiple regressions. Crucially, for the present study, the pattern of results for the social pain condition (fear of social pain predicting experiences of social pain) was consistent

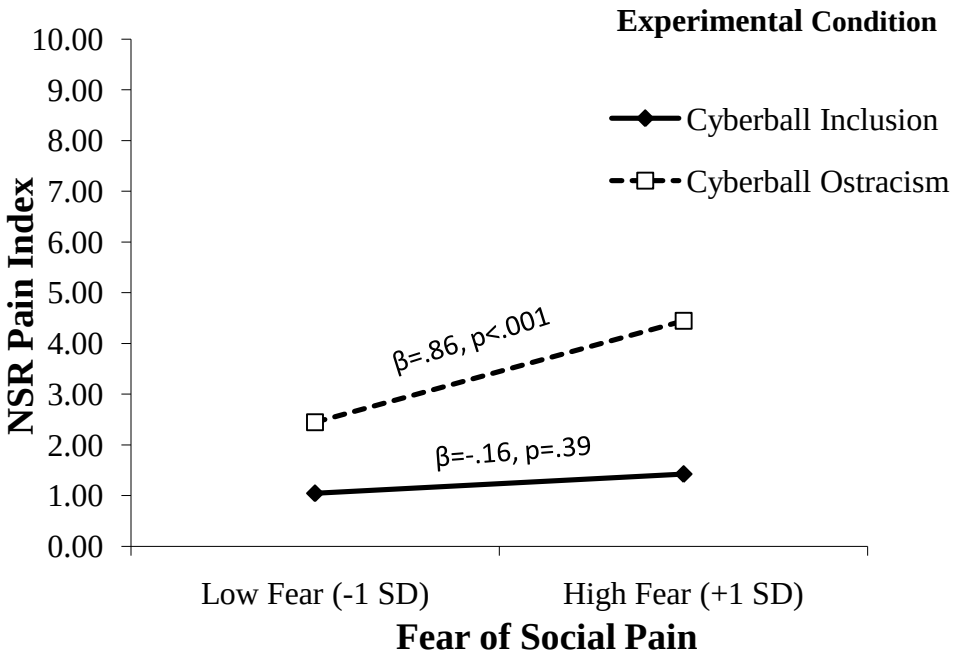
with results on physical pain (see Study 1c). As revealed by the analyses, while the social pain manipulation proved to be a predictor of the participants' reported pain, fear of social pain did not (see Table 8). Verifying the manipulation, induction of social pain resulted in higher levels of self-reported pain compared to the control condition. However, these results were qualified by a significant interaction between social pain manipulation and fear of physical pain. The slope analysis for the unstandardized solution plotted in Figure 2 shows that, in the social pain condition, the fear of social pain was significantly related to the reported pain (β=.86, p<.001), whereas in the social inclusion condition (i.e., social inclusion), it was not (β=-.16, p=.39).

Finally, the specificity of this effect (i.e., fear of social pain in predicting the experience of social pain) was controlled for in a series of hierarchical multiple regressions. When fear of physical pain (instead of fear of social pain) was included in the analysis, the social pain manipulation remained the only significant predictor of the participants' pain report (see Table 9). The same occurred when scores on the RSQ were included in the analysis (see Table 10).

Table 8. Fear of social pain predicting the experience of social pain (dependent variable: NRS-11)

Predictors	R^2	F (Sig)	β	*β*	t	Sig
First step	.30	31.192(.001)				
Social Pain Manipulation			2.21	.47	6.60	.001
Fear of Social Pain			.48	.24	3.35	.001
Second step	.33	23.604(.001)				
Social Pain Manipulation			2.21	.47	6.71	.001
Fear of Social Pain			.16	.08	.85	.393
Social Pain Manipulation X Fear of Social Pain			.69	.23	2.46	.015

Figure 2. The effect of fear of social pain in the perception of social pain



Study 1d: Participants high in fear of social pain perceived higher levels of pain intensity and unpleasantness when social pain was induced. When social pain was absent, fear of social pain did not affect pain perception.

Table 9. Fear of physical pain predicting the experience of social pain (dependent variable: NRS-11)

Predictors	R^2	F (Sig)	β	*β*	t	Sig
First step	.27	25.515(.001)				
Social Pain Manipulation			2.31	.49	6.72	.001
Fear of Physical Pain			.22	.12	1.68	.094
Second step	.28	17.577(.001)				
Social Pain Manipulation			2.31	.49	6.74	.001
Fear of Physical Pain			.06	.03	.33	.737
Physical Pain Manipulation X Fear of Physical Pain			.32	.12	1.23	.222

Table 10. Rejection Sensitivity predicting the experience of social pain (dependent variable: NRS-11)

Predictors	R^2	F (Sig)	β	*β*	t	Sig
First step	.27	18.264(.001)				
Social Pain Manipulation			2.36	.47	5.43	.001
Rejection Sensitivity			.15	.21	2.52	.013
Second step	.28	13.000(.001)				
Social Pain Manipulation			2.37	.47	5.48	.001
Rejection Sensitivity			.02	.02	.16	.873
Social Pain Manipulation X Rejection Sensitivity			.19	.23	1.44	.153

2.10.3. Discussion

In the current experiment, participants were randomly assigned to be ostracized or included. Otherwise, participants followed the same procedure of Study 1c. Consistent with the main hypothesis of this set of studies, people with higher levels of fear of social pain were more likely to suffer more social pain.

2.11. GENERAL DISCUSSION

As an ancient German proverb states: “Fear makes the wolf bigger than he is.” The current set of studies supported this observation: I found that fear of social and physical pain increase the perception of both type of threats. Yet, I also found a specific type-related effect, such that the specific type of pain one fears (e.g., physical) influences the perception of the related type of pain (e.g., physical) but not the other (e.g., social). Thus, I provided evidence for an underlying general process (the role of fear in increasing the perception of pain) but also evidence for specificity of paths that link the fear of one type of pain to increased perception of the same type of pain.

The current investigation was based on early medical research works documenting that fear of pain was one of the most important predictors of the experience of physical pain (McCracken, Zayfert & Gross, 1992; Asmundson & Stein, 1994). These studies found that fear of pain plays a significant role in accounting for why individuals vary in pain perception and their response to pain (Fillingim, 2005). Several recent empirical investigations showed that the fear of (physical) pain has an influence on acute pain intensity above and beyond other psychological predictors or demographic variables (e.g., pain catastrophizing, sex, age; see

George, Dannecker, & Robinson, 2006; Bradley, Silakowski, & Lang, 2008; Katz, Martin, Pagé, & Calleri, 2009). In light of the recently proposed theoretical framework provided by the pain overlap theories (Eisenberger & Lieberman, 2004; MacDonald & Learly, 2005), these findings suggest that (1) fear of physical pain would be associated with fear of social pain; (2) factors related to the fear of one type of pain would also be related to fear of the other type of pain and (3) individuals with higher fear of social pain would perceive social threats as more painful. Furthermore, based on the assumption derived from pain overlap theory that variables that are known for their role in regulating or potentiating one type of pain should produce a similar effect on the other type of pain (Eisenberger, 2010), I expected that fear of pain should be an antecedent of both social and physical pain (*common antecedents hypothesis*).

Accordingly, I found that fear of social pain and fear of physical pain are related. This finding is compatible with early studies on fear of physical pain, which found that fears of physical pain were associated with social anxiety and social phobias. For instance, Philips and Jahanshahi (1986) asked participants to complete the Pain Behaviour Checklist (PBC; Zarkowska, 1981), a checklist of 49 items representing several behavioral dimensions. The analyses showed that six factors emerged and accounted for 42.6% of the total scale variance. Remarkably, the strongest factor was that of social avoidance or social withdrawal (that included items such as “Avoid party-going,” “Avoid having visitors,” “Avoid cinema”) which accounted for 21.6% of the variance. Furthermore, a study conducted by Asmundson, Jacobson, Allerdings and Norton (1996) assessed the prevalence and impact of social phobia and other anxiety disorders in disabled workers with chronic musculoskeletal pain. Comparing chronic pain patients and patient controls, the authors found that social phobia was over-represented

among patients with chronic musculoskeletal pain. Several years after these studies were conducted, their findings can be reconsidered in light of the pain overlap theories (Eisenberger & Lieberman, 2004; MacDonald & Learly, 2005). Indeed, if social pain and physical pain share part of the same neural system, the sensitization toward one type of pain should be associated with some degree of sensitization toward the other type of pain. Likewise, I found that dimensions traditionally associated with fear of one type of pain showed some degree of overlap with fear of the other type of pain. For instance, pain catastrophizing tendencies are known to be associated with fear of physical pain, but they appear to be associated with fear of social pain as well. The same pattern was true of factors conceptually related to fear of social pain (e.g., rejection sensitivity). Thus, these two dimensions (i.e., fears of social and physical pain) both relate to other's conceptually similar constructs. Finally, I found support for the *common antecedents hypothesis*, that fear of pain is a predictor of both social and physical pain.

Aside from supporting the *common antecedents hypothesis*, the present results also suggest a *specificity effect* in that each fear was able to predict its associated type of pain. Indeed, I found that fear of social and physical pain uniquely predicted the perception of its associated pain. By showing the specificity of the link between the fear of one type of pain and the selectively increased perception of the same type of pain, I found support for hierarchical models of fears, namely that different fears are structurally related yet distinct from each other (Taylor, 1998). The *specificity effect* indicates that the increased perception of one type of pain is not due to a general fear, or a general sensitivity trait, rather, it is specific to the type of pain. However, the fact that I did not find significant cross-over effects could be due to the small size

of the sample. Future research should investigate cross-over effects such as that between fear of physical pain and social pain perception and that between fear of social pain and physical pain perception.

Overall, the present findings provide insight as to why one person might perceive a social injury (e.g., humiliation) as unbearably painful, whereas another person might perceive the identical social injury as minimally painful. These results also enhance our understanding of why some people express a negative or antisocial response after being socially excluded, whereas others make attempts to be re-included (Maner et al., 2007; DeWall, Baumeister & Schaller, 2007). Indeed, individual differences in pain perception might moderate the relationship between social pain and reactions. Individuals with high levels of fear of social pain experience higher levels of pain during social separations; given the degree of pain they feel after social exclusion, they may be more likely to avoid, rather than seek, novel social connections. Future studies should investigate whether pain intensity partially or fully mediates the relationship between fear of pain and avoidance tendencies; previous studies seem to support this interpretation. For instance, Garner et al. (2006) found that when participants were not under threat of evaluation, those with high social anxiety did not differ from those with low social anxiety in attention to faces. But in anticipation of a socially evaluative task, individuals with low social anxiety fixated longer on emotional faces (positive and negative) relative to neutral ones, whereas people with high social anxiety did not demonstrate this bias.

The present findings have several strengths and implications for pain management. First, studies on pain-free individuals are particularly relevant in understanding elements

involved in pain maintenance. Indeed, early studies on fear-avoidance models of pain were typically conducted on patients with chronic physical pain, making it difficult to determine the psychological factors leading to the development of the altered perception of pain because their experience of pain and emotional reactions were co-morbid. Thus, similar to previous studies (George, Dannecker, & Robinson, 2006), my investigation allows for the identification of a causal relationship between psychological predictors and increased pain perception, a relationship that may be ultimately involved in the chronicity of pain. Second, the present findings suggest that timely identification of high levels of social or physical pain-related fear may be critical for identifying individuals who will benefit most from preventative interventions aimed to limit development of chronic pain.

There are, of course, several limitations of these studies as well. First, in the present study I incorporated only self-report measures of fear of physical pain, fear of social pain and the experience of pain. However, previous research has shown that neural activation correlates strongly with self-report scores of fear of pain and with pain ratings (Eisenberger et al., 2003). Second, the generalizability of the findings is limited to pain-free individuals. Third, given time constraints that limited the number of scales I could consider in each study, the Fear of Negative Evaluation scale (Watson & Friend, 1969) was not included in my studies. From a theoretical standpoint, fear of negative evaluation is defined as apprehension and distress arising from the expectation that others will form negative evaluations and results in avoidance of evaluative situations (e.g., job interview, see Appendix G). Thus, similar to the RSQ, I argue that fear of negative evaluation is conceptually different from the fear of social pain construct. First, fear of negative evaluation taps into the distress that one's performance or ability will be

not evaluated positively. By contrast, fear of social pain assesses fears of experiencing the pain caused by several forms of social separations (e.g., betrayal). Fear of social pain thus embraces a broader range of social separation instances, whereas rejection sensitivity and fear of negative evaluation are focused on one of the many possible causes of social distress. However, for a preliminary assessment of the degree of overlap between scores on Fear of Social Pain scale, Fear of Physical Pain scale, Rejection Sensitivity questionnaire and Fear of Negative Evaluation scale, a small ad-hoc study was conducted in addition to the central four studies. Forty-two students (9 women) at Purdue University volunteered to take part in the study in exchange for course credit. The average age of the sample was 19.95 years (SD = 1.73). Replicating my previous findings, fear of social pain and fear of physical pain were significantly correlated ($r = .452$, $p < .001$). Moreover, fear of social pain was significantly correlated with Fear of Negative Evaluation ($r = .477$, $p < .001$). However, Fear of Negative Evaluation was not significantly correlated with Fear of Physical Pain ($r = .098$, $p = .536$). Therefore, the Fear of Social Pain scale and the Fear of Negative Evaluation scale seem to tap into two related, but distinct, constructs.

In conclusion, several questions arise from the present set of studies. For instance, which factors determine one's tendency to become fearful of pain (fear-proneness)? How does pain-related fear increase the perception of pain (i.e., via which neural processes)? How does this mechanism serve to maintain pain? Is this the path to the development of social chronic pain? How can we best treat individuals with high fear of social pain? Future research should start to address some of these important questions.

CHAPTER 3

THE CONSEQUENCES OF PAIN:

EFFECTS OF SOCIAL AND PHYSICAL PAIN ON BASIC NEED SATISFACTION

"*Pain is inevitable, but misery is optional*." ~

Tim Hansel

Humans have different fundamental social needs to satisfy. First, because they are inherently social animals, they desire meaningful interpersonal relationships (Baumeister & Leary, 1995) which can also provide them a reasonably positive view of self (Leary, Tambor, Terdal, & Downs, 1995). Additionally, human beings desire some degree of control over their social environment (Rothbaum, Weisz, & Snyder, 1982) and they have a strong need to know that their existence matters to other individuals (Solomon, Greenberg, & Pyszczynski, 1991).

3.1. Social pain thwarts social human needs

Accordingly, several research areas demonstrate the detrimental impact of threats of social connections on need satisfaction. K.D. Williams (2001, 2009) found that ostracism (being ignored and excluded)—a form of social pain—causes a rapid decrease in the satisfaction of belonging, self-esteem, control and meaningful existence. Thus, it has been shown that receiving no acceptance from others decreases one's sense of belonging and reduces self-esteem (Zadro, Williams, & Richardson, 2004). Further, the lack of responsiveness of others no matter what the individual does deflates one's sense of control and because it evokes feeling of

nonexistence and unworthiness it also threats existential needs (Case, & Williams, 2004). And although ostracism might represent a particularly severe threat of social needs (Williams, 2001; 2009), research on rejection, social exclusion and loneliness (see Gerber & Wheeler, 2009) have found similar social need satisfaction outcomes. For instance, research on social exclusion reported that being rejected can threaten having a satisfactory connection with others (Baumeister & Leary, 1995), decrease self-esteem (Leary, Tambor, Terdal, & Downs, 1995), impair one's sense of control (Baumeister, Dewall, Ciarocco, & Twenge, 2005) and reduce the perception that life is meaningful (Stillman, Baumeister, Lambert, Crescioni, DeWall, & Fincham, 2009). Thus, perhaps to no one's surprise, it appears that any threat of social disconnection can have a negative effect on social need satisfaction.

3.2. Social and Physical Pain Overlap

However, as I have reviewed above, threats of social disconnection have been linked to physical pain on several dimensions. Eisenberger and Lieberman theorized the Pain Overlap Theory (2004; see also MacDonald & Leary, 2005). They suggested that social pain piggybacked onto on the existent pain circuitry developed to signal a bodily threat or harm; sending a warning to keep close to one's kin. Since then, an increasing amount of evidence suggests overlaps between social and physical pain. Thus, considering the large amount of physiological evidence for common brain responses to social and physical pain, I investigated similarity in psychological responses—in the form of threatening social human needs.

Yet, converging evidence of physiological and psychological similarities does not imply that social and physical pain are equivalent constructs, with identical sensory and psychological

features and consequences. Indeed, distinctions between the two painful experiences have also been pointed out. Chen, Williams, Fitness, & Newton (2008) showed that social pain can be relived and re-experienced more readily than physical pain. Moreover, several researchers used physical pain to investigate the specificity of the effects of social exclusion, finding social pain to be uniquely able to lead to a deconstructed state and impair cognition and self-regulation (e.g., Baumeister et al., 2005). Thus, when searching for the common psychological consequences of social and physical pain, distinctions as well as similarities can be expected.

3.3. Overview of the present research

According to Eisenberger (2010), the social/physical pain neural overlap leads to two wide range predictions. First, variables that are known for their role in regulating or potentiating one type of pain should produce a similar effect on the other type of pain (e.g., genetic factors). Second, a shared pain system should imply that individual differences related to one type of pain are linked to the other (e.g., neuroticism). Following the Eisenberger's (2010) rational, in the present work I posited a third prediction, that is, effects that result from the experience of one type of pain should result from the experience of the other type of pain. Thus, I expect that the social/physical pain neural overlap implies that psychological consequences that are known to be produced by one type of pain would results by the induction of the other type of pain as well. The present set of studies investigated how social and physical pain overlap (although with specific strength) in threatening social human needs.

Specifically, based on the pain overlap theories (Eisenberger & Lieberman, 2005; MacDonald & Leary, 2005) I tested a *common consequences hypothesis*, that is, the possible

decrease in need satisfaction due to both social and physical pain. Furthering the *common consequences hypothesis*, I predict both social and physical pain will lead to increased aggressive temptations. Williams (2009) has argued that when social needs are threatened, individuals are motivated to fortify these needs. Thus, aggression will occur because both types of pain will threaten needs, which may lead to aggressive behavior intended to fortify needs satisfaction (see Gerber & Wheeler, 2009). Within the main framework of the *common consequences hypothesis*, considering the greater impact of social over physical pain on the psychological self (Chen et al., 2008; Baumeister et al., 2005), I also investigated a more specific prediction, namely, the differential strength of social and physical pain in threatening the four social human needs (*differential strength hypothesis*). I predicted that social pain should more negatively affect need satisfaction and increase aggressive tendencies than physical pain.

3.4. STUDY 2a

In Study 2a I provided the first empirical test of the *common consequences hypothesis*. In addition, I investigated whether social pain would lead to more negative psychological consequences than physical pain (e.g., *differential strength hypothesis*).

3.4.1. Method

Participants

One hundred and fifteen students (42 women; M=19.49 years, SD=1.54; 64% Caucasian) in an introductory psychology course at Purdue University participated in exchange for course credit. Similar to the procedure of Chen et al. (2008), participants were randomly assigned to

recall either a past socially painful experience or a past physical painful experience that occurred within the last 5 years of their lives. A control condition (i.e., reliving a typical Wednesday afternoon) was added to these two experimental conditions. Participants were asked to recall each experience by writing in detail what had happened and how they had felt. Following the recalling of each experience (social pain, physical pain, or a typical Wednesday afternoon), participants rated a series of pain measures, their social human need satisfaction, and aggressive temptations based on how they felt during the event they recalled.

Procedure and Materials

Numerical Rating Scale. (NRS-11; Hartrick, Kovan, Shapiro, 2003) assessed pain intensity and pain unpleasantness. The Short-Form McGill Pain Questionnaire (SF-MPQ-2; Dworkin et al., 2009) measured qualitative and quantitative aspects of pain (e.g., 'sharp pain', 'fearful').

Need-Threat Scale. To assess the impact of pain on needs, participants completed the Need-Threat Scale (Williams, Cheung, & Choi, 2000), which assessed participants' feelings of self-esteem, belongingness, meaningful existence, and control. I created an overall index.

Aggressive behavior temptations. The Conflict Tactics Scale was adopted to assess aggressive behavior temptations (Buckley, Winkel, & Leary, 2004).

3.4.2. Results

Compared to the control condition, participants recalling social pain and physical pain reported a higher level of pain (see Table 1 for all descriptive and inferential statistics) on the NRS-11. The pain ratings of physical pain condition did not differ from the ones in the social pain condition, but they were both significantly different from the control condition, confirming that the manipulations were perceived as intended. A similar pattern occurred for the SF-MPQ-2.

Commonality of social and physical pain. Finding support for the *common consequences hypothesis*, need satisfaction on the four social human needs tested was thwarted for those in the social and physical pain conditions compared to those who recalled a daily routine. Furthermore, participants who recalled a painful episode—either social or physical—reported having higher aggressive intentions than the control condition.

Specificity of social and physical pain. Supporting the *differential strength hypothesis*, recalling social pain thwarted needs more than recalling physical pain. Moreover, aggressive behavior temptations were higher following recalling social than physical pain.

Table 1. Means, standard deviation, and one-way overall ANOVA *F*- and *p*-values.

	Social Pain (*n* = 40)	Physical Pain (*n* = 38)	Control Condition (*n* = 37)
NSR Pain Index (α= .87)	5.76 (2.80)[a]	6.30 (2.71)[a]	1.14 (1.88)[b]
F (2, 112) = 47.85, *p* < .001			
McGill Pain Quest. (α = .96)	2.57 (2.38)[a]	3.49 (2.16)[a]	.93 (1.72)[b]
F (2, 112) = 14.36, *p* < .001			
Overall needs index (α = .92)	2.15 (.83)[a]	2.98 (.62)[b]	3.96 (.78)[c]
F (2, 112) = 56.06, *p* < .001			
Belonging (α = .86)	2.42 (1.11)[a]	4.20 (.85)[b]	4.50 (.72)[b]
F (2, 112) = 52.68, *p* < .001			
Control (α = .89)	1.53 (.83)[a]	1.48 (.78)[a]	3.04 (1.06)[b]
F (2, 112) = 36.74, *p* < .001			
Self-esteem (α = .92)	1.65 (1.01)[a]	1.86 (.81)[a]	3.82 (.89)[b]
F (2, 112) = 59.93, *p* < .001			
Meaningful existence (α = .91)	2.97 (1.24)[a]	4.36 (1.00)[b]	4.48 (.94)[b]
F (2, 112) = 23.80, *p* < .001			
Aggressive temptations (α = .94)	5.17 (1.93)[a]	4.27 (1.29)[b]	2.45 (1.15)[c]
F (2, 112) = 32.04, *p* < .001			

Notes. Different letters indicate statistical differences, according to the LSD test (p < .05). Standard deviations appear in parenthesis

3.4.3. Discussion

In Study 2a, I provided preliminary evidence that both social and physical pain can thwart social human needs (*common consequences hypothesis*), but that social pain thwarts the needs more (*differential strength hypothesis*). This experiment, however, was based on recalling an earlier painful event. This leads us to question whether the same pattern of results would emerge for currently inflicted physical or social pain.

3.5. Study 2b

In Study 2b, I sought to replicate the findings of Study 2a using manipulations that currently inflicted social and physical pain. Social pain was induced through a ball-tossing game (Cyberball; Williams et al., 2000) while physical pain was induced through the Cold Pressor task (Mitchell, MacDonald and Brodie, 2004). Similar to Study 2a, I tested the *common consequences hypothesis* and *differential strength hypothesis*; social and physical pain should feel worse than controls, but social pain should feel worse on the four social needs tested than physical pain.

3.5.1. Method

Participants

One hundred undergraduate students (53 women; M=19.02 years, SD=.27; 59% Caucasian) received course credits for participating. Participants were randomly assigned to be ostracized or included, or to submerge their hand in cold or room-temperature water. This resulted in four experiment conditions: social pain induction, social pain control, physical pain induction, and physical pain control.

Procedure and Materials

Social pain manipulation. To manipulate social pain participants played a virtual online ball-tossing game—Cyberball (Williams et al., 2000). Participants believed they were playing with two others, who were actually computer-controlled confederates. Participants were either included, receiving the ball about a third of the time throughout, or ostracized, receiving the

ball once from each computer controlled player at the beginning and then never again. I adopted a shortened version of the game (21 throws) so it would last the same amount of time (i.e., one minute) as participants who were asked to submerge their hand in water.

Physical pain manipulation. To induce feelings of physical pain, participants completed a standard pain induction manipulation (e.g., Mitchell, MacDonald, & Brodie, 2004). Participants were randomly assigned to place the non-dominant hand up to their wrist into a bucket of water maintained either at a cold temperature (41°F-42°F; the physical pain induction) or room temperature (75°F-80°F; the physical pain control). Subjects were told they could remove their hand at any time if the distress of the experience became too intense. However, in order to standardize the amount of physical stimulation, participants were asked to try to keep their hand inside the cold water for one minute (equal to the Cyberball duration).

After completing either the social or the physical task, participants completed all of the same measures used in Study 2a with the addition of items assessing negative affect (e.g., 'I felt sad') and feelings of ostracism ('I felt ignored' and 'I felt excluded').

3.5.2. Results

Results on pain measures indicated that the pain manipulations proved successful (see Table 2). Ostracized participants reported higher levels of pain than included participants and participants in the Cold Pressor task reported high levels of pain that those who placed their hand in room temperature water.

Commonality of social and physical pain. Providing support to the *common consequences hypothesis*, need satisfaction was thwarted for those in the social and physical pain conditions compared to their control conditions for each individual need considered. Moreover, feelings of ostracism were higher in both the social and the physical pain condition compared to the control conditions. Thus, I found that participants in both social and physical pain reported lower need satisfaction, worse affect, and felt more excluded and ignored than those in the control conditions. Finally, results for behavioral intentions revealed that both social and physical pain increased aggressive temptations compared to the control conditions.

Specificity of social and physical pain. Social and physical pain were induced with two different manipulations, thus comparisons should be interpreted with caution. Nevertheless, participants felt higher levels of pain intensity and unpleasantness following the cold water task compared to being ostracized, $t(49)=4.02$, $p<.001$, $r=.50$. A similar pattern emerged for all the other pain measures; supporting the evidence that participants in the physical pain condition felt more pain. No significant difference were found in terms of negative affect ($t(49)=1.0$, $p=.30$), however, despite the lower intensity reported on pain measures, those who experienced social pain suffered more when I examined the need satisfaction scores ($t(49)=6.13$, $p<.001$, $r=.65$). Finally, those who experienced social pain reported greater aggression temptations than those who felt physical pain, $t(49)=6.1$, $p<.05$, $r=.65$.

Table 2. Means, standard deviation (in parenthesis), t-values and their p-values (in parenthesis), and effect sizes of variables.

	Social Pain Manipulation				Physical Pain Manipulation			
	Cyberball Inclusion (*n* = 23)	Cyberball Ostracism (*n* = 25)	*t* (46) value (*p*-value)	*r*	Warm Water (*n* = 26)	Cold Water (*n* = 26)	*t* (50) value (*p*-value)	*r*
NSR Pain Index (α = .97)	1.2 (.54)	4.8 (2.3)	7.1 (< .001)	.72	1.2 (.47)	7.6 (2.5)	12.3 (< .001)	.86
McGill Overall Index (α = .98)	1.2 (.44)	2.5 (1.8)	3.4 (< .01)	.45	1.4 (.62)	5.1 (2.1)	8.6 (< .001)	.77
Overall needs index (α = .91)	3.4 (.49)	1.8 (.64)	9.6 (< .001)	.82	3.7 (.58)	2.9 (.56)	5.0 (< .001)	.58
Belonging (α = .86)	4.3 (.85)	2.1 (1.0)	7.6 (< .001)	.75	4.3 (.74)	3.5 (1.1)	3.1 (< .01)	.40
Control (α = .66)	2.3 (.80)	1.3 (.46)	5.2 (< .001)	.61	2.7 (.87)	2.1 (.71)	2.4 (< .05)	.32
Self-esteem (α = .79)	2.7 (.68)	1.7 (.61)	5.2 (< .001)	.61	3.3 (.79)	2.0 (.81)	5.6 (< .001)	.62
Meaningful existence (α = .89)	4.4 (.77)	2.1 (.97)	8.9 (< .001)	.79	4.3 (.82)	3.7 (.96)	2.3 (< .05)	.31
Negative affect (α = .92)	1.0 (.44)	2.4 (.69)	8.2 (< .001)	.77	0.9 (.53)	2.6 (.68)	10.2 (< .001)	.81
Excluded	1.7 (0.9)	4.4 (1.1)	8.7 (< .001)	.80	1.6 (.85)	2.5 (1.2)	2.9 (< .05)	.40
Ignored	1.8 (1.0)	4.2 (1.2)	7.5 (< .001)	.73	1.8 (1.0)	2.7 (1.3)	2.6 (< .01)	.36
Aggressive temptations (α = .92)	3.1 (.78)	4.3 (1.2)	3.6 (< .01)	.47	3.0 (.56)	3.5 (.99)	2.2 (< .05)	.30

3.5.3. Discussion

In Study 2b, by using minimal manipulations on healthy volunteers, I found experimental evidence that physical pain can threat satisfaction of four fundamental needs. Further replicating the patter of Study 2a, I also found that social pain has a greater impact on social need satisfaction.

3.6. GENERAL DISCUSSION

The present set of studies investigated whether, and how, social and physical pain overlap in their psychological consequences. I tested the hypothesis that both social and physical pain—even in a very short-term episode—could reduce satisfaction on four social human needs (*common consequences hypothesis*). Study 2a showed that recalling a past physical pain episode can be associated with memories of low self-esteem, poor control, and greater aggressive temptations, similar to recalling a socially painful episode. In Study 2b, a currently inflicted experience of pain resulted in lowering satisfaction on all the four needs tested for both physical and social pain and worsening affect, besides confirming the increase in aggressive temptations.

I also tested a *differential strength hypothesis* which argued a greater need threat effect of social versus physical pain on the need tested. In Study 2a, the intensity of pain associated with episodes of social and physical pain did not differ; nevertheless, social pain was associated with lower need satisfaction than physical pain. In Study 2b, even though participants in the physical pain condition reported higher pain scores than those in the social pain condition, social pain still had a greater impact on needs satisfaction. Moreover—providing convergent evidence of the specific tenacity of social pain—participants assigned to the social pain conditions not only reported higher feeling of needs frustration, but they were also more tempted to act in ways to restore their frustrated needs (see Gerber & Wheeler, 2009). Yet, there was no difference in negative affect between social and physical pain, suggesting affect cannot account for worse needs satisfaction and greater aggression for those in social

compared to physical pain. Thus, from a theoretical standpoint, from one side these results showed that social pain is not unique in its ability to affect need satisfaction (*common consequences hypothesis*). However, from the other side, what seems to be unique to social pain is its strength in frustrating the four human needs I considered (*differential strength hypothesis*).

The understanding of the psychological consequences of pain have implications for pain management. First, studies examining the influence of targets' characteristics on pain judgment have reported that the observers tend to doubt about the pain reported by sufferers showing psychological distress (e.g., depression; for a review see Tait, Chibnall, & Kalauokalani, 2009). Indeed, in the medical judgment there is often a tendency to attribute pain complaints to psychological distress—rather than the opposite—considering the psychological distress a premorbid disposition that can lead the patients to complain about pain (Wallis, Lord, Bogduk 1997). This belief might lead healthcare professional to disregard the severity of patients' pain or their analgesic needs because of the idea that pain complaints are secondary to psychological distress. Conversely, the present finding showed that psychological distress—in the form of threatened social human needs—intrinsically follows even minimal inductions of pain. Adopting experimental manipulations, the present findings extend early correlational studies that found significant psychological distress in patients with chronic pain (Haythornthwaite, Sieber, Kerns, 1991) and that reported resolution of their psychological distress after pain relief (Wallis, Lord, Bogduk 1997).

Second, this set of studies bring support to the bio-psychosocial approaches of health and disease. In several healthcare settings of western society pain management still tends to take a bio-medical approach, which often concentrates on the organic origin of pain, regarding it mostly as a potential diagnostic tool and therefore undervaluing its psychological and psychosocial consequences (Scarry, 1994; Bendelow & Williams, 1995; Kugelmann, 2003). By contrast, understanding that pain has consequences that go beyond an overwhelming physical discomfort would encourage observers still anchored to a bio-medical view to take into account the social and psychological vulnerability of people in pain. Furthermore, even when the so-called bio-psychosocial model is considered, its social component is hardly acknowledged into the clinical practice. Engel (1977) challenged the dominant medical view calling for the adoption of a wide-ranging theoretical framework that legitimated, among other things, the focus on the patient's social needs and their emotional responses. Within his novel approach, Engel underlined that the ultimate criteria for the patients' well-being are psychosocial, even when the complaint is physical in origin (e.g., pain). However, more than three decades after its first proposal (Engel, 1977), the translation of the bio-psychosocial approach into practice seems still to be problematic. Several investigations noted that the bio-psychosocial model is only partially adopted with—at best—attention given over to cognitive and behavioral factors, but with no consideration of the social implications of pain and disease (e.g., Harding, Campbell, Parsons, Rahman, & Underwood 2010). I argue that this might depend from the lack of clarity over the actual consequences of pain on basic needs. Understand that physical pain can decrease one' satisfaction of social human needs could support healthcare professionals in

appreciating why and how they can take the "social" component of the bio-psychosocial model into consideration.

Third, these findings provided insight into the likely underestimation of the damaging effects to individuals' psychological well-being caused by numerous pain conditions, including chronic pain disorders, or pain arising from life-threatening diseases (e.g., cancer). I found that one-minute induction of social or physical pain can threaten need satisfaction. However, this effect is likely to extend beyond acute conditions, involving the experiences of chronic social and physical pain. Support to this hypothesis arises from the similarities that the experiences of persistent social and physical pain—accounted by literatures that are still separated —share. Indeed, research on negative psychological consequences of chronic social pain suggests that individuals unable to fortify their threaten needs because of the persistence of pain are likely to suffer long-term negative health outcomes (Williams, 2009). Zadro (2001) analyzed qualitative interviews from over 50 individuals who reported having suffered from chronic ostracism. The general trends suggest that chronic experiences of social pain exacerbates need threat, leading these individual towards staidly feelings of alienation, depression, helplessness, and unworthiness. Similar negative outcomes can be found in the accounts of patients who endure chronic physical pain. Walker et al., (2006) report patients with chronic back pain feel alone and have difficulty in maintaining social relationships. Chronic physical pain is often also associated with loss of confidence and self-esteem, and patients can often feel that they have lost the meaning of their lives (Charmaz, 1983). Finally, patients living with chronic pain are also likely to experience a loss of control and feelings of helplessness (Campbell & Cramb, 2008). Therefore,

future research should consider the similarities of the experiences of social and physical chronic pain within the theoretical framework of pain overlap theories.

What is particularly striking in these results is that even physical pain can lead to feel ignored and excluded. The measures of belonging included item such as “I felt rejected”, showing a threatened social inclusionary status in participants who underwent the induction of physical pain. This represent the first experimental evidence that physical pain can lead an individual to report feeling more ostracized than an individual who did not receive pain. Within an evolutionary account, I speculate that feelings of ostracism (being excluded and ignored) during the experience of physical pain might serve to elicit immediate help seeking from allies and thus could potentially be a survival advantage. This would be consistent with the adaptive function of other similar processes that have been designed to offer the sufferer a chance to get support from her social environment. Indeed, the mere existence of the facial expression of pain is thought to be the results of adaptive evolutionary forces aimed at providing the sufferers with the opportunity to translate a pain state into an observable message that can be perceived by someone in the environment (Williams AC, 2002; Prkachin et al., 1994; Simon et al., 2008). In a complementary way, past research has repeatedly shown that feelings of ostracism increase the desire for social connections (Williams et al., 2001). In a similar way in which a child looks for her caregivers after falling and being hurt, individuals in physical pain are likely to increase their odds of survival by seeking social connections that can provide immediate aid, support, and protection from further threats and damages. Furthermore, the notion that physical pain is related to the feeling of ostracism seems coherent with the studies that show social support increases the tolerance of physical pain (Master, Eisenberger, Taylor,

Naliboff, Shirinyan & Lieberman, 2009). Thus, natural selection over pain experiences might have selected, on one hand, observable pain behaviors (e.g., the facial expression of pain) aimed to attract potential helpers and, on the other hand, emotional responses that lead the individuals physically injured to seek support from their akin.

Taken all together, these results suggest that both physical and social pain can frustrate needs satisfaction. In keeping with the pain overlap theories (Eisenberger & Lieberman, 2005; MacDonald & Leary, 2005) I found that even minimal manipulations of physical pain threaten the individual's psychological equilibrium thus going beyond the mere presence of physical discomfort. Nevertheless, it turned out that social pain has more strength in its effect on the social human needs tested, which is in keeping with the social pain's greater impact on several domains (e.g., cognition; see Chen et al., 2008).

CHAPTER 4

CONCLUSION:

TOWARDS AN UNDERSTANDING OF THE COMMON ANTECEDENTS AND CONSEQUENCES OF CHORNIC SOCIAL AND PHYSICAL PAIN

The overall aim of this research was to examine antecedents and consequences of social pain and physical pain. It was hypothesized that because social pain have piggybacked on the neurophysiology of physical pain over the course of evolutionary history, social and physical pain would also overlap in their psychological antecedents and consequences.

Data from this dissertation strongly support these hypotheses. From one hand, referring to the psychological antecedents, in Studies 1a and 1b I found that fear of social and physical pain were related to each other. Furthermore, in Studies 1c and 1d I found that fear of social and physical pain could account for the perception of social and physical threats, respectively. From the other hand, referring to the psychological consequences, in Studies 2a and 2b I found that recalling or the experiencing social and physical pain threat basic need satisfaction and increase aggressive temptations.

4.1. Chronic Social and Physical Pain

Findings from this dissertation have provided strong evidence that acute experiences of social and physical pain overlap in their psychological antecedents and consequences. These findings suggest several lines of research. In particular, these findings—that were related to

acute experiences of social and physical pain—suggest investigations on the antecedents and consequences of *chronic* experiences of social and physical pain. Indeed, the similarities in the antecedents and consequences of social and physical pain are likely to extend beyond acute threats, including the experiences of persistent social and physical pain.

Chronic physical pain is a widespread condition. The International Association for the Study of Pain (IASP) defines chronic physical pain as pain which has persisted beyond normal tissue healing time (1986). The definition includes cases in which pain occurs when no obvious organic pathologies are evident. Chronic physical pain is the second most common reason individuals visit physicians and its negative impacts on self and identity are well documented: loss of abilities and roles, relationships, employment, etc. (Walker, 2006). Likewise, chronic experiences of social pain may be particularly harmful to individuals. Moving from the definitions of acute social threats (e.g., the distressing experience arising from the perception of actual or potential psychological distance from others; Eisenberger & Lieberman, 2004; Panksepp, 2003) I adapt the IASP definition and consider chronic social pain as pain associated with perceived social distance that persists after ample time for recovery and opportunity to reconnect with others. Individuals experiencing chronic social pain may feel alienation, low self-evaluation, helplessness, and depression (Williams, 2009). Millions are affected by social and physical chronic pain, but our understanding of how they overlap is limited.

4.2. An Integrative Model of Chronic Social and Physical Pain

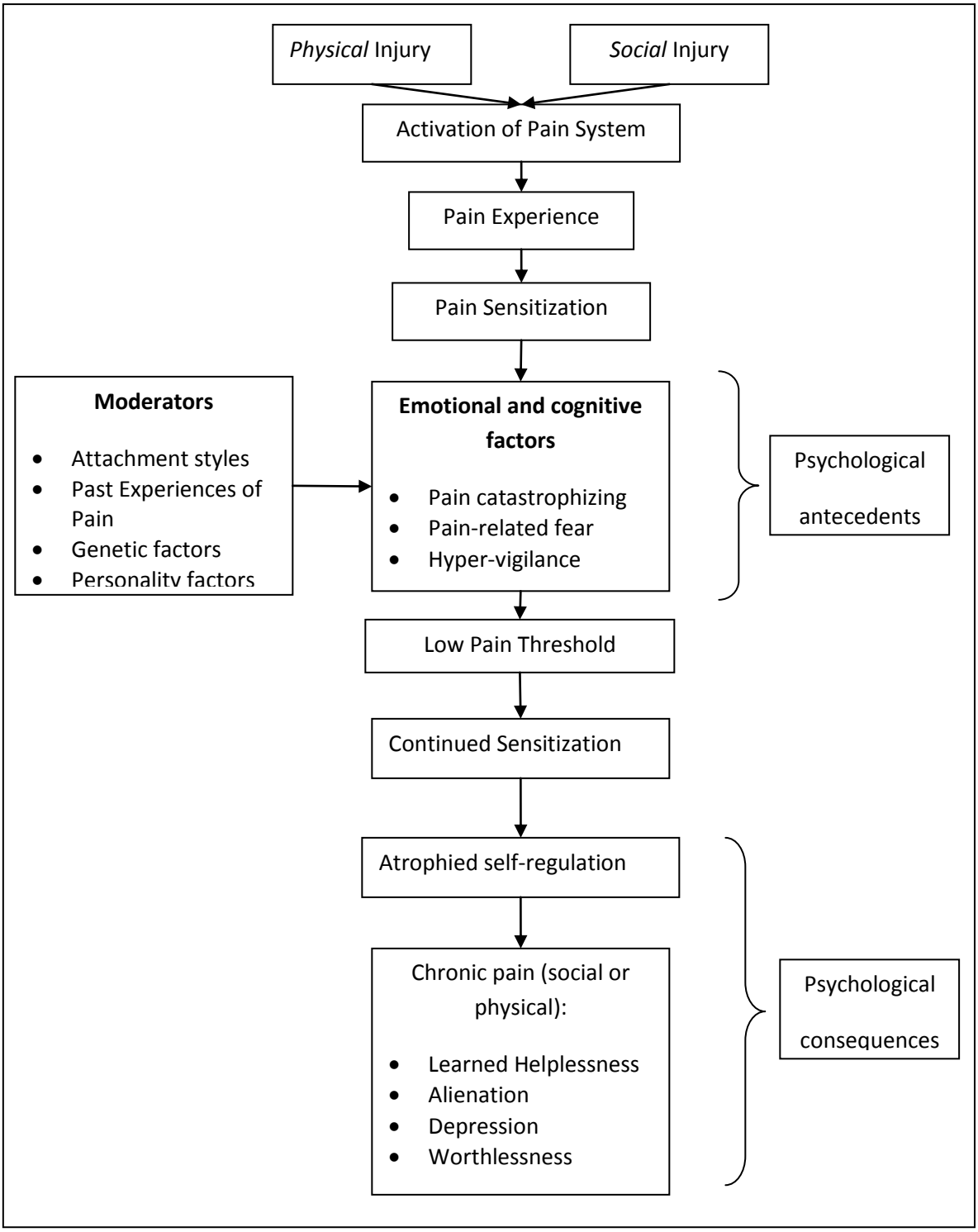
To extend the finding of the present dissertation to chronic painful conditions, I propose an integrative model (see Figure 1) that outlines several potential overlaps between chronic

social and physical pain, highlighting antecedents and consequences of chronic social and physical pain. I argue that understanding these overlaps can provide theoretical insight for scientific research on pain and practical implication for the management of chronic social and physical pain. Furthermore, by suggesting possible conceptual overlaps in the psychological antecedents and consequences of chronic social and physical pain, I urge the need for empirical investigation on this topic.

Referring to the psychological antecedents, moving from pain overlap theories (Eisenberger & Lieberman, 2005; MacDonald & Leary, 2005), I focus on the onset of social physical and physical pain, recognizing that both types of pain are acute in origin. I highlight how the activation of the pain system leads to increased sensitivity to pain-related stimuli. Self-related factors (e.g., attachment style) can moderate individuals' detection, interpretation and response to pain stimuli, eventually leading to the experience of chronic pain.

Referring to the psychological consequences, I focus on the detrimental effect chronic pain has on individuals' ability to self-regulate. Both forms of pain impair self-regulation on four fundamental domains: cognition, emotion, motivation, and interpersonal regulation. Additionally, both forms of pain threaten four fundamental human needs: belonging, control, self-esteem, and meaningful existence.

Figure 1. An Integrative model of the psychological antecedents and consequences of the experiences of chronic social and physical pain.



4.3. Antecedents of chronic social and physical pain: The common onset of chronic social and physical pain

In this section, I will describe how the process of going from acute to chronic social and physical pain has several overlaps. Sensitization is an increased response of the pain system to a variety of inputs following noxious stimuli (Baranauskas & Nistri, 1998). After a typical episode of acute pain, the pain system becomes temporarily sensitized but then returns to the normal threshold as soon as the individual is able to address the source of pain and recover from the injury (Baron, 2006). When this process fails, the sensitization does not return to normal and results in a lower pain threshold, causing a vicious cycle of hyper-detection and intensification of pain system sensitivity. The over-detection bias (i.e., perceiving pain when threat of an injury is absent) usually is considered an evolutionary adaptive response (Haselton & Buss, 2000). In fact, for many animals, missing the cues for social or physical threat would decrease the chance of survival. Yet, a pain detection system that is characterized by chronic hypersensitivity might also be dysfunctional because the individual will constantly be alert, over-perceive the stimuli in the environment as pain-related.

4.3.1. A Path towards the Increased Sensitivity of the Pain Alarm System

Several factors contribute to the transition from acute to chronic pain, ranging from genetics (Way, Taylor, & Eisenberger, 2009) to personality (Eisenberger & Lieberman, 2005) to situational factors (MacDonald & Leary, 2005). I focus on how early negative social experiences (e.g., insecure attachment style and previous pain experiences) can heighten affective (e.g., anxiety and pain-related fear) and cognitive (e.g., hyper-vigilance) factors. Negative experiences

can increase sensitivity of the pain system and the detection of pain, perpetuating pain experiences.

Attachment styles. First, the onset of chronic pain can be facilitated by the lack of satisfactory attachment with primary caregivers. Attachment style is a psychological representation of self and others, formed during early childhood experiences with primary caregivers that can influence the individual's relationships across the lifespan (Bartholomew & Horowitz, 1991). Previous research finds that individuals with an insecure attachment style are more likely to develop chronic physical pain disorders than individuals with secure attachments (for a review, see Porter, Davis, & Keefe, 2007). Furthermore, insecure individuals are also more likely to experience more intense chronic physical pain and greater disability (Davies, Macfarlane, McBeth, Morriss & Dickens, 2009). Similarly, individuals with insecure attachments are more likely to suffer persistent loneliness (Rokach & Neto, 2000), lending credence to the relation between attachment style and chronic social pain.

Early Pain Experiences. Second, dramatic early experiences of pain might contribute to facilitate the insurgence of chronic pain. A recent meta-analysis found that adults with chronic pain conditions are more likely to have been abused or neglected as children (Davis, Luecken, & Zautra, 2005) and researchers in the medical literature consistently find a relatively high percentage of patients with chronic pain have a history of childhood traumas (e.g., physical and sexual abuse; Kendall-Tackett, 2001). This provides further evidence that individuals with a greater pain history tend to show lower pain tolerance (Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004).

The lack of satisfactory attachment with primary caregivers and early negative social experience might provide early prolonged and intense activation of the pain system, which can influence the individual's tendency to detect, interpret and respond to further experience of pain.

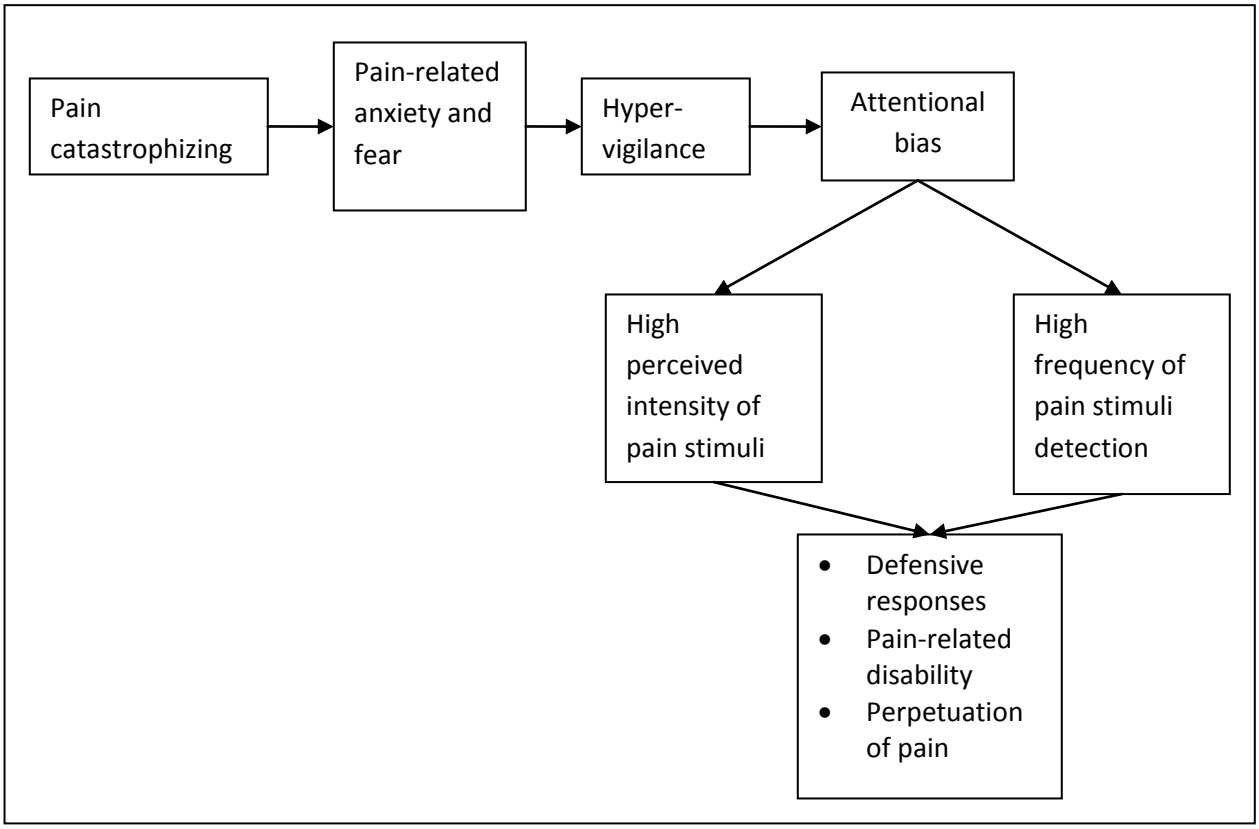
4.3.2. Cognitive and Emotional Factors that Facilitate the Perpetuation of Pain: The Pain Catastrophizing Cycle.

Cognitive and emotional factors might influence the activation of the pain system. Indeed, how social or physical pain is detected and interpreted play a key role in how the individual respond to these experiences (Figure 2).

As I discussed earlier in this dissertation, when an injury is perceived, an individual appraises the meaning of the experience. Usually, pain is perceived as unpleasant but not as a major calamity. However, under some circumstance an individual might judge the pain in a catastrophic way. Pain catastrophizing, is the tendency to focus on pain and magnify it with an intense sense of helplessness and has been shown to affect the individual's emotional response (Sullivan, Bishop, & Pivik, 1995). Furthermore, the appraisal of the experience of pain can influence the fear of pain, that is, the negative emotional response which I showed to enhance the perception of social and physical pain. Again, the fear of pain is usually considered an adaptive response, but abnormal and persistent level of fear of pain can promote a state of hyper-vigilance towards pain-related stimuli (Asmundson, Vlaeyen, & Crombez, 2004). Hyper-vigilance to social or physical threats results in an attentional bias that influences an individual's expectancies (Stinson, Cameron, Wood, Gaucher, & Holmes, 2009), and increases the likelihood

that an actual or potential threat will be detected (for a review, see Pincus & Morley, 2001). Fear, anxiety, and hyper-vigilance for evidence of threat also increases the perception of pain by lowering the pain threshold (Riva, Carter-Sowell, & Williams, 2010) and accounts for a substantial proportion of pain-related disability and chronicity (Meredith, Strong & Feeney 2006; Severeijns, Vlaeyen, van den Hout, & Weber, 2001). The increased sensitivity to pain is linked with defensive responses such as escape, avoidance, and more hyper-vigilance (Macdonald & Leary, 2005), which may alleviate the occurrence of pain in the short term but exacerbate the experience of it in the long term. Failure to address a dispute with a significant other may ease the pain at the moment but also increase the odds of a long term relational disruption, in the same way that avoiding physical movements may temporarily ease acute physical pain while increasing long term chronic pain and disabilities.

Figure 2. Emotional and Cognitive Factors Involved in the Perpetuation of Pain



4.4. Consequences of social and physical pain: The long-term self-regulation impairment caused by chronic social and physical pain

The subsequent overlap is the detrimental effect that both types of pain have on the individual's ability to self-regulate. Self-regulation is considered as the ability to exert control over the self (Baumeister, Heatherton, & Tice, 1994). Self-regulation is a key feature for living successfully in human culture and has implications in myriad domains, including mood and emotional control, thought suppression, impulse control, and task performance. Higher capacities for self-regulation increase adaptive health outcomes by managing domains such as social and physical activity (Hagger, Wood, Stiff, & Chatzisarantis, 2009). Self-regulation appears to depend on limited resources which are rapidly consumed by any attempt to exert control over unwanted urges, and once depleted results in reduced capacity to further self-regulate.

Pain represents a strong tax on self-regulatory resources because of its high attentional demand, aversiveness, and the urgency for escape that it engenders (Hamilton, Karoly & Kitzman, 2004). Furthermore, chronic pain, unlike other more temporary depleting sources (e.g., acute pain, highly cognitive demanded task, etc.), does not allow for recuperation which has been shown as an effective condition for replenishment of self-control reserves (Oaten, Williams, Jones & Zadro, 2008).

Research on the harmful effects of chronic pain on self-regulation can be summarized across four domains: cognition, emotion, motivation, and interpersonal regulation. First, chronic pain impairs cognitive abilities, making it harder for the individual to switch the focus of attention from pain to other external or internal stimuli. This attentional focus on pain can

generate worry and rumination, interfering with an individual's ability to inhibit thoughts or cognitively reframing specific situations (Solberg, Roach, & Segerstrom, 2009). Patients with chronic pain commonly report cognitive impairments such as diminished concentration or and poor memory performance (Kewman, Vaishampayan, Zald, & Han, 1991). Second, the ability to regulate positive and negative affect might be constantly and increasingly impaired by the presence of chronic pain. Several studies have linked physical pain with lack of emotional regulation (Solberg, Roach, & Segerstrom, 2009). In a similar manner, individuals suffering social pain showed dysfunctional emotion regulation, either by experiencing negative affect (Gerber & Wheeler, 2009) or emotional numbness (Baumeister, DeWall, Ciarocco, & Twenge, 2006). Third, even though motivation itself represents an antidote to ego depletion (Baumeister & Vohs, 2007), self-regulation may tax the self's willingness to engage in willful action. It is also possible that when motivated to overcome self-regulatory depletion, more and greater depletion follows. Fourth, fatigued self-regulatory resources impair the individual's ability to form and maintain positive interpersonal relationships. Individuals with chronic physical pain often report difficulty dealing with the effects of pain on relationships (Solberg Nes, Roach, & Segerstrom, 2009), and social pain often results in antisocial behavior (Twenge, Baumeister, Tice & Stucke, 2001) that can jeopardize social relationships.

4.4.1. The negative health impacts caused by chronic social and physical pain

The negative consequences of chronic pain on the self are not limited to impaired self-regulation. I have previously discussed that Williams (2009) argues that ostracism – a specific type of social pain – threatens four fundamental human needs: control, self-esteem, belonging,

and meaningful existence. In the present dissertation I found that even one short term episode of either social or physical pain can threaten need satisfaction. Germane for a chronic pain condition, Williams (2009) argues that individuals unable to fortify their threaten needs are likely to suffer long-term negative health outcomes. Williams (2009) calls this the resignation stage of ostracism. An individual who has a chronically impaired ability to self-regulate may find it difficult to fortify their threatened needs. Therefore, I suggest that the common long-term negative health outcomes due to need threat is another overlap between chronic social and physical pain.

As I already mentioned, Zadro (2001) analyzed qualitative interviews from over 50 individuals who reported having suffered from chronic ostracism. The general trends suggest that chronic ostracism exacerbates need threat. Rather than embracing control, these individuals expressed helplessness; rather than looking for self-esteem enhancement, they accepted low self-worth; rather than seeking belonging, they consented to alienation and isolation; and rather than searching for recognition by others of their existence, they became depressed and avoided further painful rejection. Consistent with these findings, research on loneliness repeatedly found individuals reporting similar long-tem negative psychological outcomes (Cacioppo & Patrick, 2008). In parallel, similar negative outcomes can be found in the accounts of patients who endure chronic physical pain (see the General Discussion section of Chapter 3).

4.5. Similar coping strategies can be adopted to deal with social and physical chronic pain

Lastly, considering the proposed overlap in the experiences of chronic social and physical pain, it might be that potential coping strategies such as focusing on replenishing an individual's self-regulatory resources and pain acceptance assuage both forms of pain. Indeed, individuals can learn to cope with chronic pain, despite its negative impact. Pain researchers have classified coping strategies according to an active/passive dimension. Active coping (e.g., problem-solving, aiming to temper or control pain, pain acceptance) requires self-regulation to achieve outcomes such as goal setting, controlling thoughts and impulses, and planning and executing strategies and actions. Passive coping (e.g., worrying, catastrophizing, withdrawal, disuse, retreating) involves inactivity, avoidance, and disengagement. Passive coping has been linked to diminished psychological adjustment and increased disability and pain (Solberg Nes, Roach, & Segerstrom, 2009). Therefore, optimal interventions for coping with chronic pain should be focused on the replenishment of individual self-regulatory resources. Baumeister and Vohs (2007) argue that self-regulation is similar to a muscle; an individual's ability to override incipient responses can be strengthened through regular exercise. This process can be supported by allowing the individual a period of rest from the pain. In this sense, one of the promising treatments for people suffering from chronic pain is attentional management (e.g., distraction): effectively helping people to direct less attention to their pain, and thus freeing up cognitive resources for self-regulation. Moreover, cognitive therapy should be employed to challenge maladaptive forms of over-detection, catastrophizing as well as reinforcing positive pain self-efficacy beliefs (i.e., the individual's confidence that s/he can function successfully despite ongoing pain). Finally, pain acceptance is considered an effective strategy for coping

with chronic pain (McCracken, 1998). Acceptance of pain is defined as acknowledging that one has pain, giving up ineffective attempts to control pain, acting as if pain does not necessarily imply disability (impairments in the individual's physical and psychological health), and being able to commit one's efforts toward living a satisfying life despite pain.

4.6. Implications of an integrated model of chronic social and physical pain

In the last section of this dissertation, moving from the empirical findings I found on antecedents and consequences of acute threats, I generated an integrative model which accounts for the pattern of findings reviewed in the literature on chronic social and physical pain and produces a series of testable hypotheses. I aimed to show the value of bringing together two separate lines of research, by providing insight for both chronic social and physical pain. This model starts depicting the occurrence of an acute episode of social or physical pain, whose neurological overlaps have already been shown and discussed (Eisenberger & Lieberman, 2005; MacDonald & Leary, 2005). I then described the transition from an acute injury to chronic pain in terms of the maintenance of hyper-sensitized pain system for both social and physical pain. Specifically, the concept of pain sensitization for chronic physical pain might inform our understanding of individuals who suffer chronic social pain, which remain largely unstudied. Furthermore, the notion that the pain system can be sensitized by both social and physical injury, leading to a diminished threshold for future social and physical stimuli might elucidate the circumstances in which the experience of one specific type of pain facilitates the chronicization of the other type (e.g., when insecure attachment is linked to development of chronic physical pain). Further, the present model applies conceptualizations

developed in the social sciences (e.g., need-threat model) to understand the potential impact of both chronic social and physical pain on self. Fulfillment of fundamental human needs constitutes a crucial condition for the motivation, well-being and, ultimately, for the survival of the individual (Deci & Ryan, 1985). The notion that physical pain threatens psychological equilibrium should direct more attention to psychosocial aspects in the pain management.

The present integrated framework can support the development and application of tools that can be adopted by therapists to assist individuals who endure long-term social pain. Therapists who work with patients suffering physical pain have already developed and tested a series of techniques (e.g., pain-related fear reduction, distraction, and acceptance) that have been successful in reducing the distress and disability caused by physical pain. In this sense, the usefulness of these tools can be tested to help individual who are suffering chronic social pain, to prevent them from entering into the resignation stage (Williams, 2009).

Further, the understanding of the impact of suffering on the self has important implications for care and management of physical pain. In western society physical pain still tends to be considered within the bio-medical paradigm, which often concentrates on the organic origin of pain, regarding it mostly as a potential diagnostic tool and therefore undervaluing its psychological and psychosocial consequences (Kugelmann, 2003). By contrast, understanding that pain has consequences that go beyond an overwhelming physical discomfort would encourage observers to take into account the psychological vulnerability of people in pain.

REFERENCES

Abrams, D., Hogg, M. A. & Marques, J. M. (2005). The Social Psychology of Inclusion and Exclusion. Psychology Press Ltd, United Kingdom.

Aldrich, S., Eccleston, C. & Crombez, G. (2000). Worry about chronic pain: vigilance to threat and misdirected problem solving. Behavioral Research Therapy, 38, 457–470. doi:10.1016/S0005-7967(99)00062-5

Allen, A. B., & Badcock, P. B. (2003). The social risk hypothesis of depression: Evolutionary, psychosocial, and neurobiological perspectives. Psychological Bulletin, 129, 887-913. doi:10.1037/0033-2909.129.6.887

Allman, W. F. (1994). The stone age present: How evolution has shaped modern life-from sex, violence, and language to emotions, morals, and communities . New York: Simon & Schuster.

Asmundson, G. J. G. & Taylor, S. (1996). Role of anxiety sensitivity in pain-related fear and avoidance. J. Behav. Med. 19, 577–586. doi:10.1007/BF01904905

Asmundson, G. J. G. & Wright, K. D., (2003). The biopsychosocial model of pain. In: Hadjistavropoulos, T. & Craig, K.D., Editors, 2003. Pain: Psychological Perspectives, Erlbaum, Hillsdale, NJ, pp. 35–57.

Asmundson, G. J. G., & Stein, M. B. (1994). Selective processing of social threat in patients with generalized social phobia: Evaluation using a dot-probe paradigm. Journal of Anxiety Disorders. 1994;8:107–117. doi:10.1016/0887-6185(94)90009-4

Asmundson, G. J. G., Jacobson, S. J., Allerdings, M. D., & Norton, G. R. (1996). Social phobia in disabled workers with chronic musculoskeletal pain. Behaviour Research and Therapy, 34, 939–943. doi:10.1016/S0005-7967(96)00055-1

Asmundson, G. J. G., Norton P. J., & Vlaeyen J. W. S. (2004). Fear-avoidance models of chronic pain: an overview. In: Asmundson GJG, Norton PJ, Vlaeyen JWS, Crombez G, editors. Understanding and treating fear of pain. New York, USA: Oxford University Press; p. 3–24.

Asmundson, G. J. G., Norton P.J. & Vlaeyen J. W. S. (2004). Fear-avoidance models of chronic pain: an overview. In: G. J. G. Asmundson, P. J. Norton, J. W. S. Vlaeyen & G. Crombez, Editors,

Understanding and treating fear of pain, Oxford University Press, New York, USA (2004), pp. 3–24. doi:10.016/0887-6185(94)90000-4

Asmundson, G. J. G., Vlaeyen J. W. S., & Crombez G. (Eds). (2004). Understanding and treating fear of pain. Oxford: Oxford University Press.

Ayduk, O., Gyurak, A., & Luerssen, A. (2007). Individual differences in the rejection-aggression link in the hot sauce paradigm: The case of rejection sensitivity. Journal of Experimental Social Psychology, 44, 775-782.

Banks, S., & Kerns, R. D. (1996). Explaining high rates of depression in chronic pain: A diathesis-stress framework. Psychological Bulletin, 119, 95-110. doi:10.1037/0033-2909.119.1.95

Baranauskas, G., & Nistri, A. (1998). Sensitization of pain pathways in the spinal cord: Cellular mechanisms. Progress in Neurobiology, 54, 349-365. doi:10.1016/S0301-0082(97)00067-1

Baron, R. (2006). Mechanisms of disease: Neuropathic pain—a clinical perspective. Nature Clinical Practice Neurology, 2, 95-106. doi:10.1038/ncpneuro0113

Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of a four-category model. Journal of Personality and Social Psychology, 61, 226-244. doi:10.1037/0022-3514.61.2.226

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. Psychological Bulletin, 117, 497–529. doi:10.1037/0033-2909.117.3.497

Baumeister, R. F., & Vohs, K. D. (2007). Self-regulation, ego depletion, and motivation. Social and Personality Psychology Compass, 1, 1-14. doi:10.1111/j.1751-9004.2007.00001.x

Baumeister, R. F., DeWall, C. N., Ciarocco, N. L., & Twenge, J. M. (2005). Social exclusion impairs self-regulation. Journal of Personality and Social Psychology, 88, 589-604.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). Losing Control: How and Why People Fail at Self-Regulation. San Diego, CA: Academic Press.

Baumeister, R. F., Twenge, J. M., & Nuss, C. (2002). Effects of social exclusion on cognitive processes: Anticipated aloneness reduces intelligent thought. Journal of Personality and Social Psychology, 83, 817-827. doi:10.1037/0022-3514.83.4.817

Beck, A. T., Emery, G., & Greenberg, R. L. (1985). Anxiety disorders and phobias: A cognitive perspective. New York: Basic Book

Beck, A. T., Steer, R. A. & Brown G. K. (1996). Manual for the Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation.

Beecher, H. K. (1956). Relationship of significance of wound to pain experienced. Journal of the American Medical Association, 161, 1609-13. doi:10.1097/00006534-195611000-00021

Bendelow, G., & Williams S. J. (1995). Transcending the dualism: towards a sociology of pain. Sociology of Health and Illness; 17:139-65. doi:10.1111/1467-9566.ep10933376

Björkqvist, K. (1994). Sex differences in physical, verbal, and indirect aggression: A review of recent research. Sex Roles 30: 177. doi: 10.1007/BF01420988

Borsook, T. K., & MacDonald, G. (2010). Mildly negative social encounters reduce physical pain sensitivity. Pain 151, 372–377. doi:10.1016/j.pain.2010.07.022

Bowlby, J. (1958). The nature of the child's tie to his mother. International Journal of Psycho-Analysis, XXXIX, 1-23.

Bowlby, J. (1960). Grief and mourning in infancy and early childhood. The Psychoanalytic Study of the Child, VX, 3-39.

Bowlby, J. (1960). Separation anxiety. International Journal of Psycho-Analysts, XLI,1-25. doi:10.1111/j.1469-7610.1960.tb01999.x

Bradley, M. M., Silakowski, T., & Lang, P. J. (2008). Fear of pain and defensive activation. Pain, 137, 156–163. doi:10.1016/j.pain.2007.08.027

Buckley, K. E., Winkel, R. E., & Leary M. R. (2004). Reactions to acceptance and rejection: Effects of level and sequence of relational evaluation. Journal of Experimental Social Psychology, 40, 14-28. doi:10.1016/S0022-1031(03)00064-7

Buckner, J. D., Maner, J. K., & Schmidt, N. B. (2009). Difficulty disengaging attention from social threat in social anxiety. Cognitive Therapy and Research. 34, 1, 99-105. doi:10.1007/s10608-008-9205-y

Buckner, J. D., Schmidt, N. B., Lang, A. R., Small, J. W., Schlauch, R. C., & Lewinsohn, P. M. (2008). Specificity of social anxiety disorder as a risk factor for alcohol and cannabis dependence. Journal of Psychiatric Research;42:230–239. doi:10.1016/j.jpsychires.2007.01.002

Burklund, L., Eisenberger, N. I., & Lieberman, M. D. (2007). The face of rejection: Rejection sensitivity moderates dorsal anterior cingulate activity to disapproving facial expressions. Social Neuroscience, 2, 238-253. doi:10.1080/17470910701391711

Buss, D. M. (1995). Evolutionary psychology: A new paradigm for psychological science. Psychological Inquiry, 6, 1-30. doi: 10.1207/s15327965pli0601_1

Buss, D. M. (2004). Evolutionary psychology: the new science of the mind. Boston: Pearson/A and B.

Cacioppo, J. T., & Patrick, B. (2008). Loneliness: Human nature and the need for social connection. New York: W. W. Norton & Company.

Cacioppo, J. T., Hawkley, L. C., Ernst, J. M., Burleson, M., Berntson, G. G., Nouriani, B., & Spiegel, D. (2006). Loneliness within a nomological net: An evolutionary perspective. Journal of Research in Personality;40:1054–1085. doi:10.1016/j.jrp.2005.11.007

Campbell, C., & Cramb, G. (2008). 'Nobody likes a back bore' -- Exploring lay perspectives of chronic pain: Revealing the hidden voices of nonservice users. Scandinavian Journal of Caring Sciences, 22, 383-390. doi:10.1111/j.1471-6712.2007.00541.x

Carleton, R. N., Asmundson G. J. G., & Taylor S. (2005). Fear of physical harm: factor structure and psychometric properties of the Illness/ Injury Sensitivity Index. Journal Psychopathol Behavioral Assessment ;27:235–41. doi:10.1007/s10862-005-2403-y

Carleton, R. N., McCreary, D. R., Norton, P. J., & Asmundson, G. J. G. (2006). Brief fear of negative evaluation scale-revised. Depression and Anxiety;23:297–303. doi:10.1002/da.20142

Case, T. I., & Williams, K. D. (2004). Ostracism: A metaphor for death. In J. Greenberg, S. L. Koole, & T. Pyszczynski (Eds.), Handbook of experimental existential psychology (pp. 336-351). New York, NY: Guilford.

Chapman, C. & Gavrin, J. (1999). Suffering: the contributions of persistent pain. Lancet 353, 2233–2237. doi:10.1016/S0140-6736(99)01308-2

Charmaz, K. (1983). Loss of self: A fundamental form of suffering in the chronically ill. Social Health Illness, 5, 1161-1172. doi:10.1111/1467-9566.ep10491512

Chen, Y. P., Ehlers, A., Clark, D. M., & Mansell, W. (2002). Patients with generalized social phobia direct their attention away from faces. Behaviour Research and Therapy;40:677–687. doi:10.1016/S0005-7967(01)00086-9

Chen, Z. & Williams, K. D. (2010). Social pain is easily relived and prelived, but physical pain is not. In Geoff MacDonald & Lauri A. Jensen-Campbell (Eds.) Social Pain: Neuropsychological and Health Implications of Loss and Exclusion.(pp. 161-177). Washington, DC: American Psychological Association.

Chen, Z., Williams, K. D., Fitness, J., & Newton, N. (2008). When hurt will not heal: Exploring the capacity to relive social and physical pain. Psychological Science, 19, 789-795. doi:10.1111/j.1467-9280.2008.02158.x

Chow, R. M., Tiedens, L. Z., & Govan, C. L. (2008). Excluded emotions: The role of anger in antisocial responses to ostracism. Journal of Experimental Social Psychology, 44, 896-903.

Cicchetti, D. (2003). Experiments of nature: Contributions to developmental theory. Development and Psychopathology, 15, 833–1106. doi:10.1017/S0954579403000397

Costello, A., & Osborne, J. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Practical Assessment Research & Evaluation, 10(7).

Crombez, G., Vlaeyen, J. W., Heuts, P. H., & Lysens, R. (1999). Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. Pain;80:329–39. doi:10.1016/S0304-3959(98)00229-2

Darwin, C. (1859). The Origin of Species by Means of Natural Selection, first edn, John Murray, London.

Davies, G. J., Macfarlane, J., McBeth, R., Morriss. C., & Dickens, C. (2009). Insecure attachment style is associated with chronic widespread pain. Pain, 143, 200-205. doi:10.1016/j.pain.2009.02.013

Davis, D. A., Luecken, L. J., & Zautra A. J. (2005). Are reports of childhood abuse related to the experience of chronic pain in adulthood? A meta-analytic review of the literature. Clinical Journal of Pain, 21(5), 398–405. doi:10.1097/01.ajp.0000149795.08746.31

Deci, E. L. & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenum Press.

DeWall, C. N. (2009). The pain of exclusion. Using insights from neuroscience to understand emotional and behavioral consequences to social exclusion. In M. J. Harris (Ed.), Bullying, rejection, and peer victimization: A social cognitive neuroscience perspective (pp. 201-224). New York: Springer.

DeWall, C. N., & Baumeister, R. F. (2006). Alone but feeling no pain: Effects of social exclusion on physical pain tolerance and pain threshold, affective forecasting, and interpersonal empathy. Journal of Personality and Social Psychology, 91, 1–15. doi:10.1037/0022-3514.91.1.1

Dewall, C. N., Macdonald G., Webster, G.D., Masten, C.L., Baumeister, R. F., Powell, C., Combs, D., Schurtz D. R., Stillman, T. F., Tice, D. M., & Eisenberger, N. I. (2010). Acetaminophen Reduces Social Pain : Behavioral and Neural Evidence. Psychological Science. 21(7):931-7.

Downey, G., & Feldman, S. (1996). Implications of rejection sensitivity for intimate relationships. Journal of Personality and Social Psychology, 70, 1327–1343. doi:10.1037//0022-3514.70.6.1327

Dworkin, R. H., Turk, D. C., Revicki, D. A., Harding, G., Coyne, K. S., Peirce-Sandner, S., Bhagwat, D., Everton, D., Burke, L. B., Cowan, P., Farrar, J. T., Hertz, S., Max, M. B., Rappaport, B. A., Melzack, R. (2009). Development and initial validation of an expanded and revised version of the Short-form McGill Pain Questionnaire (SF-MPQ-2). Pain, 6. doi:10.1016/j.pain.2009.02.007

Ecclston, C., & Crombez, G. (1999). Pain demands attention: A cognitive-affective model of the interruptive function of pain. Psychological Bulletin, 125, 356-366. doi:10.1037//0033-2909.125.3.356

Eisenberger, N. I. (2006). Identifying the neural correlates underlying social pain: Implications for developmental processes. Human Development, 49, 273-293. doi:10.1159/000095580

Eisenberger, N. I. (2008). Understanding the moderators of physical and emotional pain: A neural systems-based approach. Psychological Inquiry, 19, 189-195. doi:10.1080/10478400802608855

Eisenberger, N. I. (2010). The neural basis of social pain: Findings and implications. In Geoff MacDonald & Lauri A. Jensen-Campbell (Eds.) Social Pain: Neuropsychological and Health Implications of Loss and Exclusion.(pp. 53-78). Washington, DC: American Psychological Association.

Eisenberger, N. I., & Lieberman, M. D. (2004). Why rejection hurts: a common neural alarm system for physical and social pain. Trends in Cognitive Sciences, 8, 294-300. doi:10.1016/j.tics.2004.05.010

Eisenberger, N. I., & Lieberman, M. D. (2005). Why it hurts to be left out: The neurocognitive overlap between physical and social pain. In K. D. Williams, J. P. Forgas, & W. von Hippel (Eds.), The Social Outcast: Ostracism, Social Exclusion Rejection, and Bullying (pp. 109-127). New York: Cambridge University Press.

Eisenberger, N. I., Inagaki, T. K., Rameson, L. T., Mashal, N. M., & Irwin, M. R. (2009). An fMRI study of citokine-induced mood and social pain: the role of sex differences. NeuroImage, 47, 881-890. doi:10.1016/j.neuroimage.2009.04.040

Eisenberger, N. I., Jarcho, J. M., Liebn, M. D., & Naliboff, B. (2006). An experimental study of shared sensitivity to physical pain and social rejection. Pain, 126, 132-138. doi:10.1016/j.pain.2006.06.024

Eisenberger, N. I., Lieberman, M. D. (2004). Why rejection hurts: A common neural alarm system for physical and social pain. Trends in Cognitive Psychology, 8, 264-300. doi:10.1016/j.tics.2004.05.010

Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. Science, 302, 290-292. doi:10.1126/science.1089134. doi:10.1126/science.1089134

Eisenberger, N. I., Taylor, S. E., Gable, S. L., Hilmert, C. J., & Lieberman, M. D. (2007). Neural pathways link social support to attenuated neuroendocrine stress responses. NeuroImage, 35, 1601–1612. doi:10.1016/j.neuroimage.2007.01.038

Eisenberger, N. I., Way, B. M., Taylor, S. E., Welch, W. T., & Lieberman, M. D. (2007). Understanding genetic risk for aggression: Clues from the Brain's response to social exclusion. Biological Psychiatry, 61, 1100–1108. doi:10.1016/j.biopsych.2006.08.007

Eisenberger, N. I., Way, B., Taylor, S. E., & Lieberman, M. D. (2008). MAOA, gender differences, and social exclusion: responses to Gallardo-Pujol et al. Biological Psychiatry, 63, e11.

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. Science 196:129–136. DOI: 10.1126/science.847460. doi:10.1126/science.847460

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. Psychological Methods, 4(3), 272-299. doi:10.1037//1082-989X.4.3.272

Fillingim, R.B. (2005). Individual differences in pain responses, Curr Rheumatol Report 7, pp. 342–347. doi:10.1007/s11926-005-0018-7

Fitness, J. (2001). Betrayal, rejection, revenge and forgiveness: An interpersonal script approach. In M. Leary (Ed.), Interpersonal rejection (pp. 73-103). New York: Oxford University Press

Gardner, W., Pickett, C. L., & Brewer, M. B. (2000). Social exclusion and selective memory: How the need to belong influences memory for social events. Personality and Social Psychology Bulletin, 26, 486–496.

Garner, M., Mogg, K., & Bradley, B. P. (2006). Orienting and maintenance of gaze to facial expressions in social anxiety. Journal of Abnormal Psychology;115:760–770. doi:10.1037/0021-843X.115.4.760

Gatchel, R. J., & Kishino, N. D. (2010). The Biopsychosocial Perspective of Pain and Emotion. In G. MacDonald & L. Jensen-Campbell. (Eds.), Social Pain: A Neuroscientific, Social, and Health Psychology Analysis. Washington, DC: American Psychological Association Press.

George, S. Z., Dannecker, E. A., & Robinson, M. E. (2006). Fear of pain, not pain catastrophizing, predicts acute pain intensity, but neither factor predicts tolerance or blood pressure reactivity: an experimental investigation in pain-free individuals. European Journal of Pain.;10:457–465. doi:10.1016/j.ejpain.2005.06.007

George, S. Z., Dover, G. C., & Fillingim, R. B. (2007). Fear of pain influences outcomes after exercise-induced delayed onset muscle soreness at the shoulder. Clinical Journal of Pain.;23:76–84. doi:10.1097/01.ajp.0000210949.19429.34

Gerber, J. P., & Wheeler, L. (2009). On being rejected: A meta-analysis of experimental rejection research. Perspectives on Psychological Science, 4, 468-488. doi:10.1111/j.1745-6924.2009.01158.x

Gray, K., & Wegner, D. M. (2008). The sting of intentional pain. Psychological Science, 19(12), 1260-1262. doi:10.1111/j.1467-9280.2008.02208.x

Greenberg, J., Pyszczynski, T., Solomon, S., Rosenblatt, A., Veeder, M., Kirkland, S., & Lyon, D. (1990). Evidence for terror management theory II: The effects of mortality salience on reactions to those who threaten or bolster the cultural worldview. Journal of Personality and Social Psychology, 58, 308-318.

Greenberg, J., Solomon, S., Pyszczynski, T., Rosenblatt, A., Burling, J., Lyon, D., Simon, L., & Pinel, E. (1992). Why do people need self-esteem? Converging evidence that self-esteem serves an anxiety-buffering function. Journal of Personality and Social Psychology, 63, 913-922. doi:10.1037//0022-3514.63.6.913

Greffrath, W., Baumgartner, U., & Treede, R. D. (2007). Peripheral and central components of habituation to heat pain perception and evoked potentials in humans. Pain, 132(3), 301-311. doi:10.1016/j.pain.2007.04.026

Hagger, M. S., Wood, C., Stiff, C. & Chatzisarantis, N. L. D. (2009). The strength model of self-regulation failure and health-related behaviour. Health Psychology Review, 3, 208-238. doi:10.1080/17437190903414387

Hamilton, N., Karoly, P., & Kitzman, H. (2004). Self-Regulation and Chronic Pain: The Role of Emotion. Cognitive Therapy and Research, 28(5), 559-576. doi:10.1023/B:COTR.0000045565.88145.76

Harding, G., Campbell, J., Parsons, S., Rahman, A., & Underwood, M. (2010). British pain clinic practitioners' recognition and use of the bio-psychosocial pain management model for patients when physical interventions are ineffective or inappropriate: results of a qualitative study. BMC musculoskeletal disorders, 11 PMID:20298540. doi:10.1186/1471-2474-11-51

Hartling, L. M. (2005). Humiliation: Real Pain, A Pathway to Violence. Preliminary draft of a paper prepared for Round Table 2 of the 2005 Workshop on Humiliation and Violent Conflict, Columbia University, New York, December 15-16, 2005.

Haselton M. G. & Buss, D. M. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. Journal of Personality and Social Psychology, 78, 81-91. doi:10.1037//0022-3514.78.1.81

Haselton, M. G. & Nettle, D. (2006). The paranoid optimist: An integrative evolutionary model of cognitive biases. Personality and Social Psychology Review, 10, 47-66. doi:10.1207/s15327957pspr1001_3

Haythornthwaite, J. A., Sieber, W. J., & Kerns, R. D. (1991). Depression and the chronic pain experience. Pain ;46:177–84. doi:10.1016/0304-3959(91)90073-7

Herman, B. H. & Panksepp, J. (1978). Effects of morphine and nalozone on separation distress and approach attachment: Evidence for opiate mediation of social affect. Pharmacology, Biochemistry & Behavior 9, 213–220. doi:10.1016/0091-3057(78)90167-3

Hope, D. A., Rapee R. M., Heimberg, R. G., & Dombeck, M. J. (1990). Representations of the self in social phobia: Vulnerability to social threat. Cognitive Therapy and Research. 1990;14:177–189. doi:10.1007/BF01176208

Hughes, M. E., Waite, L. J., Hawkley, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. Research on Aging, 26, 655-672. doi:10.1177/0164027504268574

International Association for the Study of Pain. (1986). Classification of chronic pain. Pain, Suppl 3, S1–S226.

James, W. (1890). The principles of psychology. New York, NY: Henry Holt. doi:10.2307/1412102

Jensen-Campbell, L. A., & MacDonald, G. (2010). Experiencing the Ache of Social Injuries: An Integrative Approach to Understanding Social Pain. In G. MacDonald & L.A. Jensen-Campbell. (Eds.), Social Pain: Neuropsychological and Health Implications of Loss and Exclusion. (pp. 3-8). Washington, DC: American Psychological Association.

Jürgens, U., & Ploog, D. (1970). Cerebral representation of vocalization in the squirrel monkey. Experimental Brain Research, 10, 532-554. doi:10.1007/BF00234269

Katz J., Martin A. L., Pagé M. G., & Calleri, V. (2009). Alexithymia and fear of pain independently predict heat pain intensity ratings among undergraduate university students. Pain Res Manag;14(4):299-305.

Kendall-Tackett, K. (2001). Chronic pain: The next frontier in child maltreatment research. Child Abuse & Neglect, 25, 997-1000. doi:10.1016/S0145-2134(01)00252-6

Kewman, D. G., Vaishampayan, N., Zald, D. & Han, B., (1991). Cognitive impairments in musculoskeletal pain patients. International Journal of Psychiatry in Medicine, 21, 253–262.

Knack, J. M., Gomez, H. L. & Jensen-Campbell, L. A. (2011). Does Chronic Peer Victimization Influence Pain Sensitivity?. In G. MacDonald & L.A. Jensen-Campbell. (Eds.), Social Pain: Neuropsychological and Health Implications of Loss and Exclusion. (pp. 215-236). Washington, DC: American Psychological Association.

Krill, A., & Platek, S. M. (2009). In-group and out-group membership mediates anterior cingulate activation to social exclusion. Front Evolutionary Neuroscience, 1:1. doi:10.3389/neuro.18.001.2009

Kugelmann R. (2003). Pain as symptom, pain as Sign. Health: An Intern J Social Study of Heal Ill Med; 7(1):29–50. doi:10.1177/1363459303007001305

Lakin, J. L., Chartrand, T. L., & Arkin, R. M. (2008). I am too just like you: Nonconscious mimicry as an automatic behavioral response to social exclusion. Psychological Science, 19, 816-822. doi:10.1111/j.1467-9280.2008.02162.x

Langer, E. J., & Rodin, J. (1976). The effects of choice and enhanced personal responsibility for the aged. Journal of Personality and Social Psychology, 34, 191-198. doi:10.1037//0022-3514.34.2.191

Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. Personality and Social Psychology Bulletin, 9, 371-375. doi:10.1177/0146167283093007

Leary, M. R. (1983). Social anxiousness: The construct and its measurement. Journal of Personality Assessment, 47, 66-75. doi:10.1207/s15327752jpa4701_8

Leary, M. R. (2001). Toward a conceptualization of interpersonal rejection. In Interpersonal Rejection, (ed.) Leary, M. R., pp. 3–20. New York: Oxford Univ. Press

Leary, M. R. (Ed.) (2001). Interpersonal rejection. New York: Oxford University Press.

Leary, M. R., & Leder, S. (2009). The nature of hurt feelings: Emotional experience and cognitive appraisals. In A. Vangelisti (Ed.), Feeling hurt in close relationships. New York: Cambridge University Press. doi:10.1017/CBO9780511770548

Leary, M. R., & Springer, C. A. (2001). Hurt feelings: The neglected emotion. In R. Kowalski. (Ed.), Aversive behaviors and interpersonal transgression (pp. 151–175). Washington, DC: American Psychological Association. The causes, phenomenology, and consequences of hurt feelings. doi:10.1037/10365-000

Leary, M. R., Haupt, A. L., Strausser, K. S., & Chokel, J. T. (1998). Calibrating the sociometer: The relationship between interpersonal appraisals and state self-esteem. Journal of Personality and Social Psychology, 74, 1290-1299. doi:10.1037//0022-3514.74.5.1290

Leary, M. R., Kowalski, R. M., & Smith, L. (2003). Teasing, rejection, and violence: Case studies of the school shootings. Aggressive Behavior, 29, 202–214. doi:10.1002/ab.10061

Leary, M. R., Springer, C. A., Negel, L., Ansell, E., & Evans, K. (1998). The causes, phenomenology, and consequences of hurt feelings. Journal of Personality and Social Psychology, 74, 1225–1237. doi:10.1037//0022-3514.74.5.1225

Leary, M. R., Tambor, E. S., Terdal, S. J., & Downs, D. L. (1995). Self-esteem as an interpersonal monitor. The sociometer hypothesis. Journal of Personality and Social Psychology, 68, 518–530. doi:10.1037//0022-3514.68.3.518

Liddell A. & Locker, D. (1997). Gender and age differences in attitudes to dental pain and dental control. Community Dent Oral Epidemiol 25, 314–318. doi:10.1111/j.1600-0528.1997.tb00945.x

Lieberman, M. D., & Eisenberger, N. I. (2004). The neural alarm system: Behavior and beyond. Reply to Ullsperger et al. Trends in Cognitive Psychology, 8, 446-447. doi:10.1016/j.tics.2004.08.014

Lieberman, M. D., & Eisenberger, N. I. (2005). A pain, by any other name (rejection, exclusion, ostracism), still hurts the same: The role of dorsal anterior cingulate cortex in social and physical pain. In J. T. Cacioppo P. Visser, & C. Pickett (Eds.), Social neuroscience: People thinking about people. Cambridge, MA: MIT Press.

Lieberman, M. D., & Eisenberger, N. I. (2008). The pains and pleasures of social life: A social cognitive neuroscience approach. Neuroleadership.

Lieberman, M. D., & Eisenberger, N. I. (2009). Pains and pleasures of social life. Science, 323, 890-891. doi:10.1126/science.1170008

Linton S. J., Buer, N., Vlaeyen, J., & Hellsing, A. L. (2000). Are fear-avoidance beliefs related to the inception of an episode of back pain? A prospective study. Psychol Health;14:1051–9. doi:10.1080/08870440008407366

MacDonald, G. & Jensen-Campbell, L. A. (2010). Social pain research: Accomplisments and challenges. In G. MacDonald & L.A. Jensen-Campbell (Eds.) Social pain: Neuropsychological and health implications of loss and exclusion (pp. 237-241). Washington, DC: APA Books.

MacDonald, G. & Kingsbury, R. (2006). Does physical pain augment anxious attachment? Journal of Social and Personal Relationships, 23, 291-304. doi:10.1177/0265407506062481

MacDonald, G. (2008). Use of pain threshold reports to satisfy social needs. Pain Research and Management, 13 (4), 309 - 319.

MacDonald, G. (2009). Social pain and hurt feelings. In P.J. Corr & G. Matthews (Eds.) Cambridge Handbook of Personality Psychology (pp.541-555). Cambridge: Cambridge University Press.

MacDonald, G., & Jensen-Campbell, L. A. (2011). Social Pain Research: Accomplishments and Challenges. In G. MacDonald & L. A. Jensen-Campbell. (Eds.), Social Pain: Neuropsychological and Health Implications of Loss and Exclusion (pp. 237-241). Washington, DC: American Psychological Association.

MacDonald, G., & Leary M. R. (2005). Why does social exclusion hurt? The relationship between social and physical pain. Psychological Bulletin, 131, 202-223. doi:10.1037/0033-2909.131.2.202

MacDonald, G., & Leary, M. R. (2005). Roles of Social Pain and Defense Mechanisms in Response to Social Exclusion: Reply to Panksepp (2005) and Corr (2005). Psychological Bulletin, 131, 237-240. doi:10.1037/0033-2909.131.2.237

MacDonald, G., Borsook, T., & Spielmann, S. S. (2010). Defensive avoidance of social pain via perceptions of social threat and reward. In G. MacDonald & L.A. Jensen Campbell (Eds.) Social pain:

Neuropsychological and health implications of loss and exclusion (pp. 141-160). Washington, DC: APA Books.

MacDonald, G., Kingsbury, R., & Shaw, S. (2005). Adding insult to injury: Social pain theory and response to social exclusion. In K. D. Williams, J. P. Forgas & W. von Hippel (Eds.) The social outcast: Ostracism, social exclusion, rejection, and bullying (pp. 77-90). New York: Psychology Press.

MacLean, P. D., & Newman, J. D. (1988). Role of midline frontolimbic cortex in production of the isolation call of squirrel monkeys. Brain research, 450, 111-123. doi:10.1016/0006-8993(88)91550-8

Maddux, J. E., Norton, L. W., & Leary, M. R. (1988). Cognitive components of social anxiety: An investigation of the integration of selfpresentation theory and self-efficacy theory. Journal of Social and Clinical Psychology, 6, 180–190.

Maner, J. K., DeWall, C. N., Baumeister, R. F., & Schaller, M. (2007). Does social exclusion motivate interpersonal reconnection? Resolving the "porcupine problem." Journal of Personality and Social Psychology, 92, 42-55. doi:10.1037/0022-3514.92.1.42

Mansell, W., Clark, D. M., Ehlers, A., & Chen, Y-P. (1999). Social anxiety and attention away from emotional faces. Cognition and Emotion. 1999;13:673–690. doi:10.1080/026999399379032

Márquez, G. G. (1968). Cien años de soledad, Buenos Aires, Editorial Sudamericana, 1968.

Masten, C. L., Eisenberger, N. I., Borofsky, L. A., Pfeifer, J. H., McNealy, K., Mazziotta, J. C., & Dapretto, M. (2009). Neural correlates of social exclusion during adolescence: understanding the distress of peer rejection. Social Cognitive and Affective Neuroscience, 4, 143-157. doi:10.1093/scan/nsp007

Masten, M. L., & Eisenberger, N. I. (2009). Exploring the experience of social rejection in adults and adolescents: A social cognitive neuroscience perspective. In M. J., Harris (Ed.), Bullying, rejection, and peer victimization: A social cognitive neuroscience perspective. New York: Springer Publishing Company, (pp. 53-78).

Master, S. L., Eisenberger, N. I., Taylor, S. E., Naliboff, B. D., Shirinyan, D., & Lieberman, M. D. (2009). A picture's worth: Partner photographs reduce experimentally induced pain. Psychological Science, 20, 1316-1318. doi:10.1111/j.1467-9280.2009.02444.x

Mattia, J. I., Heimberg, R. G., & Hope, D. A. (1993). The revised Stroop color-naming task in social phobics. Behaviour Research and Therapy.;31:305–313. doi:10.1016/0005-7967(93)90029-T

Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. Journal of Personality and Social Psychology, 55, 102–111. doi:10.1037//0022-3514.55.1.102

McCracken, L. M. (1998). Learning to live with the pain: Acceptance of pain predicts adjustment in persons with chronic pain. Pain, 74, 27. doi:10.1016/S0304-3959(97)00146-2

McCracken, L. M., Faber, S. D. & Janeck, A. S. (1998). Pain-related anxiety predicts non-specific physical complaints in persons with chronic pain. Behaviour Research and Therapy. 36, 621–630. doi:10.1016/S0005-7967(97)10039-0

McCracken, L. M., Gross, R. T., Sorg, P. J. & Edmands, T. A., (1993). Prediction of pain in patients with chronic low back pain: effects of inaccurate prediction and pain-related anxiety. Behavioural Resource Therapy. 31, 647–652. doi:10.1016/0005-7967(93)90117-D

McCracken, L. M., Zayfert, C. & Gross, R. T. (1992). The Pain Anxiety Symptoms Scale: development and validation of a scale to measure fear of pain. Pain 50, 67–73. doi:10.1016/0304-3959(92)90113-P

McNeil, D. W., & Rainwater, A. J., III (1998). Development of the Fearof Pain Questionnaire-III. J. Behav. Med. 21: 389–410.

McWilliams, L. A., & Asmundson, G. J. (2007). The relationship of adult attachment dimensions to pain-related fear, hyper-vigilance, and catastrophizing. Pain 2007;127:27-34. doi:10.1016/j.pain.2006.07.020

Meredith, P. J., Strong J., & Feeney, J. A. (2006). The relationship of adult attachment to emotion, catastrophizing, control, threshold and tolerance in experimentally-induced pain, Pain, 120, 4-52. doi:10.1016/j.pain.2005.10.008

Mitchell, L. A., MacDonald, R. A., & Brodie, E. E. (2004). Temperature and the cold pressor test. Journal of Pain, 5:233-237. doi:10.1016/S1526-5900(04)00746-1

Mobbs, D., Marchant, J. L., Hassabis, D., Seymour, B., Tan, G., Gray, M., Petrovic, P., Dolan, R., & Frith, C.D. (2009). From Threat to Fear: The Neural Organization of Defensive Fear Systems in Humans J. Neurosci. 29: 12236-12243; doi:10.1523/JNEUROSCI.2378-09.

Mogg, K., & Bradley, B. P. (2002). Selective orienting of attention to masked threat faces in social anxiety. Behaviour Research and Therapy.;40:1403–1414. doi:10.1016/S0005-7967(02)00017-7

Moor, B. G., Crone, E. A., & van der Molen, M. W. (2010). The Heartbrake of Social Rejection: Heart Rate Deceleration in Response to Unexpected Peer Rejection. Psychological Science; DOI: 10.1177/0956797610379236.

Myoshi, K. (2001). Depression associated with physical illness. Japanese Medical Association Journal, 44, 279-282.

Nelson, E. E., & Panksepp, J. (1998). Brain substrates of infant-mother attachment: Contributions of opioids, oxytocin and norepinephrine. Neurosci Biobehav Rev.;22:437-452. doi:10.1016/S0149-7634(97)00052-3

Nezlek, J., Wheeler, L., Williams, K., & Govan, C. (2004, January). Ostracism in everyday life. Presented at the Society for Personality and Social Psychology, Austin, TX.

Nisbett, R., & Schachter, S. (1966). Cognitive manipulation of pain. Journal of Experimental Social. Psychology, 1966, 2, 227-236. doi:10.1016/0022-1031(66)90081-3

Nordgren, L. F., Banas, K., & MacDonald, G. (in press). Empathy gaps for social pain: Why people underestimate the pain of social suffering. Journal of Personality and Social Psychology.

Nunnally J. (1978). Psychometric Theory. New York: McGraw-Hill.

O'Connor, M. F., Wellisch, D. K., Stanton, A., Eisenberger, N. I., Irwin, M. R., & Lieberman, M. D. (2008). Craving love: Enduring grief activates brain's reward center. NeuroImage, 42, 969-972. doi:10.1016/j.neuroimage.2008.04.256

Oaten, M., Williams, K., Jones, A., & Zadro. L. (2008). The effects of ostracism on self-regulation in the socially anxious. Journal of Social and Clinical Psychology, 27, 471-504. doi:10.1521/jscp.2008.27.5.471

Ochsner K. N., Ludlow, D. H., Knierim, K., Hanelin, J., Ramachandran, T., Glover, G. C., & Mackey, S. C. (2006). Neural correlates of individual differences in pain-related fear and anxiety. Pain; 120 (1-2), 69-77. doi:10.1016/j.pain.2005.10.014

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. Behavior Research Methods, Instrumentation, and Computers, 32, 396-402.

Öhman, A. (2000). Fear and anxiety: Evolutionary, cognitive, and clinical perspectives. In M. Lewis & J. M. Haviland-Jones (Eds.). Handbook of emotions. (pp.573–593). New York: The Guilford Press.

Öhman, A., Lundqvist, D., & Esteves, F. (2001). The face in the crowd revisited: A threat advantage with schematic stimuli. Journal of Personality and Social Psychology.;80:381–396. doi:10.1037//0022-3514.80.3.381

Onoda, K., Okamoto, Y., Nakashima, K., Nittono, H., Ura, M., & Yamawaki, S. (2009). Decreased ventral anterior cingulate cortex activity is associated with reduced social pain during emotional support. Social Neuroscience, 4 (5), 443 – 454. doi:10.1080/17470910902955884

Onoda, K., Okamoto, Y., Nakashima, K., Nittono, H., Yoshimura, S., Yamawaki, S., Yamaguchi S., & Ura, M. (2010). Does low self-esteem enhance social pain?: The relationship between trait self-esteem and anterior cingulate cortex activation induced by ostracism. Social Cognitive and Affective Neuroscience. doi:10.1093/scan/nsq002

Oravecz, R., Hárdi, L., & Lajtai, L. (2004). Social transition, exclusion, shame and humiliation. Torture, 14 (1): 3–15.

Osman, A., Breitenstein, J.L., Barrios, F.X., Gutierrez, P.M., & Kopper, B.A.. (2002). CIII: further reliability and validity with nonclinical samples. J Behav Med; 25: 155–73.

Ouwerkerk, J. W., Kerr, N. L., Gallucci, M., & van Lange, P. A. M. (2005). Avoiding the social death penalty: Ostracism and cooperation in social dilemmas. In K. D. Williams, J. P. Forgas, & W. von Hippel (Eds.), The social outcast: Ostracism, social exclusion, rejection, and bullying (pp. 321–332). New York: Psychology Press.

Panksepp, J. (1998). Affective neuroscience: The foundations of human and animal emotions. London: Oxford University Press.

Panksepp, J. (2003). Feeling the pain of social loss. Science, 302, 237-239. doi:10.1126/science.1091062

Panksepp, J. (2005). Why does separation distress hurt? Comment on MacDonald and Leary (2005). Psychological Bulletin, 131, 224–230. doi:10.1037/0033-2909.131.2.224

Patterson, A. C., & Veenstra, G. (2010). Loneliness and risk of mortality: a longitudinal investigation in Alameda County, California. Soc Sci Med. Jul;71(1):181-6. doi:10.1016/j.socscimed.2010.03.024

Pepitone A,Wilpizeski C. (1960). Some consequences of experimental rejection. Journal of Abnormal and Social Psychology, 60:359–64. doi:10.1037/h0042405

Peters, M. L., Vlaeyen, J.W. S. & Weber, W. E. J. (2005). The joint contribution of physical pathology, pain-related fear and catastrophizing to chronic back pain disability. Pain, 113, 45 –50. doi:10.1016/j.pain.2004.09.033

Philips, H., & Jahanshahi, M. (1986). The components of pain behaviour report. Behaviour Research and Therapy, 24, 117–125. doi:10.1016/0005-7967(86)90082-3

Pickett, C. L., Gardner, W. L., & Knowles, M. (2004). Getting a cue: The need to belong and enhanced sensitivity to social cues. Personality and Social Psychology Bulletin, 30, 1095–1107. doi:10.1177/0146167203262085

Pincus, T. & Morley, S.J. (2001). Cognitive-processing bias in chronic pain: A review and integration. Psychological Bulletin, 127(5), 599-617. doi:10.1037//0033-2909.127.5.599

Pishyar, R., Harris, L. M., & Menzies, R. G. (2004). Attentional bias for words and faces in social anxiety. Anxiety, Stress and Coping. 2004;17:23–36. doi:10.1080/10615800310001601458

Porter, L. S., Davis, D. & Keefe, F. J. (2007). Attachment and pain: Recent findings and future directions. Pain, 128, 195-198. doi:10.1016/j.pain.2007.02.001

Rainville, P., Duncan, G. H., Price, D. D., Carrier, B., & Bushnell, M. C. (1997). Pain affect encoded in human anterior cingulate but not somatosensory cortex. Science, 277, 968-971. doi:10.1126/science.277.5328.968

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. Behaviour Research and Therapy;35:741–756. doi:10.1016/S0005-7967(97)00022-3

Rokach, A., & Neto, F. (2000). Coping with loneliness in adolescence: A cross-cultural study. Social Behavior and Personality, 28, 329–342. doi:10.2224/sbp.2000.28.4.329

Rollman, G. B., Abdel-Shaheed, J., Gillespie, J. M., & Jones, K. S. (2004). Does past pain influence current pain: Biological and psychosocial models of sex differences. European Journal of Pain, 8, 427-433. doi:10.1016/j.ejpain.2004.03.002

Rothbaum R., Weisz J. R., & Snyder S. S. (1982). Changing the world and changing the self: a two-process model of perceived control. Journal of Personality & Social Psychology, 42, 5-37. doi:10.1037//0022-3514.42.1.5

Rowbotham, G. F. (1946). Pain and its underlying pathology. Journal of Mental Science, 92, 595-604. doi:10.1192/bjp.92.388.595

Russell, D. (1996). UCLA Loneliness Scale (Version 3): Reliability, Validity, and Factor Structure. Journal of Personality Assessment, 66: 20-40. doi:10.1207/s15327752jpa6601_2

Scarry, E. (1994). Resisting representation. New York: Oxford University Press.

Schmidt, N. B., Richey, J. A., Buckner, J. D., & Timpano, K. R. (2009). Attention training for generalized social anxiety disorder. Journal of Abnormal Psychology.;118:5–14. doi:10.1037/a0013643

Sebastian, C. L., Tan, G. C. Y, Roiser, J. P., Viding, E., Dumontheil, I., & Blakemore, S-J. (2010). Developmental influences on the neural bases of responses to social rejection: implications of social neuroscience for education. Neuroimage.

Seligman, M. E. P. (1975). Helplessness: On Depression, Development, and Death. San Francisco, CA: Freeman & Co.

Severeijns, R., Vlaeyen, J. W. S., van den Hout, M. A., & Weber, W. E. J. (2001). Pain catastrophizing predicts pain intensity, disability, and psychological distress independent of the level of physical impairment. Clinical Journal of Pain, 17, 165-172.

Slavich, G. M., Way, B. M., Eisenberger, N. I., & Taylor, S. E. (2010). Neural sensitivity to social rejection is associated with inflammatory responses to social stress. Proceedings of the National Academy of Sciences of the United States of America, 107, 1417-14822. doi:10.1073/pnas.1009164107

Smart Richman, L., & Leary, M. R. (2009). Reactions to discrimination, stigmatization, ostracism, and other forms of interpersonal rejection: A dynamic, multi-motive model. Psychological Review, 116, 365-383. doi:10.1037/a0015250

Solberg Nes, L., Roach, A. R., & Segerstrom, S. C. (2009). Executive functions, self-regulation, and chronic pain: A review. Annals of Behavioral Medicine, 37, 173-183. doi:10.1007/s12160-009-9096-5

Solomon, S., Greenberg, J., & Pyszczynski, T. (1991). A terror management theory of self-esteem and its role in social behavior. In M. Zanna (Ed.), Advances in Experimental social psychology (pp. 93-159). New York: Academic Press.

Somerville, L. H., Heatherton, T. F., Kelley, W. M. (2006). Anterior cingulate cortex responds differentially to expectancy violation and social rejection. Nat Neurosci. 9, 1007-1008. doi:10.1038/nn1728

Sommer, K. L., Williams, K. D., Ciarocco, N. J., & Baumeister, R. F. (2001). Explorations into the intrapsychic and interpersonal consequences of social ostracism. Basic and Applied Social Psychology, 23, 227-245. doi:10.1207/153248301753225694

Spoor, J.,Williams, K.D. (2006). The evolution of an ostracism detection system. In The Evolution of the Social Mind: Evolutionary Psychology and Social Cognition, ed. JP Forgas, M Haselton, Wvon Hippel. New York: Psychol. Press. In press

Staub, E. (2004). Basic human needs, altruism, and aggression. In A.G. Miller (Ed.), The social psychology of good and evil (pp. 2051_2084). New York, NY: Guilford Press.

Stillman, T. F., Baumeister, R. F., Lambert, N. M., Crescioni, A. W., DeWall, C. N., & Fincham, F. D. (2009). Alone and without purpose: Life loses meaning following social exclusion. Journal of Experimental Social Psychology, 45, 686-694. doi:10.1016/j.jesp.2009.03.007

Stinson, D. A., Cameron, J. J., Wood, J., Gaucher, D., & Holmes, J. G. (2009). Deconstructing the “reign of error:” A risk-regulation account of the self-fulfilling prophecy of acceptance. Personality and Social Psychology Bulletin, 35, 1165-1178. doi:10.1177/0146167209338629

Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. Psychological Assessment, 7, 524-532. doi:10.1037//1040-3590.7.4.524

Sullivan, M. J., Bishop, S., & Pivik, J. (1995). The Pain Catastrophizing Scale: development and validation. Psychol Assess, 7:524-32. doi:10.1037//1040-3590.7.4.524

Sullivan, M. J., Thorn, B., Haythornthwaite, J. A., Keefe, F., Martin, M., Bradley, L. A., & Lefebvre, J. C. (2001). Theoretical per-spectives on the relation between catastrophizing and pain. Clin J Pain;17:52-64.

Tait, R. C., Chibnall, J. T., & Kalauokalani, D. (2009). Provider judgments of patients in pain: Seeking symptom certainty. Pain Med;10:11–34. doi:10.1111/j.1526-4637.2008.00527.x

Taylor, S. (1993). The structure of fundamental fears. Journal of Behavior Therapy and Experimental Psychiatry;24:289–299. doi:10.1016/0005-7916(93)90053-Y

Taylor, S. (1998). The hierarchic structure of fears. Behaviour Research and Therapy, 36, 205–214. doi:10.1016/S0005-7967(98)00012-6

Tooby, J. & Cosmides, L. (2005). Conceptual foundations of evolutionary psychology. In D. M. Buss (Ed.), The Handbook of Evolutionary Psychology (pp. 5–67). Hoboken, NJ: Wiley.

Twenge, J. M., Baumeister, R. F., DeWall, C. N., Ciarocco, N. J., & Bartels, J. M. (2007). Social exclusion decreases prosocial behavior. Journal of Personality and Social Psychology, 92, 56–66.

Twenge, J. M., Baumeister, R. F., Tice, D. M. & Stucke, T. S. (2001). If you can't join them, beat them: Effects of social exclusion on aggressive behavior. Journal of Personality and Social Psychology, 81, 1058–1069. doi:10.1037//0022-3514.81.6.1058

Twenge, J. M., Catanese, K. R., & Baumeister, R. F. (2003). Social exclusion and the deconstructed state: Time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. Journal of Personality and Social Psychology, 85, 409-423. doi:10.1037/0022-3514.85.3.409

Vanin, J. (2008). Overview of anxiety and the anxiety disorders. Anxiety Disorders: A Pocket Guide for Primary Care. Humana Press. Virginia. doi:10.1007/978-1-59745-263-2

Vlaeyen, J. W. S, & Linton, S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain;85:317–32. doi:10.1016/S0304-3959(99)00242-0

Vul, E., Harris, C., Winkielman, P., Pashler, H. (2009). Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition. Perspectives on Psychological Science 4(3), 274-290. doi:10.1111/j.1745-6924.2009.01125.x

Walker, J., Sofaer B., & Holloway, I. (2006). The experience of chronic back pain: Accounts of loss in those seeking help from pain clinics. European Journal of Pain, 10, 3, 199-207. doi:10.1016/j.ejpain.2005.03.007

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. Journal of Consulting and Clinical Psychology, 33, 448–457. doi:10.1016/j.ejpain.2005.03.007

Way, B. M., Taylor, S. E., & Eisenberger, N. I. (2009). Variation in the mu-opiod receptor gene (OPRM1) is associated with dispositional and neural sensitivity to social rejection. Proceedings of the National Academy of Sciences of the United Stated of America, 106, 15079-15084.

Weeks, J. W., Heimberg, R. G., Fresco, D. M., Hart, T. A., Turk, C. L., Schneier, F. R., & Liebowitz, M. R. (2005). Empirical validation and psychometric evaluation of the brief Fear of Negative Evaluation Scale in patients with social anxiety disorder. Psychological Assessment.;17:179–190. doi:10.1037/1040-3590.17.2.179

Williams, K. D. (2001). Ostracism: The power of silence. New York: Guilford Press.

Williams, K. D. (2007). Ostracism. Annual Review of Psychology, 58, 425-452. doi:10.1146/annurev.psych.58.110405.085641

Williams, K. D. (2007). Ostracism: The kiss of social death. Social and Personality PsychologyCompass, 1, 236-247. doi:10.1111/j.1751-9004.2007.00004.x

Williams, K. D. (2009). Ostracism: A temporal need-threat model. In M. Zanna (Ed.), Advances in Experimental Social Psychology (Vol. 41, pp. 279-314). NY: Academic Press.

Williams, K. D. (2009). Ostracism: Effects of being excluded and ignored. In: M. Zanna, Editor, Advances in experimental social psychology, Academic Press, New York, 275–314.

Williams, K. D., & Eisenberger, N. I. (2007). The pain of ostracism. Newsletter to the International Society for Interpersonal Acceptance-Rejection, 1, 2-4.

Williams, K. D., & Jarvis, B. (2006). Cyberball: A program for use in research on ostracism and interpersonal acceptance. Behavior Research Methods, Instruments, and Computers, 38, 174-180.

Williams, K. D., & Zadro, L. (2001). Ostracism: On being ignored, excluded, and rejected. In M. R. Leary (Ed.), Interpersonal rejection (pp. 21–53). New York: Oxford University Press.

Williams, K. D., & Zadro, L. (2005). Ostracism: The indiscriminate early detection system. In K. D. Williams, J. P. Forgas, & W. von Hippel (Eds.), The social outcast: Ostracism, social exclusion, rejection, and bullying (pp. 19–34). New York: Psychology Press.

Williams, K. D., Cheung, C. K., & Choi, W. (2000). Cyberostracism: Effects of being ignored over the Internet, Journal of Personality and Social Psychology, 79, 5, 748-762. doi:10.1037//0022-3514.79.5.748

Williams, K. D., Forgas, J. P., & Hippel, W.V. (2005). The Social Outcast: Ostracism, Social Exclusion, Rejection, and Bullying. New York: Psychol. Press.

Williams, L. E., & Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. Science, 322, 606-607. doi:10.1126/science.1162548

Zadro, L. (2004). Ostracism: Empirical studies inspired by real-world experiences of silence and exclusion. Unpublished doctoral dissertation. University of New South Wales, Sydney, NSW.

Zadro, L., Williams, K.D., & Richardson, R. (2004). How low can you go? Ostracism by a computer lowers belonging, control, self-esteem, and meaningful existence . Journal of Experimental Social Psychology, 40, 560-567. doi:10.1016/j.jesp.2003.11.006

Zhong, C., & Leonardelli, G.J. (2008). Cold and Lonely: Does Social Exclusion Literally Feel Cold? Psychological Science, 19, 9, 838-842. doi:10.1111/j.1467-9280.2008.02165.x

Zimet, G. D., Dahlem, N. W., Zimet, S. G. & Farley, G. K. (1988). The Multidimensional Scale of Perceived Social Support. Journal of Personality Assessment, 52, 30-41. doi:10.1207/s15327752jpa5201_2

APPENDICES

Appendix A - Fear of Social and Physical Pain Scale

You will be shown a series of items which describe a variety of PAINFUL EXPERIENCES. Please read each item and think about how FEARFUL you are of experiencing the PAIN associated with each item. If you have never experienced the PAIN of a particular item, please answer on the basis of how FEARFUL you expect you would be if you had such an experience. *Click on one rating per item to rate your FEAR OF PAIN in relation to each event.* *Please note that some questions may ask you to think about "someone who is important to you." Please think about the same person when answering these kind of questions.* **How FEARFUL you are of experiencing the PAIN of...**		Not at all						Extremely
1	being left out of a group.	1	2	3	4	5	6	7
2	being ignored during a party.	1	2	3	4	5	6	7
3	being ignored during a conversation.	1	2	3	4	5	6	7
4	being excluded from a conversation.	1	2	3	4	5	6	7
5	being betrayed by someone who is important to you.	1	2	3	4	5	6	7
6	feeling ignored by someone who is important to you.	1	2	3	4	5	6	7
7	someone who is important to you stops talking to you.	1	2	3	4	5	6	7
8	not being invited to a party organized by your friends.	1	2	3	4	5	6	7
9	being verbally abused by a family member.	1	2	3	4	5	6	7
10	your partner forgetting your birthday.	1	2	3	4	5	6	7
11	your spouse/partner forgetting your anniversary.	1	2	3	4	5	6	7
12	being betrayed by your partner.	1	2	3	4	5	6	7
13	being embarrassed in front of your classmates by your professor.	1	2	3	4	5	6	7
14	your professor telling at you that you are an incompetent student.	1	2	3	4	5	6	7
15	being verbally abused by your boss.	1	2	3	4	5	6	7
16	breaking your arm.	1	2	3	4	5	6	7
17	breaking your leg.	1	2	3	4	5	6	7
18	breaking your neck.	1	2	3	4	5	6	7
19	hitting a sensitive bone in your elbow - your "funny bone".	1	2	3	4	5	6	7
20	getting a paper-cut on your finger.	1	2	3	4	5	6	7
21	getting strong soap in both eyes while bathing or showering.	1	2	3	4	5	6	7
22	having a blood sample drawn with a hypodermic needle.	1	2	3	4	5	6	7
23	receiving an injection in your arm.	1	2	3	4	5	6	7
24	receiving an injection in your hip/buttocks.	1	2	3	4	5	6	7

Appendix B – Rejection Sensitivity Questionnaire

(Downey & Feldman, 1996)

Each of the items below describes things college students sometimes ask of other people. Please

imagine that you are in each situation. You will be asked to answer the following questions:

1) How concerned or anxious would you be about how the other person would respond?

2) How do you think the other person would be likely to respond?

1. You ask someone in class if you can borrow his/her notes.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

2. You ask your boyfriend/girlfriend to move in with you.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

3. You ask your parents for help in deciding what programs to apply to.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

4. You ask someone you don't know well out on a date.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

5. Your boyfriend/girlfriend has plans to go out with friends tonight, but you really want to spend the evening with him/her, and you tell him/her so.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

6. You ask your parents for extra money to cover living expenses.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

7. After class, you tell your professor that you have been having some trouble with a section of the course and ask if he/she can give you some extra help.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

8. You approach a close friend to talk after doing or saying something that seriously upset him/her.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

9. You ask someone in one of your classes to coffee.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

10. After graduation, you can't find a job and ask your parents if you can live at home for a while.

How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

11. You ask your friend to go on a vacation with you over Spring Break.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

12. You call your boyfriend/girlfriend after a bitter argument and tell him/her you want to see him/her.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

13. You ask a friend if you can borrow something of his/hers.
How concerned or anxious would you be over whether or not the person would want to lend you his/her notes?

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

14. You ask your parents to come to an occasion important to you.

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

15. You ask a friend to do you a big favor.

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

16. You ask your boyfriend/girlfriend if he/she really loves you.

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

17. You go to a party and notice someone on the other side of the room and then you ask them to dance.

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

18. You ask your boyfriend/girlfriend to come home to meet your parents.

very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to move in very unlikely very likely with me.

very unlikely 1 2 3 4 5 6 very likely

Appendix C – Short Scale for Measuring Loneliness

(Hughes, Waite, Hawkley, & Cacioppo, 2004)

The next questions are about how you feel about different aspects of your life. For each one, tell me how often you feel that way.

	hardly ever	some of the time	often
First, how often do you feel that you lack companionship: Hardly ever, some of the time, or often	1	2	3
How often do you feel left out: Hardly ever, some of the time, or often	1	2	3
How often do you feel isolated from others? Hardly ever, some of the time, or often	1	2	3

Appendix D – Beck Depression Inventory

(Second Edition; BDI-II; Beck, 1996)

	ITEM	RESPONSE			
1	Sadness	I do not feel sad	I feel sad much of the time	I am sad all the time	I am so sad or unhappy that I can't stand it
2	Pessimism	I am not discouraged about my future	I feel more discouraged about my future than I used to be	I do not expect things to work out for me	I feel that my future is hopeless and will only get worse
3	Past Failure	I do not feel like a failure	I have failed more than I should have	As I look back, I see a lot of failures	I feel I am a total failure as a person
4	Loss of Pleasure	I get as muchpleasure as I ever did from the things I enjoy	I don't enjoy things as much as I used to	I get very little pleasure from the things I used to enjoy	I can't get any pleasure from the things I used to enjoy
5	Guilty Feelings	I don't feel particularly guilty	I feel guilty over many things I have done or should have done	I feel quite guilty most of the time	I feel guilty all of the time
6	Punishment Feelings	I don't feel I am being punished	I feel I may be punished	I expect to be punished	I feel I am being punished
7	Self-Dislike	I feel the same about myself as ever	I have lost confidence in myself	I am disappointed in myself	I dislike myself
8	Self-Criticalness	I don't criticize or blame myself more than usual	I am more critical of myself than I used to be	I criticize myself for all of my faults	I blame myself for everything bad that happens
9	Suicidal Thoughts or Wishes	I don't have any thoughts of killing myself	I have thoughts of killing myself, but I would not carry them out	I would like to kill myself	I would kill myself if I had the chance
10	Crying	I don't cry anymore than I used to	I cry more than I used to	I cry over every little thing	I feel like crying, but I can't
11	Agitation	I am no more restless or wound up than usual	I feel more restless or wound up than usual	I am so restless or agitated that it's hard to stay still	I am so restless or agitated that I have to keep moving or doing something

12	Loss of Interest	I have not lost interest in other people or activities	I am less interested in other people or things than before	I have lost most of my interest in other people or things	It's hard to get interested in anything
13	Indecisiveness	I make decisions about as well as ever	I find it more difficult to make decisions than usual	I have much greater difficulty in making decisions than I used to	I have trouble making any decisions
14	Worthlessness	I do not feel I am worthless	I don't consider myself as worthwhile and useful as I used to	I feel more worthless as compared to other people	I feel utterly worthless
15	Loss of Energy	I have as much energy as ever	I have less energy than I used to have	I don't have enough energy to do very much	I don't have enough energy to do anything
16	Changes in Sleep Pattern	I have not experienced any change in my sleeping pattern	I sleep somewhat more than usual	I sleep somewhat less than usual	I sleep a lot more than usual
17	Irritability	I am no more irritable than usual	I am more irritable than usual	I am much more irritable than usual	I am irritable all the time
18	Changes in Appetite	I have not experienced any change in my appetite	My appetite is somewhat less than usual	My appetite is somewhat greater than usual	My appetite is much less than before
19	Concentration Difficulty	I can concentrate as well as ever	I can't concentrate as well as usual	It's hard to keep my mind on anything for very long	I find I can't concentrate on anything
20	Tiredness or Fatigue	I am no more tired or fatigued than usual	I get more tired or fatigued more easily than usual	I am too tired or fatigued to do a lot of the things I used to do	I am too tired or fatigued to do most of the things I used to do
21	Loss of Interest in Sex	I have not noticed any recent change in my interest in sex	I am less interested in sex than I used to be	I am much less interested in sex now	I have lost interest in sex completely

Appendix E – Pain Catastrophyzing Scale

(Sullivan et al., 1995)

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

Instructions: We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

RATING	0	1	2	3	4
MEANING	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time

When I'm in pain …

Number	Statement	Rating
1	I worry all the time about whether the pain will end.	
2	I feel I can't go on.	
3	It's terrible and I think it's never going to get any better	
4	It's awful and I feel that it overwhelms me.	
5	I feel I can't stand it anymore	
6	I become afraid that the pain will get worse.	
7	I keep thinking of other painful events	
8	I anxiously want the pain to go away	
9	I can't seem to keep it our of my mind	
10	I keep thinking about how much it hurts.	
11	I keep thinking about how badly I want the pain to stop	
12	There's nothing I can do to reduce the intensity of the pain	
13	I wonder whether something serious may happen.	

Appendix F – Pain History Scale

Instructions: For each question, please circle the number to the right that best represents your feelings	Completely untrue of me	Mostly untrue of me	Slightly more true than untrue	Moderately true of me	Mostly true of me	Describes me perfectly
In the past, people have not been there to give me warmth, comfort, and affection.	1	2	3	4	5	6
In the past, I often felt excluded and ignored.	1	2	3	4	5	6
In the past, I haven't felt that I am special to someone.	1	2	3	4	5	6
In the past, I have suffered a lot from illness and injury.	1	2	3	4	5	6
In the past, I have suffered much physical pain.	1	2	3	4	5	6
In the past, I often had pain in my body.	1	2	3	4	5	6

Appendix G – Fear of Negative Evaluation Scale

(Watson & Friend, 1969)

ITEM	RESPONSE	
1. I rarely worry about seeming foolish to others.	true	false
2. I worry about what people will think of me even when I know it doesn't make any difference.	true	false
3. I become tense and jittery if I know someone is sizing me up.	true	false
4. I am unconcerned even if I know people are forming an unfavorable impression of me.	true	false
5. I feel very upset when I commit some social error.	true	false
6. The opinions that important people have of me cause me little concern.	true	false
7. I am often afraid that I may look ridiculous or make a fool of myself.	true	false
8. I react very little when other people disapprove of me.	true	false
9. I am frequently afraid of other people noticing my shortcomings.	true	false
10. The disapproval of others would have little effect on me.	true	false
11. If someone is evaluating me I tend to expect the worst.	true	false
12. I rarely worry about what kind of impression I am making on someone.	true	false
13. I am afraid that others will not approve of me.	true	false
14. I am afraid that people will find fault with me.	true	false
15. Other people's opinions of me do not bother me.	true	false
16. I am not necessarily upset if I do not please someone.	true	false
17. When I am talking to someone, I worry about what they may be thinking about me.	true	false
18. I feel that you can't help making social errors sometimes, so why worry about it.	true	false
19. I am usually worried about what kind of impression I make.	true	false
20. I worry a lot about what my superiors think of me.	true	false
21. If I know someone is judging me, it has little effect on me.	true	false
22. I worry that others will think I am not worthwhile.	true	false
23. I worry very little about what others may think of me.	true	false
24. Sometimes I think I am too concerned with what other people think of me.	true	false
25. I often worry that I will say or do the wrong things.	true	false
26. I am often indifferent to the opinions others have of me.	true	false
27. I am usually confident that others will have a favorable impression of me.	true	false
28. I often worry that people who are important to me won't think very much of me.	true	false
29. I brood about the opinions my friends have about me.	true	false
30. I become tense and jittery if I know I am being judged by my superiors.	true	false

Appendix H – Need Threat Scale

(Williams, Cheung, & Choi, 2000)

For each question, please circle the number to the right that best represents the feelings you were experiencing during the game.	Not at all				Extremely
Belonging					
I felt "disconnected" (R)	1	2	3	4	5
I felt rejected (R)	1	2	3	4	5
I felt like an outsider (R)	1	2	3	4	5
I felt I belonged to the group	1	2	3	4	5
I felt the other players interacted with me a lot	1	2	3	4	5
Self esteem					
I felt good about myself	1	2	3	4	5
My self-esteem was high	1	2	3	4	5
I felt liked	1	2	3	4	5
I felt insecure (R)	1	2	3	4	5
I felt satisfied	1	2	3	4	5
Meaningful existence					
I felt invisible (R)	1	2	3	4	5
I felt meaningless (R)	1	2	3	4	5
I felt non-existent (R)	1	2	3	4	5
I felt important	1	2	3	4	5
I felt useful	1	2	3	4	5
Control					
I felt powerful	1	2	3	4	5
I felt I had control over the course of the game	1	2	3	4	5
I felt I had the ability to significantly alter events	1	2	3	4	5
I felt I was unable to influence the action of others (R)	1	2	3	4	5
I felt the other players decided everything (R)					
MOOD					
Good	1	2	3	4	5
Bad	1	2	3	4	5
Friendly	1	2	3	4	5
Unfriendly	1	2	3	4	5
Angry	1	2	3	4	5
Pleasant	1	2	3	4	5
Happy	1	2	3	4	5
Sad	1	2	3	4	5

Manipulation check					
For the next three questions, please circle the number to the right (or fill in the blank) that best represents the thoughts you had during the game.					
I was ignored	1	2	3	4	5
I was excluded	1	2	3	4	5
Assuming that the ball should be thrown to each person equally (33% if three people; 25% if four people), what percentage of the throws did you receive?	____ %				

Appendix I – The Conflict Tactics Scale

(Buckley, Winkel, & Leary, 2004)

Imagine for a moment that, rather than receiving the other participant's evaluations of you on a feedback form, you received them face-to-face. If you had been talking about yourself face-to-face with the other participant in a real-life conversation, how tempted would you have been to do each of the behaviors below.

Note that we are not asking whether you would have actually done each behavior, but rather the degree to which you would have been tempted to do each one. Use the scale below to indicate your response.

1 -------- 2 -------- 3 -------- 4 -------- 5 -------- 6 -------- 7 -------- 8 -------- 9

not at all tempted — somewhat tempted — very tempted

_____ Smiling at the other person
_____ Showing interest in what the other person said
_____ Humiliating the other person in front of others
_____ Purposely ignoring the other person
_____ Making the other person feel good
_____ Insulting or swearing at the other person
_____ Shouting or yelling at the other person
_____ Trying to make the other person laugh
_____ Throwing something at the other person that could hurt him or her
_____ Complimenting the other person
_____ Putting the other person at ease
_____ Pushing or shoving the other person
_____ Treating the other person nicely
_____ Slapping the other person
_____ Showing that you enjoyed talking to the other person
_____ Threatening to hit or throw something at the other person

ACKNOWLEDGEMENTS

Elenco dei GRAZIE alle persone con cui ho condiviso questi quattro anni di dottorato.

- ✓ Ringrazio in primo luogo il mio tutor, Lorenzo Montali, per avermi sempre ispirato, sostenuto e per la fiducia che ha voluto concedermi.
- ✓ Ringrazio Kip Williams per avermi fatto fare pace con la psicologia sociale.
- ✓ Ringrazio quel venerdì mattina del settembre 2008 in cui ho scoperto, per caso, l'esistenza del dolore sociale.
- ✓ Ringrazio i dottorandi miei carissimi compagni di ufficio e di corridoio che, nel corso di questi anni, hanno reso un piacere il nostro contesto di lavoro.
- ✓ Ringrazio anche i dottorandi conosciuti alla Purdue University, in particolare Jim e Eric, siete stati splendidi compagni di avventure oltreoceano.
- ✓ Ringrazio i miei nipoti, Agnese, Giorgio, Gioele e Giacomo perché sono la cosa più bella che esiste.
- ✓ Ringrazio i consigli e la vicinanza delle mie sorelle, Sara e Alessia.
- ✓ Ringrazio i mie genitori perché, con grande semplicità, hanno insegnato ai loro figli la passione per il sapere.
- ✓ Ringrazio Monica, per la condivisione umana e scientifica di questi anni, e perché mi ha insegnato che le maschere non sono necessarie, nemmeno in questa professione.
- ✓ Ringrazio Chiara (sebbene mi abbia fortemente sconsigliato di scrivere dei ringraziamenti) per avere condiviso con me i piaceri e i dolori della stesura della tesi e della preparazione all'assegno di ricerca. Ce l'abbiamo fatta Chiara!
- ✓ Ringrazio Simona, per il suo grande spessore morale, scientifico e soprattutto umano. Perché è sempre di esempio per tutti noi.
- ✓ Ringrazio i miei amici di paese, in particolare Alessandro, Claudio e Franco, perché ci siete sempre stati nonostante la mia assenza.

- ✓ Ringrazio le mie care coinquiline, Alessandra e Monica, per avermi accolto, per il clima familiare e i dibattiti alla Pink House.
- ✓ Ringrazio Valentina, perché se prima volevo andare via, ora voglio restare.