Chapter 4

How do emotions impact conflicts? A neuroscientific perspective

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What are emotions?

Before turning to the relationship between emotions and conflict, it is useful to explore the meaning of emotions. Although it might seem obvious what emotions are, it is difficult to find a definition that scholars agree upon. In fact, as Fehr and Russell (1984) noted, "everyone knows what an emotion is, until asked to give a definition. Then, it seems, no one knows" (p. 464). Indeed, there are different models of emotions. Some scholars argue there are distinct basic emotions with specific facial expressions (Ekman, 1992), as well as characteristic biological and neural underpinnings (Panksepp & Watt, 2011). Other scholars highlight the so-called dimensional approach, arguing emotions can be mapped on the two dimensions of activation, which refers to the degree of feeling aroused vs sleepy, and pleasantness, which refers to the degree to which one experiences positive or negative feelings (e.g., Feldman Barrett & Russell, 1998; Posner, Russel, & Peterson, 2005).

In general, many scholars agree on the notion that emotions have the following characteristics (e.g., Ekman & Davidson, 1994; Sander, 2013):

i) Emotions are subjective experiences that relate to a particular event. In this respect, emotions are different from moods, which are defined as affective phenomena of longer durations, such as depression.

ii) Emotions are accompanied by physiological reactions (e.g., accelerated heart beat or increased sweating) and facial expressions (such as smiles or frowns). Physiological reactions can prepare the body for taking actions (such as fighting a danger or taking flight). Facial expressions probably serve a double function, as they signal emotions to others and at the same time allow an enhanced or diminished processing of the emotion-evoking stimulus. It has, for instance, been shown that expressing fear (characterized by widely opened eyes, nose and mouth) enhances perception, while disgust (characterized by narrowed eyes and nose) diminishes sensory input (Susskind et al., 2008).

iii) Emotions are often associated with behavioral tendencies and even with certain cognitive states. A person who is experiencing positive emotions might be more creative (Isen, 2008) and a person who is afraid of the current traffic might cross a street more carefully.

An overview of the "emotional brain"

We think emotions and their neural underpinnings are crucial for understanding conflict and conflict resolution, because growing evidence shows that emotions influence decision making in various ways (for a review, see Lerner, Li, Valdesolo, & Kassam, 2015). To illustrate how quickly emotions can influence behavior, there is the famous example of a man walking in the forest who withdraws from a snake before consciously perceiving it (LeDoux, 1994, 2002). Emotional events – such as encountering a snake, but also encountering someone who is perceived as an enemy – can be processed very rapidly by neural structures that comprise the thalamus, the amygdala, the hippocampus, and the hypothalamus (see Figure 4.1). Sensory

information (for instance in the form of a visual percept of a snake) is received by the thalamus, a small structure in the center of the brain. The thalamus then passes this information to the visual cortex and to a small almond-shaped region called amygdala, which is crucial for relevance detection (see also Sander, Grafman, & Zalla, 2003). In interaction with a brain region called hippocampus, which has the form of a sea horse and is crucial for short-term memory storage (Squire, Stark, & Clark, 2004) and another brain region called the hypothalamus, which is crucial for controlling bodily states, such as body temperature (Ransom & Ingram, 1935), hunger and thirst (Grossman, 1975), and fatigue and sleep cycles (Mignot, Taheri, & Nishino, 2002). This detection system can then, for instance in reaction to danger, lead to a quick activation of bodily responses related to flight behavior (in the form of increased muscle tension, heart rate and sweating). In addition to these rapid links between emotions and behavior, it has been suggested that human decisions are often influenced by so-called somatic markers, which are related to emotions and bioregulatory processes (Damasio, Everitt, & Bishop, 1996). This integration of somatic information for decision making has been proposed to take place in the ventromedial prefrontal cortex (Damasio et al., 1996).

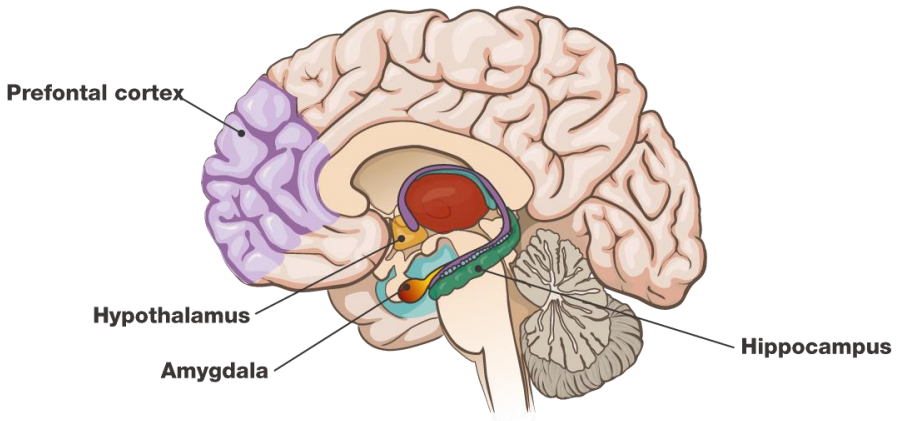

Figure 1 –The key regions of the emotional brain

The realization that the prefrontal cortex is included in the so-called “emotional brain” goes back to an accident that happened to a construction site foreman in 1848 called Phineas Gage (Macmillan, 2000). Phineas Gage was described as a good-natured and efficient man prior to his accident, but when an iron rod caused a serious injury to his prefrontal cortex, he became capricious, childish, and obstinate (Harlow, 1868). This provided one of the first pieces of evidence that the prefrontal cortex is crucially involved in emotional behavior.

Taken together, events that are perceived as relevant (and thus emotional) are processed by various brain structures. These brain structures interact to adapt bodily responses (such as muscle tension or sweating), behavior (such as withdrawing from danger or approaching rewards), and decision making. Since conflictual issues are perceived as relevant (otherwise people would probably not bother to argue), it is highly likely that each conflict is closely linked to emotions and their underlying brain functions. To explore this, the following paragraphs will address the interaction of emotions and stress with memory, cognition, and social behaviors. A special emphasis will be placed on the links that are most relevant to conflict and conflict resolution.

Emotions and memory

In the domain of emotions and memory, it has been shown that emotional experiences generally help to remember short stories (Cahill, Prins, Weber, & McGaugh, 1994). Furthermore, there is evidence that the memory consolidation of an event is facilitated when stress is experienced at the time of an event, even though exposure to stress prior to the event might lead to memorization impairment (Joëls, Pu, Wiegert, Oitzl, & Krugers, 2006). Memories of traumatic events can be extremely intense, leading to an unavoidable recurring recollection of those events

(Yehuda, Joëls, & Morris, 2010). Post-Traumatic Stress Disorder can happen after a person has experienced, witnessed, or otherwise been confronted with an event that involved actual or threatened death, serious injury, or threat to physical integrity (American Psychiatric Association, 2013) and it can lead to hyper-responsiveness to threats (Vythilingam et al., 2007).

This relationship between emotions and memory is extremely relevant to interpersonal conflict. Some authors have proposed conflict escalation models (e.g. Glasl, 2013) that assume that the conflict starts with the assimilation of the "other" with a "bad person" or a person of "inferior quality" and ultimately leads to the de-humanization of that person, who becomes a "devil". One can assume that when parties reach the highest level of such an escalation model, the emotions they have associated in their memory with the "enemy" are highly negative, but this has not been so far validated scientifically.

Emotions and rational thinking

Stress is not only a crucial factor when it comes to functions related to memory, but also when it comes to functions related to the capacity to think, regulate emotions, and make decisions (for a review, see Arnsten, 2009). These functions crucially rely on the optimal involvement of the prefrontal cortex, which in turn is dependent on optimal levels of neurotransmitters such as dopamine and norepinephrine. These neurotransmitters are tightly related to the level of stress and arousal – the higher the stress level, the more these neurotransmitters are released. The interaction between the levels of norepinephrine and dopamine with the prefrontal cortex can be described by an inverted U-shape. Low levels of norepinephrine or dopamine are related to fatigue and a suboptimal functioning of the prefrontal cortex, whereas moderate levels are associated with an optimal functioning of the prefrontal cortex and an alert state. Finally,

excessive amounts of norepinephrine or dopamine impair the functioning of the prefrontal cortex, which is in turn associated with impairments in emotion regulation and complex thinking (Arnsten, 2009). With regard to conflict situations, this implies that in order to have an optimal level of attention, emotion regulation skills and cognitive capacities, it is vital to keep stress at moderate levels.

Emotions and social relations

Although there is consensus that many brain structures are involved in emotional experiences, there is also the question of whether different emotions and potentially even different social relations have distinguishable neural signatures. Decades of animal research have mapped the different systems underlying specific emotional experiences, such as care or fear (Panksepp & Watt, 2011). More recently, neuroscientists also started to investigate the representation of emotions in humans (for recent meta-analyses, see Lindquist, Satpute, Wager, Weber, & Barrett, 2015; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012). These meta-analyses suggest a largely shared network for emotions of different valence, but other authors have argued for a dissociation of neural activations linked to pleasant as opposed to unpleasant experiences (e.g., Eisenberger & Cole, 2012). More specifically, these authors suggest that whereas positive emotions are linked to activations in a brain network that includes the ventral medial prefrontal cortex and the ventral striatum, threat is processed in the anterior insula and the anterior cingulate cortex (Eisenberger & Cole, 2012). This aligns with meta-analytic findings pointing to the specific involvement of anterior insula in processing negative affect (Lindquist et al., 2015). Interestingly, these neural systems do not seem to be specific for processing emotions. It has thus been observed that activations related to rewards largely overlap with activations related to

feelings of social connection, while threat and feelings of social disconnection also share a common neural basis (Eisenberger & Cole, 2012). It has also been proposed that these two systems have an antagonistic role when it comes to physical health, with the neural system related to positive affect and social connection being linked to better physical health than the neural system involved in the processing of threat and social disconnection (Eisenberger & Cole, 2012). In a similar line of reasoning, it was also recently suggested that neural activations related to caregiving in both animals and humans (spanning amygdala, ventral tegmental area, nucleus accumbens, and ventral pallidum) overlap to a large degree with neural activations involved in altruistic behavior (Preston, 2013). Importantly, it has been shown that the two antagonistic systems can be trained and shaped in a targeted manner (e.g. Klimecki, 2015; Singer & Klimecki, 2013). These findings suggest that feelings, well-being, social relations, and altruistic behavior can be influenced in a targeted way. In other words, one can change the way in which one relates to difficult situations through specific training techniques. As will be outlined in more detail below, certain emotional training techniques have already proven as highly useful in conflict situations (Halperin, 2015).

Another important notion related to emotions and bonding is similarity: how one sees the "other" in relation to one's own group has a significant impact on the capacity to relate to the other´s emotions. Research has shown for instance that the capacity to empathize with the pain of "out-of-group" people – people that are perceived as dissimilar to oneself – is dramatically reduced compared to "in-group" people who are perceived as similar (Xu, Zuo, Wang, & Han, 2009). It has also been shown that increasing levels of a neurotransmitter and hormone called oxytocin can increase the level of trust (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005), but this effect seems to be present primarily for "in-group" members. In interactions with "out-of-group" members, oxytocin has been shown to stimulate defensive aggression under a specific

threat from those members (De Dreu et al., 2010; De Dreu & Kret, 2015). Taken together, these findings suggest the perception of social closeness crucially determines how one will relate to others and that the same neurotransmitter can have opposing consequences on social behavior depending on whether one is dealing with “in-group” members or “out-of-group” members.

Possible interventions during conflict resolution

Based on what is presented above, one can assume that conflict is often related to negative emotions and involves stressful events. To minimize the impact of stress and negative emotions during conflict resolution, several techniques are available and can be presented using the emotion regulation model designed by Gross, Richards, & John (2006). In this model, there are four types of intervention.

The first two types of intervention are called Situation Selection and Modification. These are two techniques directly tied to the capacity to identify and remember which situations trigger which emotions. Those two techniques allow us to control the influence of context on emotional states and can thus contribute to avoid difficult situations. Situation Selection is particularly useful for process-related techniques. One can, for instance, carefully choose the location of a conflict resolution session to stimulate positive feelings in the parties involved. One can also create situations in which the setting is particularly inviting, for instance by seating the conflict parties on comfortable chairs. Situation Modification can also help overcome conflicts that are stuck. This can, for instance, be done by modifying the context of a conversation by changing the location from inside the building to outside of the building, or by proposing to the conflict parties to go for a walk.

The third technique, Attentional Deployment, is related to where one focuses attention. When a discussion of a particular conflictual topic becomes stuck, one can for example change the topic to another aspect that is less burdened with conflict. Another example would be to change the type of activity that is being done – for instance by interrupting a heated debate to do a brain storming session.

The fourth technique, Cognitive Change, is an essential technique that can be used by mediators in conflict resolution to help parties who are experiencing negative emotions. The aim here is to label and then reformulate negative emotions to reduce their magnitude and their detrimental influence. One form of Cognitive Change is reappraisal, which means analyzing the causes, the meaning, and the possible consequences of an emotional situation to change one's affective state (for a review, see Gross, 2001). Cognitive Change is often used as a complement to Attentional Deployment: first, a person is asked to change her perspective on a topic of conversation and then her emotional expressions are more easily reformulated – taking a "3rd person" position is a typical implementation of this mix of the two techniques. Research has shown that perspective-taking is a very efficient form of Cognitive Change, including in intractable conflicts (see for instance Halperin, Porat, Tamir, & Gross, 2013). It has thus been shown that Israeli subjects trained to practice cognitive reappraisal experienced decreased negative emotion and increased support for conflict-resolution policies (Halperin et al., 2013).

Many of the techniques mentioned here rely on some form of attention or emotion regulation. In light of the previously described role of the prefrontal cortex in attention, emotion regulation and complex thinking and the detrimental influence that high levels of stress can have on these functions (Arnsten, 2009), it is probably vital for successful conflict resolution processes to reduce the level of stress as much as possible. As outlined above, this can be done already when thinking about the location or the setting of a discussion. In addition, it is probably

helpful to monitor the stress levels during the conflict discussion in order to take quick actions to reduce stress once it exceeds a certain threshold.

Conclusion and future research

Based on the premise that emotions are tightly linked to conflict, we have proposed that understanding the brain functions underlying emotional experiences can help design more efficient conflict resolution processes. We have started out by describing various brain structures involved in processing emotional events (Ledoux, 2002). This work shows that emotions are processed very rapidly and can lead to quick bodily reactions. Furthermore, accumulating evidence shows that emotions inform decision making (Lerner et al., 2015) and it has been suggested that the integration of emotional and somatic information with the decision at hand takes place in the prefrontal cortex (Damasio et al., 1996). In fact, the long-held view that decisions are made mostly on a rational basis is increasingly being replaced by the notion that emotions play a key role in many decisions (Lerner et al., 2015). As conflicts mostly involve decisions under strong negative emotions and stress, research on the impact of stress on brain functions has provided valuable insights that may help improve the conditions for conflict resolution. More specifically, it has been shown that stress impairs the functioning of the prefrontal cortex, which is crucial for attention, decision-making, and emotion regulation (Arnsten, 2009). Reducing stress levels prior to and during a conflict discussion may thus help restore optimal functioning of cognitive resources that are needed to resolve the issue at hand efficiently. Furthermore, we have described research showing that the emotional and the social brain are tightly linked. In light of overlapping brain networks for positive other-related emotions, helping behavior and good health (Eisenberg & Cole, 2012; Klimecki, 2015; Preston,

2015) and the malleability of the emotional brain (Klimecki, Leiberg, Lamm, & Singer, 2012; Klimecki, Leiberg, Ricard, & Singer, 2013), it is likely targeted training techniques that promote a more favorable and friendly attitude towards others could foster conflict resolution. Although there is accumulating evidence for the efficacy of emotion training for improving conflictual relations (Halperin, 2015), there is so far no research on the link to the underlying neural processes. There is also no scientific research on the efficacy of emotional regulation during interpersonal conflict resolution processes such as mediation. Future research is needed to address the question of the neural mechanisms that are important for conflict resolution and how these can be targeted by training or interventions from a neutral third-party.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*, 5th Edition: DSM-5. American Psychiatric Association Publishing.

Arnsten, A. F. T. (2009). Stress signalling pathways that impair prefrontal cortex structure and function. *Nature Reviews Neuroscience, 10*, 410–422. http://doi.org/10.1038/nrn2648

Cahill, L., Prins, B., Weber, M., & McGaugh, J. L. (1994). Beta-adrenergic activation and memory for emotional events. *Nature*, *371*(6499), 702–704. http://doi.org/10.1038/371702a0

Damasio, A. R., Everitt, B. J., & Bishop, D. (1996). The Somatic Marker Hypothesis and the possible functions of the prefrontal cortex [and discussion]. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *351*(1346), 1413–1420. http://doi.org/10.1098/rstb.1996.0125

De Dreu, C. K. W., Greer, L. L., Handgraaf, M. J. J., Shalvi, S., Kleef, G. A. Van, Baas, M., … Feith, S. W. W. (2010). The neuropeptide oxytocin regulates parochial altruism in intergroup conflict among humans. *Science, 328*.

De Dreu, C. K. W., & Kret, M. E. (2015). Oxytocin conditions intergroup relations through upregulated in-group empathy, cooperation, conformity, and defense. *Biological Psychiatry*, 1–9. http://doi.org/10.1016/j.biopsych.2015.03.020

Eisenberger, N. I., & Cole, S. W. (2012). Social neuroscience and health: neurophysiological mechanisms linking social ties with physical health. *Nature Neuroscience, 15*, 669–74. http://doi.org/10.1038/nn.3086

Ekman, P. (1992). Are there basic emotions? *Psychol Rev, 99*, 550–553. http://doi.org/10.1037/0033-295X.99.3.550.

Ekman, P., & Davidson, R. J. (1994). *The nature of emotion: Fundamental questions*. Oxford, UK: Oxford University Press.

Feldman Barrett, L., & Russell, J. A. (1998). Independence and Bipolarity in the Structure of Current Affect. *Journal of Personality and Social Psychology, 74*, 967–984. http://doi.org/10.1037/0022-3514.74.4.967

Glasl, F. (1982). The Process of Conflict Escalation and Roles of Third Parties. *Conflict Management and Industrial Relations*. Springer Netherlands. http://doi.org/10.1007/978-94-017-1132-6_6

Gross, J. J. (2001). Emotion regulation in adulthood: Timing is everything. *Current Directions in Psychological Science, 10*(6), 214–219. http://doi.org/10.1111/1467-8721.00152

Gross, J. J., Richards, J. M., & John, O. P. (2006). *Emotion regulation in everyday life. Emotion regulation in couples and families: Pathways to dysfunction and health*. Washington, DC: American Psychological Association.

Grossman, S. P. (1975). Role of the hypothalamus in the regulation of food and water intake. *Psychol Rev, 82*, 200–24. Retrieved from http://www.ncbi.nlm.nih.gov/htbin-post/Entrez/query?db=m&form=6&dopt=r&uid=168602

Halperin, E. (2015). *Emotions in conflict: Inhibitors and facilitators of peace making*. Oxford, UK: Routledge.

Halperin, E., Porat, R., Tamir, M., & Gross, J. J. (2013). Can emotion regulation change political attitudes in intractable conflicts? From the laboratory to the field. *Psychological Science*. http://doi.org/10.1177/0956797612452572

Harlow, J. M. (1868). Recovery from the passage of an iron bar through the head. Publ Mass *Med Soc, 2*(2), 327–347. http://doi.org/10.1177/0957154X9300401407

Isen, A. M. (2008). Some ways in which positive affect influences decision making and problem solving. In *Handbook of emotions* (pp. 548–573). New York, NY: The Guilford Press.

Joëls, M., Pu, Z., Wiegert, O., Oitzl, M. S., & Krugers, H. J. (2006). Learning under stress: how does it work? *Trends in Cognitive Sciences, 10*(4), 152–158. http://doi.org/10.1016/j.tics.2006.02.002

Klimecki, O. M. (2015). The plasticity of social emotions. *Social Neuroscience, 10*, 466–473. http://doi.org/10.1080/17470919.2015.1087427

Klimecki, O. M., Leiberg, S., Lamm, C., & Singer, T. (2012). Functional Neural Plasticity and Associated Changes in Positive Affect After Compassion Training. *Cerebral Cortex, 23*(7), 1552-1561. . http://doi.org/10.1093/cercor/bhs142

Klimecki, O. M., Leiberg, S., Ricard, M., & Singer, T. (2013). Differential pattern of functional brain plasticity after compassion and empathy training. *Social Cognitive and Affective Neuroscience, 9*, 873–879. http://doi.org/10.1093/scan/nst060

Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature, 435*(7042), 673–676. http://doi.org/10.1038/nature03701

Ledoux, J. E. (2002). Memory and the Brain. *Scientific American*, (June 1994), 62–71. http://doi.org/10.1038/scientificamerican0694-50

LeDoux, J. E. (1994). Emotion, memory and the brain. Scientific American, 270(June), 50–57. http://doi.org/10.1038/scientificamerican0694-50

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and Decision Making. *Annual Review of Psychology, 66*, 799–823. http://doi.org/10.1146/annurev-psych-010213-115043

Lindquist, K. A., Satpute, A. B., Wager, T. D., Weber, J., & Barrett, L. F. (2015). The Brain Basis of Positive and Negative Affect: Evidence from a Meta-Analysis of the Human Neuroimaging Literature. *Cerebral Cortex, 26*(5), 1910-1922. http://doi.org/10.1093/cercor/bhv001

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *Behavioral and Brain Sciences, 35*(3), 121–143. http://doi.org/10.1017/S0140525X11000446

Macmillan, M. (2000). *An odd kind of fame: Stories of Phineas Gage*. Cambridge, MA: MIT Press. http://doi.org/10.1353/bhm.2001.0173

Mignot, E., Taheri, S., & Nishino, S. (2002). Sleeping with the hypothalamus: emerging therapeutic targets for sleep disorders. *Nature Neuroscience, 5*(Supp), 1071–1075. http://doi.org/10.1038/nn944

Panksepp, J., & Watt, D. (2011). What is Basic about Basic Emotions? Lasting Lessons from Affective Neuroscience. *Emotion Review, 3*, 387–396. http://doi.org/10.1177/1754073911410741

Posner, J., Russel, J. A., & Peterson, B. S. (2005). The circumplex model of affect: An integrative approach to affective neuroscience, cognitive development, and psychopathology. *Development and Psychopathology*, *17*, 612–615. http://doi.org/10.1017/S0954579405050340

Preston, S. D. (2013). The origins of altruism in offspring care. *Psychological Bulletin*, *139*, 1305–41. http://doi.org/10.1037/a0031755

Ransom, S. W., & Ingram, W. . (1935). Hypothalamus and Regulation of Body Temperature. *Experimental Biology and Medicine, 32*, 1439–1441.

Sander, D. (2013). Models of emotion: The affective neuroscience approach. (J. Armony & P. Vuilleumier, Eds.)The Cambridge handbook of human affective neuroscience. Cambridge University Press. http://doi.org/10.1017/CBO9780511843716 Sander, D., Grafman, J., & Zalla, T. (2003). The human amygdala: an evolved system for relevance detection. *Reviews in the Neurosciences, 14*, 303–16. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14640318

Singer, T., & Klimecki, O. M. (2014). Empathy and compassion. *Current Biology*, 24, R875–R878. http://doi.org/10.1016/j.cub.2014.06.054

Squire, L. R., Stark, C. E. L., & Clark, R. E. (2004). The Medial Temporal Lobe. *Annual Review of Neuroscience, 27*, 279–306. http://doi.org/10.1146/annurev.neuro.27.070203.144130

Susskind, J. M., Lee, D. H., Cusi, A., Feiman, R., Grabski, W., & Anderson, A. K. (2008). Expressing fear enhances sensory acquisition. *Nature Neuroscience, 11*, 843–850. http://doi.org/10.1038/nn.2138

Vythilingam, M., Blair, K. S., McCaffrey, D., Scaramozza, M., Jones, M., Nakic, M., … Biology, C. (2007). Biased emotional attention in post-traumatic stress disorder: a help as

well as a hindrance? *Psychological Medicine, 37*, 1445–1455. http://doi.org/10.1017/S003329170700092X

Xu, X., Zuo, X., Wang, X., & Han, S. (2009). Do you feel my pain? Racial group membership modulates empathic neural responses. *The Journal of Neuroscience : The Official Journal of the Society for Neuroscience, 29*, 8525–9. http://doi.org/10.1523/JNEUROSCI.2418-09.2009

Yehuda, R., Joëls, M., & Morris, R. G. M. (2010). The memory paradox. Nature Reviews. *Neuroscience, 11*, 837–9. http://doi.org/10.1038/nrn2957

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