EMPLOYING A NOVEL PARADIGM AND SETS OF STIMULI TO EXAMINE EMOTIONAL INTENSITY RECOGNITION AND ITS MODULATION BY EMPATHY FOR PAIN

Navot Naor, Simone Shamay-Tsoory, & Hadas Okon-Singer.
Department of Psychology, University of Haifa, Haifa, Israel

Abstract

Over the last two decades, research has devoted increasing attention to the examination of empathy. Yet research examining empathic accuracy, defined as how well we judge the emotional intensity felt by another, has grown more modestly. This asymmetry may be due to the complexity of paradigms used to study empathic accuracy, as well as to the fact that the stimuli used so far are dependent upon linguistic and cultural factors. To circumvent these issues, here we present a novel paradigm that examines the ability to assess empathic accuracy in a simple and implicit manner by using stimuli that are not dependent on language and culture. To this end, we devised two sets of stimuli: (1) a painful scenario set consisting of empathy-evoking still images; and (2) a facial expression set comprising morphed intensities of emotional facial expressions. Together, these sets can be used to study the effect of the empathic experience on an individual's ability to make accurate judgments of others' emotional facial intensity, a sub-process of empathic accuracy. We contend that adopting these sets may facilitate the replicability of findings across countries and populations, which in turn will increase the number of investigations of empathic accuracy.

In recent decades, research attention to the study of empathy—the ability to react cognitively and emotionally to the happenings of another (Shamay-Tsoory, 2011)—has increased tremendously. A recent Web of Science search for the term "empathy" revealed a steady rise in the number of publications, from 130 papers in 1993 to 1987 papers in 2016. Advancements in the study of empathy have led to the development of a multitude of paradigms, stimuli and methods to study this phenomenon. Yet, not one central standardized set of stimuli has been adopted. The absence of standardized stimuli is most evident in the study of empathic accuracy—the ability to *accurately* understand and infer not only the nature but also the intensity of the thoughts, feelings and emotional states of another (Ickes, Stinson, Bissonnette, & Garcia, 1990).

The common paradigms used to examine empathic accuracy have two central drawbacks. First, the paradigms rely on comparison between the self-reports of a target-individual and the judgments made by a perceiving individual about the target individual's emotional state. This comparison procedure is cumbersome as it requires first manipulating the emotion of one participant while recording him (or her), then presenting him with his own self-report while he continually rates his own emotional state, and finally showing the recorded stimuli to a new participant, who then judges the emotional intensity. Second, most existing variations of this paradigm used verbal testimony as stimuli. As emotions are highly vulnerable to linguistic and cultural effects (see Wierzbicka, 1992; 2009), replication of results in a different country, culture or language is virtually impossible.

The paradigm proposed in this paper and the stimuli sets used to manipulate it are novel in that they employ a new way to measure empathic accuracy. The term "empathic accuracy," originally coined by Carl Rogers, "...involves being sensitive, moment by moment, to the changing

felt meanings which flow in this other person, to the fear or rage or tenderness or confusion or whatever, that he or she is experiencing” (Rogers, 1995, p. 142). As such, the common practice for studying empathic accuracy focused on continuous assessment of the emotional state of the other. In contrast, here we focus on the individual's ability to accurately infer an emotion and its intensity in a single moment. We refer to this ability as emotional intensity recognition, as we believe that empathic accuracy is formed by a series of emotional intensity recognition judgments.

Existing procedures for measuring empathic accuracy

A common procedure used in studies of empathic accuracy is the self-rating/other-rating procedure (Ickes et al., 1990). In this procedure, pairs of participants are videotaped during a dyad interaction in a waiting room where they are allegedly waiting for a different experiment to begin. After the observation period, each participant is shown the videotaped interaction and asked to list all the points during the interaction when he/she remembers having specific feelings or thoughts. Subsequent to the self-rating period, participants are shown the videotaped interaction again. This time they are asked to judge the content of the emotions and thoughts felt by the other participant at different time points during the interaction. Thus, content is the measure of accuracy tested in this procedure. That is, how well can one participant classify the emotions of another? Note that this procedure does not test empathic accuracy regarding emotion intensity, i.e., how well participants recognize the intensity of felt emotions. In addition, in the study by Ickes et al., empathy was not directly manipulated but rather measured using two questionnaires, both of which yielded no significant results.

Over the years, a number of adaptations of the procedure in Ickes et al. (1990) were introduced. For example, Zaki, Bolger and Ochsner (2008) videotaped participants recalling emotional events from their lives (four positive and four negative). Following the recall period, participants were shown their own video clips and asked to provide continuous ratings of how they felt during the recall, on a scale ranging from very positive to very negative. Participants' own ratings were then used as a baseline for comparison of the ratings of future participants. Using this procedure, Zaki, Bolger and Ochsner (2009) found that the accuracy of empathic judgments was predicted by the emotional expressivity of the target rather than by their own reported levels of empathy. Higher levels of reported empathy predicted empathic accuracy only when the target exhibited high emotional expressivity. Furthermore, it was found that auditory cues, and especially verbal cues, are critical for the formulation of accurate empathy (Zaki et al., 2009).

More recently, Kanske, Böckler, Trautwein, and Singer (2015) developed a tool designed to assess both empathy and Theory of Mind (ToM) abilities. Similar to the tool in Zaki et al. (2008), the EmpaToM comprises a series of clips in which target individuals retell an autobiographical narrative, either negative or neutral. However, unlike Zaki's set, here no baseline ratings were created. Participants viewed the clips and were asked to indicate how they felt (i.e., ranging between negative and positive) and how much compassion they felt. Finally, they were asked either a question about what the target individual is thinking or a factual question about the content of the story. Similar to the study by Zaki et al., this procedure is limited by its reliance on verbal cues, which are language-dependent and therefore cannot be replicated in other languages. Furthermore, reliance on language limits the procedure to populations that do not

have any language-related difficulties. Ruben and Hall (2013) used another variation of Ickes' model to create suppressed, genuine and exaggerated pain detection tests. Each of these tests consists of video clips of target individuals undergoing a tourniquet task. The clips depict the first 30 seconds of the task, another 30 seconds leading up to the pain threshold point and the 30 seconds leading up to the individual's tolerance time. The clips differ from one another in the way participants are instructed to exhibit their pain: suppress it, express it as it is, or exaggerate it. Target individuals are then shown their own clips and asked to rate the intensity of pain at the end of each clip. The measure of accuracy is the difference between the score given by the target individual and the perceiving individuals. Ruben and Hall's (2013) variation managed to overcome the linguistic pitfall by avoiding the reliance on verbal cues. However, this procedure does not directly manipulate or examine empathy, but rather targets individuals' ability to detect pain.

While these procedures have been widely used in different studies, they nevertheless fall short on two main points: 1) None of the procedures described here directly manipulates empathy, and specifically not empathy for pain. Aside from the EmpaToM, all of the sets used questionnaires to assess trait empathy in the perceiving participants and correlated the trait empathy score with performance on the empathic accuracy test. The EmpaToM evokes empathy in participants, but uses negative vs. positive emotions rather than any specific emotions. 2) Aside from Ruben and Hall's (2013) tests, all the rest are culturally limited. Because they rely on videotaped testimonies, these procedures are limited to countries where the same language is spoken and the events are culturally relevant (English in the case of Ickes et al., 1990 and Zaki et al., 2009, and German in Kanske et al., 2015).

Procedures evoking empathy for pain

A different group of procedures is designed to elicit empathy for painful experiences. Jackson, Meltzoff, and Decety (2005) used a set of 128 pictures that showed the right hands and feet of target individuals in painful and non-painful situations. The situations are familiar, everyday situations, such as opening a door or cutting a cucumber, and the painful and non-painful pictures are identical aside from the element of pain. The pictures are taken from an angle that promotes a first-person perspective, thus avoiding the need for mental rotation. Please note, however, that when we experience an empathy-evoking situation in real life, we always witness it from a third-person perspective, as by definition we are witnesses to the event and do not experience the pain ourselves. The need to mentally rotate a situation in order to place ourselves in someone else's shoes may be cognitively taxing but cannot be disregarded as it is a crucial part of empathy formulation.

In an adaptation of the set created by Jackson et al., (2005), Decety, Michalska and Akitsuki (2008) used a similar setting—a picture depicting right hands and feet in painful and non-painful situations. Each stimulus in this set consisted of three pictures shown to participants consecutively, thus creating an animated scenario of sorts. Participants were asked to judge whether the pain caused to the target is intentional or accidental. Yet cognitive engagement with the stimuli is somewhat problematic as such stimuli can alter one's emotional experience. For example we have shown elsewhere (Naor, Shamay-Tsoory, Sheppes, & Okon-Singer, 2017) that asking participants to engage cognitively with an empathy-evoking task reduces, and can even eliminate, the overall effect of empathy (see also related findings of Hutcherson, Goldin, Ochsner, Gabrieli, Barrett, Gross 2005; and Rohr et al., 2016 regarding the impact of rating on felt emotions).

A different approach to empathy-eliciting stimuli was adopted by Xu, Zuo, Wang and Han, (2009), who used a series of video clips depicting models being pierced by a needle (painful condition) or touched by a Q-tip (neutral condition). Both stimulations were delivered to the model's cheeks. The models maintained a neutral expression throughout, regardless of whether they were pierced or touched. Note, however, that the inconsistency between the physical experience and the model's emotional expression could lead to the development of conflicting experiences in participants, thus hindering both the creation of an empathic response and judgment accuracy.

To summarize, while the increase in studies examining empathy has led to the development of a number of procedures and stimuli sets either for manipulating empathy or for testing empathic accuracy, to date no single procedure has been designed to do both in a way that is independent of linguistic and cultural influences. Here we propose a novel paradigm that facilitates the manipulation of empathy for pain and the assessment of someone else's emotional intensity.

The current study

To account for some of the limitations of current procedures and stimuli used for studying empathic accuracy, we created two separate sets of stimuli. The Painful Scenario Stimuli set is designed to be used for eliciting and manipulating empathy. It is based on the sets used by Jackson et al. (2005) and Decety et al. (2008), depicting painful and non-painful everyday situations as applied hands and feet, though with a number of fundamental changes. The Facial Expression Stimuli set is designed to allow for culture-free and language-free assessment of

emotion intensity. When used in tandem, these two sets facilitate the investigation of emotional intensity recognition.

Experiment 1: Validation of the Painful Scenario Stimuli set

Our first goal was to devise a new set of pictures to be used in examining emotional intensity recognition. To this end, we created and validated a set of pictures showing painful and matched non-painful scenarios. We chose not to use existing sets of pictures as these sets employed a first-person perspective whereas we wanted a third-person perspective so as to better fit our goal of evoking empathy for another's pain. Thus the purpose of this experiment was to validate a new set of painful and non-painful scenario stimuli.

Participants

Twenty-three undergraduate students from the University of Haifa (5 male, age=24.04±4.5) participated in both Experiment 1 and Experiment 2 (detailed below) for course credit. They all had normal or corrected-to-normal vision and no history of neurological or psychological problems. All completed an informed consent form before participating. The order of the tasks was counterbalanced so that half the participants began with Experiment 1, took a 10-minute break and continued with Experiment 2, while the other half began with Experiment 2. One participant was disqualified due to a technical failure. At the end of the procedure, participants were debriefed and thanked for their participation.

Materials

Painful Scenario Set

The set comprised 248 colored pictures showing hands and feet in painful and matched non-painful scenarios (Figure 1). The set was based on a similar set used by Jackson, Meltzoff and Decety (2005) and adapted to the study population (e.g., ice skaters were removed and more

agricultural tools were introduced). The pictures were taken from an onlooker perspective rather than a first-person perspective. The scenarios were tailored to familiar everyday events, and various types of pain were portrayed (pressure, mechanical and thermal). Each painful scenario was matched with a neutral scenario that involved all the components except for the painful element. The picture set included two male models and two female models, each in 31 painful scenarios and 31 neutral scenarios. All pictures were edited and cropped to the same size (400X300 pixels).

Figure 1: Sample pictures of hands and feet in painful and non-painful conditions. Note that a corresponding non-painful stimulus is provided for each painful stimulus.

Experimental Procedure

Participants were shown a picture from the scenario set, presented in random order. Participants were first asked to judge the intensity of the pain they believed is felt by the person in the

presented picture on a scale of 1-10 using the Wong-Baker FACES™ pain rating scale (Wong & Baker, 1988). The scale is a self-report measure designed to assess levels of pain. In this relational faces scale, "face – 0" represents no pain and "face – 10" represents the worst pain imaginable (see Figure 2). After that, participants were asked to judge the degree to which the picture aroused them on a scale of 1-100, using an adapted version of the Self-Assessment-Manikin (SAM) scale (Bradley & Lang, 1994) in which 0 indicates "not at all aroused" and 100 indicates "very aroused" (Figure 2). The experiment was programmed using the E-Prime 2.0 software (Psychology Software Tools, Inc., www.pstnet.com), and responses were collected using a computer mouse. E-prime 2.0 is used in all subsequent experiments.

Figure 2: Example of an experimental trial in Experiment 1. A picture is shown depicting either a painful or a non-painful scenario. Participants are asked to judge the pain intensity represented in each picture on a scale of 1 to 10 and the extent to which the picture aroused them on a scale from 1 to 100.

Data Analysis

For each picture presented in this experiment, two separate scores were calculated: Pain Intensity Score (PIS) and Arousal Score (AS). For each score, standard deviation (SD) and Z values

were computed. Both the PIS and the AS were calculated from the mean of the total responses collected on their respected scales after exclusion of responses that were three SDs above or below the mean score. Based on the PIS and the AS, we chose only pairs where the non-painful scenario PIS score was not higher than 1 (i.e., not painful at all), the AS Z value was lower than 0 (i.e., not arousing at all), and the corresponding painful scenario PIS score was at least 6 points

higher (i.e., painful scenario depicted much more pain than non-painful one) and had a higher AS Z value (i.e., painful scenario was more arousing than the corresponding non-painful one; see Figure 3). Twenty-three sets of matched painful and non-painful scenarios were selected.

Figure 3: Scatter plot showing the relationship between Z values of stimuli pain intensity score (X axis) and Z values of arousal score (Y axis). Blue circles represent non-painful stimuli and red circles represent painful stimuli, both from the experimental set. Light blue and yellow circles respectively represent non-painful and painful stimuli not used in the final set.

Experiment 2: Validation of the Facial Expression Stimuli set

As mentioned, our aim is to propose a new paradigm for studying emotional intensity recognition. The major novelty of our paradigm lies in the adoption of Carl Roger's view of empathic accuracy as a moment-to-moment change, which we term emotional intensity recognition. In order to account for these singular moments, we opted to use still images rather than videos as the target stimuli assessed by participants. Based on the classic sets of static emotional facial expressions often used in emotion recognition experiments (Ekman, & Friesen, 1971; Lundqvist, Flykt, & Öhman, 1998; Tottenham, et al., 2009), we created a series of stimuli in which each emotional facial stimulus was morphed with a corresponding neutral stimulus. In the current experiment, not only did we examine how well participants distinguish between different emotions, but we also tested how accurately participants judge the intensity of the portrayed emotions. Thus, this experiment was designed to validate the morphed facial expression stimuli. Participants and order of presentations are similar to those described in Experiment 1.

Materials

Facial expressions stimuli

A well validated and highly recognizable set of the faces of ten Caucasian actors (five female) was used (Blais, Roy, Fiset, Arguin, and Gosselin, 2012). Both the database and the normative data can be found at: <http://mapageweb.umontreal.ca/gosselif/STOIC.rar>. Out of the original set of eight different static facial expressions, we used six: neutral, sad, painful, surprised, happy and angry. Each morphed picture combined a neutral and an emotional expression. Drawing on a similar procedure used by Enticott, Johnston, Herring, Hoy and Fitzgerald (2008) and by Johnston, Mayes, Hughes and Young (2013), we created a morphed static set using Abrosoft FantaMorph

5.0 software (www.fantamorph.com). Pairs of images showing the same actor displaying a neutral pose and an emotional expression were co-identified using a number of feature locations. These locations included, but were not restricted to, the pupils, the corners of the mouth, the nostrils and the chin. A sequential morph between each two pictures was then created, yielding 100 same-sized individual pictures (240X240 pixels; Figure 5). Stimuli from two models, one female and one male, were discarded due to quality issues (e.g., photos were too grainy and blurred after the morphing procedure). This procedure yielded 240 pictures depicting five emotions (happiness, pain, sadness, anger and disgust) for eight models (four female). For each morphed expression, six different intensity levels were prepared (40%, 50%, 60%, 70%, 80%, and 90%).

Figure 4: Examples of one female model depicting a painful facial expression and one male model depicting a sad facial expression. Both examples comprise a neutral expression and 30%, 50%, 70% and 90% morphed expressions.

Experimental Procedure

Participants were shown a picture from the facial expression stimuli set, presented in random order. Through a multiple-choice question offering the six basic emotions and pain, participants

were asked to select the type of emotion depicted. Following this selection, participants were asked to judge the intensity of the emotion represented by the facial expression, on a scale of 1-100. To assist participants in making this judgment, the corresponding neutral and emotional images were presented on the respective sides of the scale (i.e., 1-neutral expression and 100-emotional expression), and the target picture was shown in the center (Figure 5). Stimuli presentations and selection were similar to those in Experiment 1.

Figure 5: Example of an experimental trial in Experiment 2 with picture depicting an emotional (in this example: sad) facial expression. Participants were asked to select the emotion being represented. After selection, they were asked to judge the intensity depicted in the expression.

Results

To avoid confounding accuracy with usage frequency, we calculated the unbiased hit rate proportion (Wagner, 1993) for each stimulus. This calculation takes into account the number of times a stimulus is correctly identified and the number of times a response is inappropriately used. Because this sort of calculation yields a proportional score, data were further arcsine-

transformed before statistical analysis. Arcsine values ranged from 0 to 1.57, the arcsine equivalent of 1, indicating that a stimulus was always correctly identified and appropriately used. Statistical values are given based on analysis of the arcsine data. For readability, Figure 6 depicts the untransformed data.

To compare the percentage hit rate between emotions, a five-level repeated-measures one-way ANOVA was conducted, with emotion (anger, disgust, happiness, sadness, pain) as the independent variable and the hit rate ratio arcsine value across all judgments per photo as the dependent variable. As can be seen in Figure 6, the results revealed a main effect for emotion [$F(2.5, 52.8) = 49.75, p < .0001, \eta_p^2 = .701$]. Bonferroni-corrected post hoc comparisons revealed that the percentage hit rate for pictures expressing happiness ($M=1.113$; $SD=.025$) was significantly higher than for all the other emotions, whereas no noticeable differences in the percentage hit rate were found between disgust ($M=.689$; $SD=.033$), pain ($M=.646$; $SD=.052$), sadness ($M=.852$; $SD=.021$) and anger ($M=.877$; $SD=.021$). Nevertheless, these two couplings—disgust-pain and sadness-anger—differed significantly from one another.

Conclusion

These results indicate that recognition of emotions across all intensity levels was above the chance rate, that no two emotions were repeatedly conflated with one another, and that the most distinctive emotions are happiness, either pain or disgust, and either sadness or anger.

Figure 6: Percentage of unbiased hit rate of a chosen emotion per presented emotion. For the sake of readability, untransformed proportions are shown. Recognition of emotions across all intensity levels is above the rate of chance, no two emotions are repeatedly conflated with one another, and the most distinctive emotions are happiness, either pain or disgust, and either sadness or anger.

Discussion

In this paper, we proposed a new paradigm for studying emotional intensity recognition judgments, which are the building blocks of empathic accuracy. As part of this new paradigm, we further developed and validated two stimuli sets. As mentioned above, existing sets used to manipulate empathy and/or to study empathic accuracy have a number of limitations, among them major reliance on linguistic and cultural characteristics and complicated methodology.

In the first experiment, we validated a new empathy-evoking stimulus set. The set comprises matched painful and non-painful scenarios depicting everyday actions applied to hands and feet. The stimuli are photographed from a third-person perspective and depict various types of pain (pressure, mechanical and thermal). Out of the original 31 pairs we chose 23 pairs

in which the non-painful scenario was rated as not at all painful and not at all arousing and the corresponding painful scenario was rated as much more painful and arousing than the corresponding non-painful one.

The second experiment aimed at validating a new method to assess emotional accuracy, as well as a new set of stimuli. By combining a neutral and an emotional facial expression we created a series of morphed expressions based on a well-validated and highly recognizable set of emotional faces (Blais, Roy, Fiset, Arguin, and Gosselin, 2012). For each morphed expression, six different intensity levels were prepared (40%, 50%, 60%, 70%, 80%, and 90%). The unbiased hit rate proportion was calculated for each morphed expression and revealed recognition of emotion type and intensity.

The paradigm described here assesses the impact of empathy on biases in emotional intensity judgments (Naor et al., 2017). Using different stimuli, this paradigm can be easily modified to examine other aspects of empathy, such as empathy for a socially difficult situation or for another type of unpleasant situation. Furthermore, the stimuli can be modified to explore the impact of empathy on other cognitive biases, such as biases of memory, attention, and expectancy. Such research initiatives are congruent with recent examinations of the factors modulating cognitive biases in different psychopathologies, such as anxiety and depression (Aue & Okon-Singer, 2015; Okon-Singer & Aue, 2017). Cognitive biases are thought to play a dominant role in the initiation and maintenance of psychiatric disorders. Therefore, understanding their causes is of fundamental theoretical and clinical importance.

Taken together, these sets of stimuli can be used to study how empathy for an emotional experience affects empathic accuracy, as implicitly assessed via the ability to recognize the

emotional intensity of different facial emotional expressions. This paradigm offers a way to study emotional intensity recognition that is implicit and independent of language and culture. Zaki and Ochsner (2011) noted that compared to the study of empathy, the study of empathic accuracy has yielded far fewer research examinations. It is plausible to assume that this trend may be partly explained by the lack of stimuli and paradigms that are standardized and easily replicable. It is our hope that the new paradigm and stimuli sets introduced here will facilitate more research on emotional intensity recognition and consequently on empathic accuracy.

References

- Aue, T., & Okon-Singer, H. (2015). Expectancy biases in fear and anxiety and their link to biases in attention. *Clinical psychology review*, 42, 83-95.
- Blais, C., Roy, C., Fiset, D., Arguin, M., & Gosselin, F. (2012). The eyes are not the window to basic emotions. *Neuropsychologia*, 50(12), 2830-2838.
- Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: the self-assessment manikin and the semantic differential. *Journal of behavior therapy and experimental psychiatry*, 25(1), 49-59.
- Decety, J., Michalska, K. J., & Akitsuki, Y. (2008). Who caused the pain? An fMRI investigation of empathy and intentionality in children. *Neuropsychologia*, 46(11), 2607-2614.
- Decety, J., Michalska, K. J., Akitsuki, Y., & Lahey, B. B. (2009). Atypical empathic responses in adolescents with aggressive conduct disorder: a functional MRI investigation. *Biological psychology*, 80(2), 203-211.
- Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of personality and social psychology*, 17(2), 124.
- Enticott, P. G., Johnston, P. J., Herring, S. E., Hoy, K. E., & Fitzgerald, P. B. (2008). Mirror neuron activation is associated with facial emotion processing. *Neuropsychologia*, 46(11), 2851-2854.
- Hutcherson CA, Goldin PR, Ochsner KN, Gabrieli JD, Barrett LF, Gross JJ (2005): Attention and emotion: Does rating emotion alter neural responses to amusing and sad films? *Neuroimage* 27:656–668.

- Ickes, W., Stinson, L., Bissonnette, V., & Garcia, S. (1990). Naturalistic social cognition: Empathic accuracy in mixed-sex dyads. *Journal of Personality and Social Psychology*, 59(4), 730.
- Jackson, P. L., Meltzoff, A. N., & Decety, J. (2005). How do we perceive the pain of others? A window into the neural processes involved in empathy. *Neuroimage*, 24(3), 771-779.
- Jackson, P. L., Meltzoff, A. N., & Decety, J. (2005). How do we perceive the pain of others? A window into the neural processes involved in empathy. *Neuroimage*, 24(3), 771-779.
- Johnston, P., Mayes, A., Hughes, M., & Young, A. W. (2013). Brain networks subserving the evaluation of static and dynamic facial expressions. *Cortex*, 49(9), 2462-2472.
- Kanske, P., Böckler, A., Trautwein, F. M., & Singer, T. (2015). Dissecting the social brain: Introducing the EmpaToM to reveal distinct neural networks and brain-behavior relations for empathy and Theory of Mind. *NeuroImage*, 122, 6-19.
- Kanske, P., Böckler, A., Trautwein, F. M., & Singer, T. (2015). Dissecting the social brain: Introducing the EmpaToM to reveal distinct neural networks and brain-behavior relations for empathy and Theory of Mind. *NeuroImage*, 122, 6-19.
- Lieberman MD, Eisenberger NI, Crockett MJ, Tom SM, Pfeifer JH, Way BM (2007): Putting feelings into words: Affect labeling disrupts amygdala activity in response to affective stimuli. *Psychol Sci* 18:421–428.
- Lundqvist, D., Flykt, A., & Öhman, A. (1998). The Karolinska directed emotional faces (KDEF). CD ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institutet, 91-630.
- Okon-Singer, H., & Aue, T. (2017). Neurocognitive mechanisms modulating attention bias in anxiety: Current perspectives. *Biological psychology*, (122), 1-3.

- Rogers, C. (1995). *A way of being*. Houghton Mifflin Harcourt.
- Rohr, C. S., Villringer, A., Solms-Baruth, C., Meer, E., Margulies, D. S., & Okon-Singer, H. (2016). The neural networks of subjectively evaluated emotional conflicts. *Human brain mapping*, 37(6), 2234-2246.
- Ruben, M. A., & Hall, J. A. (2013). "I Know Your Pain" Proximal and Distal Predictors of Pain Detection Accuracy. *Personality and Social Psychology Bulletin*, 39(10), 1346-1358.
- Shamay-Tsoory, S. G. (2011). The neural bases for empathy. *The Neuroscientist*, 17(1), 18-24.
- Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., ... & Nelson, C. (2009). The NimStim set of facial expressions: judgments from untrained research participants. *Psychiatry research*, 168(3), 242-249.
- Wagner, H. L. (1993). On measuring performance in category judgment studies of nonverbal behavior. *Journal of nonverbal behavior*, 17(1), 3-28.
- Wierzbicka, A. (2009). Language and metalanguage: Key issues in emotion research. *Emotion review*, 1(1), 3-14.
- Wierzbicka, A. (1992). Talking about emotions: Semantics, culture, and cognition. *Cognition & Emotion*, 6(3-4), 285-319.
- Wong, D. L., & Baker, C. M. (1988). Pain in children: comparison of assessment scales. *Pediatric Nursing*, 14(1), 9-17.
- 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*, 29(26), 8525-8529.
- Zaki, J., & Ochsner, K. (2011). Reintegrating the study of accuracy into social cognition research. *Psychological Inquiry*, 22(3), 159-182.

Zaki, J., Bolger, N., & Ochsner, K. (2008). It takes two: The interpersonal nature of empathic accuracy. *Psychological Science*, 19(4), 399-404.

Zaki, J., Bolger, N., & Ochsner, K. (2009). Unpacking the informational bases of empathic accuracy. *Emotion*, 9(4), 478.