

## They do not suffer like us: The differential attribution of social pain as a dehumanization criterion in children

Alexandra Chas Villar, Verónica Betancor Rodríguez, Naira Delgado Rodríguez and Armando Rodríguez Pérez  
Universidad de La Laguna

### Abstract

**Background:** Social pain is considered a feature of humanity. The goal of this study was to confirm whether children, like adults, dehumanise out-group members attributing them less capacity to experience social pain than to in-group members. **Methods:** A total of 119 participants aged between 9 and 13 years responded to a questionnaire which collected information about situations that caused physical pain and situations that caused social pain. The task of the participants was to indicate to what extent they considered that two persons (a member of the in-group and a member of an out-group) would experience pain in each situation. **Results:** The results indicated that there was a higher estimate of social pain suffered by in-group members. There were no significant differences in the case of situations that generated physical in the groups. **Conclusions:** The results were analysed from the dehumanisation perspective.

**Keywords:** Dehumanisation, social pain, intergroup relations, childhood.

### Resumen

**Ellos no sufren como nosotros: la atribución diferencial de dolor social como criterio de deshumanización en niños. Antecedentes:** se considera que la capacidad de experimentar dolor social es una característica exclusivamente humana. El objetivo de esta investigación es comprobar si los niños, al igual que los adultos, deshumanizan a los miembros de exogrupos atribuyéndoles menos capacidad de experimentar dolor social que a los miembros del endogrupo. **Método:** un total de 119 participantes de entre 9 y 13 años respondieron a un cuestionario en el que se recogían situaciones que causan dolor físico y situaciones que causan dolor de tipo social. La tarea de los participantes era indicar en qué medida consideraban que dos personas (un miembro del endogrupo y un miembro de un exogrupo) experimentarían dolor en cada una de las situaciones. **Resultados:** los resultados indican que se produce una mayor estimación de dolor social en los miembros del endogrupo que en los miembros del exogrupo. En el caso de las situaciones que generan dolor físico no se encontraron diferencias significativas en función del grupo. **Conclusiones:** los resultados se analizan desde la perspectiva de la deshumanización.

**Palabras clave:** deshumanización, dolor social, relaciones intergrupales, infancia.

The majority of human beings have the capacity of empathy that allows them to perceive the pain that others are suffering, when it comes both to physical and to social pain. Physical pain is felt when a physical damage occurs, such as, for example, taking a hit. In these cases, neuroimaging studies have demonstrated that people tend to automatically experience the emotional and sensory experience of physical pain when they perceive pain in another person (Jackson, Meltzoff, & Decety, 2005; Osborn & Derbyshire, 2009). On the other hand, social pain refers to that experienced after the loss of social relations, such as ostracism, humiliation, exclusion, or social rejection. In addition, with respect to this type of pain, it has been found how the simple observation of someone suffering ostracism (e.g., ignored and excluded) causes the same

level of negative affect and psychological stress in the observer (Wessellmann, Bagg, & Williams, 2009).

However, having the ability to share the experience of physical and social pain does not mean that we always detect others' suffering accurately in all circumstances. In fact, in recent years, different researchers have been interested in studying the characteristics that can influence the level of physical or social pain attributed. This way, for example, observers tend to underestimate physical pain when it is suffered by a woman (Riva, Sacchi, Montali, & Frigerio, 2011; Riva, Wirth, & Williams, 2011), an older adult (Horgas & Elliot, 2004), or someone socially distant (Batson & Ahmad, 2009; Cikara, Bruneau, & Saxe, 2011). Similar results have been found for social pain. Specifically, persons who had not actively experienced social pain were less accurate in their estimates of others' social pain in comparison to persons who had actively experienced that pain (Nordgren, MacDonald, & Banas, 2011). It has also been found that social pain is underestimated when it is suffered by a psychologically distant person (Meyer et al., 2013).

Nevertheless, there is only one study that has conducted a comparative research on the tendency to attribute social and

physical pain in the field of inter-group relations. Specifically, Riva and Andrighetto (2012) carried out an integration between research on bias of inter-group members in their judgements about pain (e.g., Chiao & Mathur, 2010) and psychosocial research on attribution of humanity by inter-group members (Haslam et al., 2008). These authors hypothesised that social pain-in comparison to physical pain—can be considered a feature of humanity and, therefore, more typical of in-group than out-group members. Conversely, physical pain may not only be perceived as a typical feature of human beings, but also of other living beings. This way, there would be no differential attributions to out-group and in-group members.

To confirm their hypothesis, they conducted two studies in different scenarios. The participants of the two studies were Italians, and the out-groups were two national groups composed of Chinese and Ecuadorians, who were highly representative of ethnic minorities in the research context and perceived in a different way in terms of human warmth and competence. Specifically, the Chinese were perceived as little warm and very competent, and the Ecuadorians as very warm, but little competent. The results indicated that the Italians attributed less social pain when they considered members of the out-group (Chinese or Ecuadorians) in comparison to the social pain attributed to in-group members. Those attributions were not observed with respect to physical pain.

Following the study conducted by Riva and Andrighetto (2012), the goal of our study was to confirm whether this differential attribution of physical and social pain also occurred in children. That is, whether children, like adults, dehumanised out-group members by attributing them less capacity to experience social pain.

In recent years, some studies have approached the phenomenon of dehumanisation in childhood. In the few studies conducted with children—in comparison to those addressing adult populations—the researchers have primarily focused on two paradigms. Firstly, using the theory of infra-humanisation proposed by Leyens et al. (2000), different studies found that children, like adults, dehumanised out-group members by denying them the ability to experience feelings (Brown, Eller, Leeds, & Stace, 2007; Chas, Betancor, Rodríguez-Pérez, & Delgado, 2015; Costello & Hodson, 2014; Martin, Bennett, & Murray, 2008; Vezzali, Capozza, Stathi, & Giovannini, 2011).

Secondly, based on the model of dehumanisation proposed by Haslam et al. (Haslam, 2006; Haslam, Loughnan, Kashima, & Bain, 2008, for a review), it has been confirmed that children, like adults, dehumanised through differential association of animal attributes with out-group members in comparison to that association with in-group members. Thus, in addition to measuring the attribution of emotions and feelings, Costello and Hodson (2014) measured the degree of similarity perceived between out-group members and animals. Their results indicated that the two forms of dehumanisation were strongly interrelated. In addition, the measure associated with interspecies bias—i.e., differentiation between humans and animals—also indicated a strong relationship with the other two measures of dehumanisation. For their part, through direct and indirect measures of dehumanisation, Chas, Betancor, Delgado and Rodríguez-Pérez (in press) found that children established a stronger association between animal terms and the out-group members in comparison to the same association with in-group members.

The goal of the present study was to confirm whether dehumanisation performed by adults, attributing less social pain to out-group members than to in-group members, also occurred in children. This way, we aimed to provide two contributions to the study of dehumanisation in inter-group relations. One of these contributions consists in indicate that different attributions of pain experienced by in-group and out-group members would be a subtle way of removing a part of the human essence. This paradigm might be consolidated in the same way that other dehumanisation models have, such as those proposed by Leyens or Haslam. On the other hand, we intended to assess the behaviour of different dehumanisation measures in children. Although there is a well-established body of knowledge in the field of bias during childhood, the number of studies conducted with children on dehumanisation is scarce, even though assessing this phenomenon in childhood could facilitate the development of early intervention strategies aimed at reducing the dehumanisation of others.

Since previous research did not find a clear pattern of prejudice in early adolescence, it is especially interesting to explore dehumanization in this age group. Raabe and Beelmann (2011) conducted a meta-analysis to explore the developmental tendencies of prejudice. They concluded that prejudice increases between early childhood (2-4 years) and middle childhood (5-7 years), and slightly decreases from the age of seven to late childhood (8-10 years). From that age, according to the authors, the developmental tendency of prejudice cannot be confirmed.

## Method

### Participants

The sample of the present study was composed of 119 students aged between nine and thirteen years ( $M_{age} = 10.96$ ;  $SD = 0.919$ ). Of these students, 65 were boys and 54 girls, who were attending the same school (40 in fifth year and 37 in sixth year of primary education, and 42 in first year of secondary education). All the participants responded voluntarily within the classroom in the presence of a teacher and the researcher.

### Instruments

#### Pilot study

A pilot study was conducted to select the situations of physical and social pain for the experimental research. Specifically, 30 situations of pain were presented to 36 participants ( $M_{age} = 11$ ;  $SD = 0.676$ ), 15 relating to physical pain (for example, *cutting oneself with a paper* or *burning the tongue with hot food*), and the other 15 relating to social pain (for example, *betrayal of a friend* or *parental separation*). Most of the situations were selected from those used by other researchers (Dore, Hoffman, Lillard, & Trawalter, 2014; Riva & Andrighetto, 2012; Trawalter, Hoffman, & Waytz, 2012), and others were specifically prepared for the present study. Each situation was followed by the question “Who will feel pain in this situation?” to which the participants responded using a 7-point Likert scale (1 = humans and other living beings to 7 = only humans). The analysis of the responses provided the average measure of each situation. From this list, we selected 14 situations, namely, seven relating to physical pain and seven to social pain (see Table 1), so that the averages were significantly different in

the humanity scale ( $M = 2.34$ ,  $SD = 0.39$  for physical pain, and  $M = 6.14$ ,  $SD = 0.29$  for social pain;  $t(12) = 20.57$ ,  $p < .001$ ).

*Experimental research*

A questionnaire adapted to children was prepared, with simple, brief and exemplified language. It questioned about the physical and social pain that two characters would suffer, one with prototypical Spanish name and surname (in-group) and another with typical Arab name and surname (out-group). For the questionnaire responded by boys, the selected names were ‘Jaime Vega’ (in-group) and ‘Said Abu-Abbar’ (out-group), and for the questionnaire responded by girls, the names were ‘Marina Menéndez’ (in-group) and ‘Rachida Amain’ (out-group). The Spanish names and surnames were selected from the website of the National Institute of Statistics (<http://www.ine.es>), which contains the most common names and surnames of the country. The Arab names were selected from the same website, whereas the surnames were selected from a database specialised in Arab culture (<http://www.clubarabe.cl>).

The questionnaire consisted of two parts. The first part included a total of seven physical or social pain situations selected from the pilot study. The question relating to each situation was “How much do you think that *in-group name* and *out-group name* will suffer in this situation?” The participants had to answer using a 10-point Likert scale (1 meant nothing and 10 too much). To give their answers, the participants had to write the two names using one point of the scale, taking into account that the same point could not be used for the two names. With this procedure, the tendency to attribute the same degree of suffering to the in-group and out-group members was avoided.

In the second part of the questionnaire, the task was similar to the previous one, with the difference that the seven situations presented in this second task were related to the other type of pain (social or physical).

*Procedure*

The order of the tasks was counterbalanced. In the first place, half of the sample responded to situations of social pain and then to those of physical pain, and the other half responded in the reverse order. The order of the in-group and out-group names was

also counterbalanced. In half of the questionnaires, the character of the in-group was presented in first place and, in the other half, the names were presented in the reverse order. In addition, in order to facilitate the identification with the character of the in-group that would suffer, the girls responded to questionnaires whose protagonists were girls, and the boys responded to questionnaires whose protagonists were boys.

*Data analysis*

The distribution of the variables was carried out in accordance with a 2 (group: in-group vs. out-group)  $\times$  2 (type of pain: physical vs. social pain) factor model. The two variables were within-participants. The dependent variable was the degree of physical and social pain attributed to in-group and out-group members.

Data analysis was executed with SPSS, version 21. We performed analysis of variance (ANOVA) including Group, Type of pain, Sex of participants, and Order of presentation.

*Results*

Before determining the average measures corresponding to physical and social pain, an analysis of the internal consistency of the questionnaire items was carried out. Cronbach’s alpha coefficient of physical pain measures in the seven items relating to the in-group member and the seven items relating to the out-group member was .79, whereas this same coefficient relating to social pain was .80.

Subsequently, a 2 (group = in-group vs. out-group)  $\times$  2 (type of pain = physical vs. social pain)  $\times$  2 (sex = boy vs. girl)  $\times$  2 (order = A vs. B) ANOVA was performed, in order to determine whether the order of the stimuli presentation had affected the results. The results indicated that the order of the presentation did not cause any significant effect ( $p > .05$ ), so the ANOVA was repeated without the variable ‘order’.

The results indicated a significant main effect of the variable ‘group’ ( $F(1, 115) = 18.53$ ;  $p = .001$ ,  $\eta^2_p = 0.14$ ), in such a way that more pain was significantly attributed to the in-group member ( $M = 7.56$ ;  $SD = 0.95$ ) than to the out-group member ( $M = 7.32$ ;  $SD = 1.02$ ). In addition, a significant effect of the variable ‘type of pain’ was found ( $F(1, 115) = 14.82$ ;  $p = .001$ ;  $\eta^2_p = 0.11$ ), indicating that physical pain ( $M = 7.65$ ;  $SD = 0.97$ ) was more significantly attributed than social pain ( $M = 7.23$ ;  $SD = 1.21$ ). Finally, a significant effect of the variable ‘sex’ was found ( $F(1, 115) = 9.70$ ;  $p = .002$ ;  $\eta^2_p = 0.08$ ), which was due to the fact that the boys attributed less pain ( $M = 7.18$ ;  $SD = 1.02$ ) than the girls ( $M = 7.70$ ;  $SD = 0.73$ ).

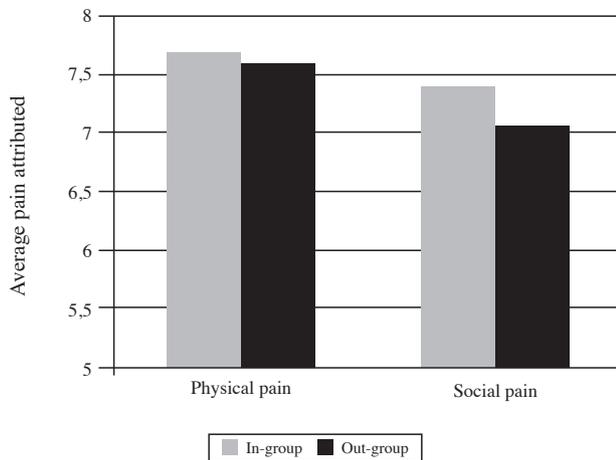
In addition, two double interactions were statistically significant. The first was between group and sex ( $F(1, 115) = 9.56$ ;  $p = .003$ ;  $\eta^2_p = 0.077$ ), which indicated that the girls significantly attributed more pain to the in-group ( $M = 7.90$ ;  $SD = 0.75$ ) than to the out-group members ( $M = 7.50$ ;  $SD = 0.80$ ;  $F(1, 115) = 25.00$ ;  $p = .001$ ;  $\eta^2_p = 0.18$ ). On the other hand, there were no significant differences in the boys ( $M = 7.21$ ;  $SD = 0.99$ , and  $M = 7.15$ ;  $SD = 1.14$ ;  $p = .369$ ). However, the second interaction, which was more relevant with respect to our hypothesis, established a relationship between the variables group and type of pain ( $F(1, 115) = 5.21$ ;  $p = .024$ ;  $\eta^2_p = 0.04$ ).

As illustrated in Figure 1, the analysis of the simple effects of the interaction indicated that the participants (boys and girls)

Social pain	Physical pain
Being embarrassed in front of their peers	Being run over
Losing the confidence of the parents	Being pricked by a thorn
The friends stop talking to him/her	Cutting a part of the body
Being humiliated in front of the group of friends	Being imprisoned with no food and beverages for two days
Not being invited to the best friend’s birthday party	Being hit with a baseball bat from behind
His/her best friend said that he/she wants nothing to do with him/her	Cutting oneself with a crystal
His/her friends arranged to go out without him/her	Having an injection

significantly attributed more social pain to the in-group ( $M = 7.40$ ;  $SD = 1.18$ ) than to the out-group members ( $M = 7.06$ ;  $SD = 1.35$ ;  $F(1, 115) = 21.70$ ;  $p = .001$ ;  $\eta_p^2 = 0.16$ ). On the other hand, there were no statistically significant differences regarding physical pain ( $M = 7.71$ ;  $SD = 1.04$  for the in-group, and  $M = 7.58$ ;  $SD = 1.04$  for the out-group;  $p = .06$ ).

In addition, we found greater attribution of physical than social pain in the two groups. This difference was significant in the in-group ( $M = 7.71$  and  $7.40$ ;  $F(1, 115) = 7.94$ ;  $p = .006$ ;  $\eta_p^2 = 0.06$ ) and in the out-group ( $M = 7.58$  and  $7.07$ ;  $F(1, 115) = 17.66$ ;  $p = .001$ ;  $\eta_p^2 = 0.13$ ).



**Figure 1.** Means of physical and social pain attributed to the in-group and the out-group members

## Discussion

In recent years, research on dehumanisation has experienced a breakthrough, especially due to the significant number of studies conducted. Most of these studies have focused on the hypothesis of traits attribution, following the model proposed by Leyens et al. (2001), or the model proposed by Haslam et al. (2008). In addition, a high number of studies have been conducted with adult populations, and only few of them have studied this phenomenon in the child population. Precisely, the goal of the present study was to enhance the understanding of dehumanisation in children using a new measure: the attribution of social pain.

Riva and Andrighetto (2012) found that adults dehumanised out-group members by attributing them less capacity to experience social pain, which is essentially a human characteristic. However, they did not find differences in the attribution of physical pain to in-group and out-group members (shared by animals). The goal of that study had been to confirm whether the same pattern of differential attribution of social pain to in-group and out-group members also occurred in children. The present study reveals similar results, i.e., children were capable of dehumanising out-group members by attributing them less capacity to experience social pain than that attributed to in-group members. At the same time, they did not make different attributions of physical pain to in-

group and out-group members. Therefore, children took away part of the human essence of out-group members by depriving them of a unique feature of human beings, i.e., feeling social pain.

The present study allowed us to make two major contributions to the field of dehumanisation in inter-group relations. On the one hand, even though there is a well-established body of knowledge in the field of children's bias, the number of studies conducted with children in the specific area of dehumanisation is considerably scarce. Our study provided new data that increase the knowledge about dehumanisation in children.

On the other hand, this study empirically supports the usefulness of a new subtle measure to assess the dehumanisation of others. From our point of view, the ability to experience social pain would be similar to the ability to have feelings or traits of human nature. These characteristics define the human essence and, therefore, denying them to other human beings means that they are being dehumanised.

Other direct and indirect measures of dehumanisation, focused on assessing the differential association of animal terms with out-group and in-group members, have been adapted for the child population in previous studies (Chas, Betancor, Delgado, & Rodríguez-Pérez, in press). Given the importance of understanding the phenomenon of dehumanisation in childhood, in order to create early intervention strategies, the more different measures we use to know the process, the more possibilities we will have to address it in its whole complexity.

However, the present study had some limitations. This way, the results should be treated with caution. Firstly, a reduced range of children's ages was studied, and, therefore, it was not possible to determine whether this subtle form of dehumanisation occurs at different stages of childhood. It is necessary to conduct further studies in order to shed light on this issue. Secondly, social pain occurs when dealing with situations of different intensity, and these intensities might influence the results. For example, differences in social pain might occur depending on situations with high emotional intensity (for example, the death of a loved one), but not in situations of low intensity (for example, not being invited to a birthday party), or *vice versa*. Thirdly, we worked with a single out-group. This way, it is necessary to explore whether these results can be observed in different social categories, even in those more linked to suffering from the stereotypical point of view.

In synthesis, the results obtained in the present study indicated that the degree in which individuals differentiate the ability of own groups or other groups to suffer is a form of bias that is present since childhood. Future studies may provide relevant information about potential consequences in terms of the intention to help or establish contact, as well as their relationship with other measures of dehumanisation.

## Acknowledgments

This study was supported by two research projects: PS2012-34227 and PSI2016-78450-P, Office of Scientific and Technical Research (DGICYT).

References

- Batson, C. D., & Ahmad, N. Y. (2009). Using empathy to improve intergroup attitudes and relations. *Social Issues and Policy Review*, 3, 141-177. doi: 10.1111/j.1751-2409.2009.01013.x
- Brown, R., Eller, A., Leeds, S., & Stace, K. (2007). Intergroup contact and intergroup attitudes: A longitudinal study. *European Journal of Social Psychology*, 37, 692-703. doi: 10.1002/ejsp.384
- Chas, A., Betancor, V., Delgado, N., & Rodríguez-Pérez, A. (in press). Children consider their own groups to be more human than other social groups: Evidence from indirect and direct measures. *Social Psychology*.
- Chas, A., Betancor, V., Rodríguez-Pérez, A., & Delgado, N. (2015). Differential attribution of secondary emotions to members of the ingroup and the outgroup: Infrahumanization bias in children. *Studies in Psychology*, 2, 366-388. doi: 10.1080/02109395.2015.1026120
- Chiao, J. Y., & Mathur, V.A. (2010). Intergroup empathy: How does race affect empathic neural responses? *Current Biology*, 20, R478-R480. doi: 10.1016/j.cub.2010.04.001
- Cikara, M., Bruneau, E. G., & Saxe, R. (2011). Us and them: Intergroup failures of empathy. *Currents Directions in Psychological Science*, 20, 149-153. doi: 10.1177/0963721411408713
- Costello, K., & Hodson, G. (2014). Explaining dehumanization among children: The interspecies model of prejudice. *British Journal of Social Psychology*, 53, 175-197. doi: 10.1111/bjso.12016
- Dore, R. A., Hoffman, K. M., Lillard, A. S., & Trawalter, S. (2014). Children's racial bias in perceptions of other's pain. *British Journal of Developmental Psychology*, 32, 218-231. doi:10.1111/bjdp.12038
- Haslam, N. (2006). Dehumanization: An integrative review. *Personality and Social Psychology Review*, 10, 252-264. doi:10.1207/s15327957pspr1003\_4
- Haslam, N., Loughnan, S., Kashima, Y., & Bain, P. (2008). Attributing and denying humanness to others. *European Review of Social Psychology*, 19, 55-85. doi: 10.1080/10463280801981645
- Jackson, P. L., Meltzoff, A. L., & Decety, J. (2005). How do we perceive the pain of others: A window into the neural processes involved in empathy. *NeuroImage*, 24, 771-774. doi: 10.1016/j.neuroimage.2004.09.006
- Horgas, A. L., & Elliott, A. F. (2004). Pain assessment and management in persons with dementia. *Nursing Clinics of North America*, 39, 593-606. doi: 10.1016/j.cnur.2004.02.013
- Leyens, J. P., Paladino, P. M., Rodríguez, R. T., Vaes, J., Demoulin, S., Rodríguez, A. P., & Gaunt, R. (2000). The emotional side of prejudice: The role of secondary emotions. *Personality and Social Psychology Review*, 4, 186-197. doi: 10.1207/S15327957PSPR0402\_06
- Leyens, J. P., Rodríguez-Pérez, A., Rodríguez-Torres, R., Gaunt, R., Paladino, M. P., Vaes, J. & Demoulin, S. (2001). Psychological essentialism and the differential attribution of uniquely human emotions to ingroups and outgroups. *European Journal of Social Psychology*, 31, 395-411. doi: 10.1002/ejsp.50
- Martin, J., Bennett, M., & Murray, W. S. (2008). A developmental study of the infrahumanization hypothesis. *British Journal of Developmental Psychology*, 26, 153-161. doi: 10.1348/026151007X216261
- Meyer, M. L., Masten, C. L., Ma, Y., Wang, C., Shi, Z., Eisenberger, N. I., & Han, S. (2013). Empathy for the social suffering of friends and strangers recruits distinct patterns of brain activation. *Social Cognitive and Affective Neuroscience*, 8, 446-454. doi: 10.1093/scan/nss019
- Nordgren, L. F., MacDonald, G., & Banas, K. (2011). Empathy gaps for social pain: Why people underestimate the pain of social suffering. *Journal of Personality and Social Psychology*, 100, 120-128. doi: 10.1037/a0020938
- Osborn, J., & Derbyshire, S. (2009). Pain sensation evoked by observing injury in others. *Pain*, 148, 268-274. doi: 10.1016/j.pain.2009.11.007
- Raabe, T., & Beelmann, A. (2011). Development of ethnic, racial, and national prejudice in childhood and adolescence: A multinational meta-analysis of age differences. *Child Development*, 82(6), 1715-1737. doi: 10.1111/j.1467-8624.2011.01668.x
- Riva, P., Sacchi, S., Montali, L., & Frigerio, A. (2011). Gender effects in pain detection: Speed and accuracy in decoding female and male pain expressions. *European Journal of Pain*, 15, 985.e1-985.e11. doi: 10.1016/j.ejpain.2011.02.006
- Riva, P., Wirth, J., & Williams, K. D. (2011). The consequences of pain: The social and physical pain overlap on psychological responses. *European Journal of Social Psychology*, 41, 681-687. doi: 10.1002/ejsp.837
- Riva, P., & Andrighetto, L. (2012). "Everybody feels a broken bone, but only we can feel a broken heart": Group membership influences the perception of targets' suffering. *European Journal of Social Psychology*, 42, 801-806. doi:10.1002/ejsp.1918
- Trawalter, S., Hoffman, K. M., & Waytz, A. (2012). Racial bias in perceptions of others' pain. *PLoS ONE*, 7, e48546. doi: 10.1371/journal.pone.0048546
- Vezzali, L., Capozza, D., Stathi, S., & Giovannini, D. (2011). Increasing outgroup trust, reducing infrahumanization, and enhancing future contact intentions via imagined intergroup contact. *Journal of Experimental Social Psychology*, 48, 437-440. doi: 10.1016/j.jesp.2011.09.008
- Wesselmann, E. D., Bagg, D., & Williams, K.D. (2009). "I feel your pain": The effects of observing ostracism on the ostracism detection system. *Journal of Experimental Social Psychology*, 45, 1308-1311. doi: 10.1016/j.jesp.2009.08.003