Adults' implicit reactions to typical and atypical infant cues

Santamaria, Francesca; Esposito, Gianluca; Senese, Vincenzo Paolo; Sergi, Ida

2018

Senese, V. P., Santamaria, F., Sergi, I., & Esposito, G. (2019). Adults' implicit reactions to typical and atypical infant cues. In A. Esposito, M. Faundez-Zanuy, F. Morabito, & E. Pasero (Eds.), Quantifying and Processing Biomedical and Behavioral Signals (pp. 35-43). doi:10.1007/978-3-319-95095-2

https://hdl.handle.net/10356/88416

https://doi.org/10.1007/978-3-319-95095-2

Adults' Implicit Reactions to Typical and Atypical Infant Cues

Vincenzo Paolo Senese[1], Francesca Santamaria[1], Ida Sergi[1] and Gianluca Esposito[2,3]

[1]Department of Psychology, University of Campania "Luigi Vanvitelli", Italy

[2]Division of Psychology, Nanyang Technological University, Singapore

[3]Department of Psychology and Cognitive Sciences, University of Trento, Italy

vincenzopaolo.senese@unicampania.it; francescasantamaria44@gmail.com; ida.sergi@unicampania.it; gianluca.esposito@unitn.it

Abstract This study investigates the valence of adults' implicit associations to typical and atypical infant cues, and the consistency of responses across the different stimuli. 48 non-parent adults (25 females, 23 males) were presented three kinds of infant cues, typical cry (TD-cry), atypical cry (ASD-cry) and infant faces, and their implicit associations were measured by means of the Single Category Implicit Association Test (SC-IAT). Results showed that, independently of gender, the implicit associations to typical and atypical infant cries had the same negative valence, whereas infant faces were implicitly associated to the positive dimension. Moreover, data showed that implicit responses to the different infant cues were not associated. These results suggest that more controlled processes influence the perceptions of atypical infant cry, and confirm the need to investigate individual reactions to infant cues by adopting a multilevel approach.

Keywords Infant cry · Infant face · ASD · Implicit association · SC-IAT

1 Introduction

Several researchers argue that humans have an innate predisposition to caregiving infants [1] which is the expression of a biologically rooted behaviour [2-4]. Providing a different perspective, studies also showed that adults do not always manifest adequate or sensitive behaviours toward infants, and that child abuse and neglect were also observed [5-7]. Therefore, individual differences can be considered a critical factor in the regulation of infant caregiving [3,8,9]. Indeed, even when it is stated that caregiving is influenced by the interaction of a variety of forces (adult characteristics, child characteristics and context characteristics), as in the Determinants of Parenting Model [10], it is recognized that the individuals

have a crucial role in determining caregiving behaviours, and that individual characteristics can even buffer the negative effects of the other factors.

In line with these considerations, in the literature, researchers have investigated adults' reaction to salient infant cues in order to better understand the processes that regulate adult-infant interaction, showing that caregiving behaviours relies on the interrelation of multilevel systems that involve cortical and subcortical brain structures [8,11]; and that responsiveness to infant cues is related to infant later development [12-15].

Among the infant cues, the most studied are infant faces and cries. Infant faces are characterized by a constellation of morphological features, "*Kindchenschema*", which distinguish them from adult faces [16], capture attention [17], are associated with a positive implicit evaluation [3], activate specific brain areas [8,11], and elicit willingness to approach, to smile and to communicate [18]. These results were consistent across genders [3].

Infant cry is the earliest mean of infant social vocal communication which promotes caregiver proximity, activates specific brain areas [8,11], and is supposed to trigger caregiving behaviours [19,20]. Typical infant cry (TD-cry) has a specific acoustic pattern (e.g., pause length, number of utterances, and fundamental frequency) that influences the perception of infant distress and its meaning [21,22]. Studies investigating whether gender influences adults' responses to infant cries showed a mixed pattern of results [23].

Infant cry also has the advantage of allowing the investigation of adults' responses to typical and atypical infant cues, thus facilitating the examination of the effects of different child characteristics on the individual reactions. Indeed, it has been shown that cry of infants later diagnosed with ASD (ASD-cry) has a specific acoustical pattern (shorter pauses, fewer utterances, and higher fundamental frequency), activates specific brain areas [24], is recognized as different by caregivers [19], and affects adult behaviours [25].

Despite its specificity, only few studies have investigated adults' reactions to atypical infant cry (see [9,19,24,25]). Moreover, the extant studies have the limitation of not evaluating in a direct way the valence of the reaction to this atypical infant cue or taking into account the social desirability bias. Indeed, they mainly focused on self-report or behavioural responses in women, thus taking into account only conscious or controlled processes, or considering indirect measures (e.g., physiological) that cannot clarify the positive or negative valence of the responses. Only one study considered males [9], and no study directly investigated gender differences.

Recently, the Single Category Implicit Association Test (SC-IAT) has been adapted to investigate in a direct way the valence of implicit reaction to visual and acoustical infant cues by taking into account the social desirability bias [3,23]. Senese and colleagues showed that, independently of gender and parental status, infant faces were associated with specific and positive implicit reactions, whereas TD-cries were associated to negative implicit reaction. Besides, results showed wide individual differences in implicit reactions that in turn were associated to pa-

rental models. To our knowledge no study has investigated yet the valence of implicit reaction to ASD-cry, or investigated the association between implicit reactions to different infant cues. From a theoretical perspective, showing if the ASD-cry has a specific implicit valence could be useful to better understand the processes that regulate the different perception of atypical cries [19] and the consequent behaviours [25].

Building on the aforementioned considerations, the aim of the present study was to investigate the valence of the implicit reaction to ASD-cry and to compare adults' reactions to typical and atypical infant cues. To this aim three SC-IATs were adapted to evaluate implicit associations to TD-cry, ASD-cry and typical infant faces. According to the literature [3,23], we expected negative implicit association to typical and atypical infant cry, positive implicit reaction to infant faces, and significant differences between TD- and ASD-cry [19], with the latter showing a more negative implicit association. In line with the literature on implicit reaction to infant cues [3,23], no gender differences were expected.

2 Method

2.1 Sample

A total of 48 non-parent adults (25 females, 23 males) participated in a within-subject experimental design. Their ages ranged from 19 to 38 years (M = 24.94, SD = 3.5), and their educational level varied from middle school to college levels. Males and females were matched as a function of the age, $F< 1$, and all participants were tested individually.

2.2 Procedure

The experimental session was divided in two phases. In the first phase, basic socio demographic information (i.e., sex, age and socio economic status) was collected, after which the three SC-IATs (TD-cry, ASD-cry and infant faces) were administered in a counterbalanced order. The study was conducted in accordance with ethical principles stated in the Helsinki Declaration. All participants signed a written informed consent before starting the experimental session. The session lasted about 25 minutes.

2.3 Measures

Single Category Implicit Association Test (SC-IAT). Abiding by the literature [3,23], three SC-IATs — two auditory versions and one classical visual version — were adapted to evaluate the valence of implicit reactions to typical and atypical infant cues: TD-cry, ASD-cry, and infant faces. The SC-IAT is a two-stage classification task. In each stage, a single target item (audio clip or picture) was presented with target words in random order. Participants were presented one item at time (i.e., target items or words) and asked to classify it into the correct category as quickly as possible. Words were distinguished as "good" and "bad" and had to be classified into the positive or negative category, respectively. In case of error, an "X" appeared at the centre of the screen. To emphasize speed of responding, a response window of 1500 ms following stimulus onset was applied for each stimulus. Each SC-IAT was repeated twice. In the first stage, good words and target objects were categorized according to the same response key, and bad words were categorized using a second key (positive condition). In the second stage, bad words and target objects were categorized using the same response key, and good words were categorized using the second key (negative condition). The SC-IAT score is derived from the comparison of latencies of responses in the two classification stages. If participants were faster in categorizing stimuli in the positive condition in comparison to the negative condition, they were considered to have positive implicit attitudes towards the target. If the contrary was true, a negative implicit attitude was attributed. For each test, the SC-IAT score was calculated by dividing the difference between means of RTs of the two classification conditions by the standard deviation of latencies of the two phases [26]. Scores around 0 indicate no IAT effect; absolute values from 0.2 to 0.3 indicate a "slight" effect, values around 0.5 a "medium" effect, and values of about 0.8 to infinity a "large" effect. In this study, positive values indicate that the target cue was implicitly associated with the positive dimension. All the SC-IAT scores showed adequate reliability ($\alpha s > .70$).

Stimuli. Infant stimuli were the same used into previous researches. In particular, TD-cry [23] and ASD-cry [19] were extracted from home videos of 13-month-old infants to be acoustically representative of the relative category. Both stimuli lasted 5 seconds each and were normalized for intensity. They were presented through headphones at a constant volume. Infant faces [3] portrayed infants with a mean age of about 6 months showing a neutral expression.

3 Data Analysis

Normality of univariate distributions of SC-IAT scores of each type of cue was preliminarily checked. To analyse the effect of the cue characteristics on the va-

lence of infant cues, implicit associations were analysed by means of a 3×2 mixed *ANOVA* that treated infant Cue (TD-cry, ASD-cry and infant faces) as a three-level within-subjects factor, and Gender (males vs. females) as a two-level between-subjects factor. Bonferroni correction was used to analyse post-hoc effects of significant factors, and partial eta squared (η^2_p) was used to evaluate the magnitude of significant effects. To investigate the association of implicit reactions to the different implicit cues, Pearson correlation coefficients were computed.

4 Results

The *ANOVA* on SC-IAT scores showed that implicit associations were influenced by the Cue, $F(2,90) = 17.56$, $p < .001$, $\eta^2_p = .281$, not significant were the Gender main effect, $F(1,45) = 1.07$, $p = .306$, $\eta^2_p = .023$, and the Cue×Gender interaction, $F < 1$. Post-hoc analysis revealed that infant faces, $M = 0.194$, 95% CI [0.096; 0.293], were associated with the positive dimension, while the TD-cry, $M = -0.183$, 95%CI [-0.297; -0.068], and the ASD-cry, $M = -0.154$, 95%CI [-0.256; -0.051], were associated with the negative dimension (see Figure 1). No differences were observed between typical and atypical cry.

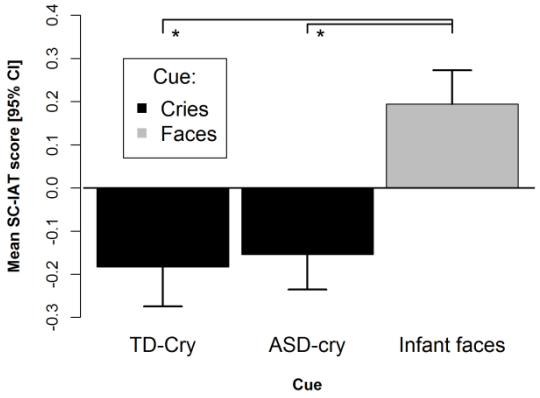

Fig. 1. Mean SC-IAT score as a function of the Cue (*$p < .001$)

Finally, correlation analysis showed that the implicit reactions to infant cues were not significantly associated (see Table 1).

Table 1. Pearson correlation coefficients between implicit associations to infant cues

Variables	1	2	3
SC-IAT			
1. TD-cry	—		
2. ASD-cry	.210	—	
3. Infant faces	-.030	.099	—

5 Discussion

The aim of the present study was to assess whether typical and atypical infant cries were associated with specific implicit responses in non-parent adults, as well as the consistency of implicit responses toward different infant cues. The literature showed that the cry of infants diagnosed with ASD has a specific acoustic pattern that activates specific brain areas, is differentiated by caregivers, and affects adults' behaviours [9,19,24,25]. We hypothesized that ASD-cry would be associated with a more negative implicit response if compared with TD-cry and infant faces, with the latter showing a positive implicit association. Moreover, given that previous studies did not show gender differences in the valence of the implicit responses to infant faces and TD-cry [3,23], we expected that males and females would show a similar implicit association to infant cues. To test these hypotheses, participants were presented three kinds of infant cues (TD-cry, ASD-cry and infant faces) and their implicit associations were measures by means of the SC-IAT paradigm.

We considered infant cry because it has been showed that adult responses to this cue are associated to the quality of caregiver-infant relationships and child development [12-15], and because it serves as a good basis for the investigation of child characteristics on adult responsiveness. We used the SC-IAT paradigm because to our knowledge it is the only paradigm that allows the direct investigation of the valence of responses to infant cues by taking into account the social desirability bias [3,23]. This is the first study that implements this paradigm to investigate adults' implicit reactions to atypical cries.

In line with the previous literature [19,23], results showed that both typical and atypical cries were associated with the negative domain, whereas infant faces were associated with the positive domain [3], therefore showing that adults have a specific implicit response to infant faces and negative implicit associations toward infant cries. Contrary to our expectations and the previous literature [19], no significant differences were observed between typical and atypical cries. In their study, Bornstein and colleagues [19] used an explicit classification task showing that women were slower in classifying ASD-cry vs. TD-cry. A possible explanation could be that at implicit level the valence of the infant cry is independent of the acoustic pattern, and that the previous observed differences are related to more

controlled processes. Indeed, according to parental models [8,11], adult responses to infant cues are regulated at different levels, from more reflexive processes to more controlled ones. Another possible explanation could be that the way we implemented the SC-IAT paradigm was not sensitive to evaluate the differences between typical and atypical cry. This is the first study that used SC-IAT to evaluate implicit responses to similar auditory stimuli. Future studies should replicate this study by modifying the paradigm to elucidate whether TD-cry and ASD-cry have specific implicit associations.

With regards the gender differences, our results replicate previous findings showing similar implicit responses between males and females on infant faces and TD-cry [3,23]. Moreover, data showed that no gender differences were observed on ASD-cry. Therefore, this is the first study that directly investigated gender differences in response to atypical infant cry. In the literature studies investigating gender differences on responses to typical infant cues showed a mixed pattern (see [3,23]). It is possible that gender differences are the expression of conscious or controlled thoughts and beliefs. Further studies that investigate adults' responses to infant cues by using a multilevel approach are needed.

Finally, the associations between implicit responses to the different infant cues were investigated. Results showed a substantial independence between responses to cry (both typical and atypical) and infant faces. In the literature only one study [27] directly compared reaction (P300) to different infant cues and showed differential responses as a function of the infant cue. Further studies are needed to investigate to what extent responses to different infant cues are the expression of a general caregiving propensity or reflect different components.

The results of this study should be interpreted with certain limitations in mind. First, we considered only a small sample ($N = 48$), therefore it is possible that the results neglected small effects size. Further studies with bigger samples should replicate the investigation and test the robustness of our findings. Second, we considered only non-parent adults because we were interested in the investigation of adults' responsiveness to infant cues independent of parental experience. Further studies should directly compare parents and non parents on implicit responses to typical and atypical infant cues. Third, we administered infant cues by adopting a unimodal methodology (acoustic vs. visual), while research showed that the multimodal approach is a more valid methodology for investigating individual responses because human perception is holistic [28]. Further studies should replicate the findings by adopting a more ecological multimodal approach that integrates at least audio and visual information. Fourth, we measured implicit reactions only, but researchers agree that caregiving behaviours are regulated at different levels of processing. Further studies applying a multilevel approach should be carried out. Finally, we considered the valence of implicit reactions to different infant cues, but no direct measure of caregiving was considered. Further study should include a direct measure of caregiving to investigate the predictive validity of the implicit reactions.

6 Conclusions

The result of this study showed that, independent of gender, implicit responses to typical and atypical infant cries have the same negative valence, while it confirmed that infant faces have a positive valence. Moreover, the data showed wide individual differences and that implicit responses to the different infant cues were not associated. If we assume that the valence of adults' implicit associations to infant cues may contribute to influencing the quality of adult-infant interaction, and consequent child development, then we may suggest that the evaluation of adult implicit associations to different infant cues should be included in the screening protocols in order to better prevent negative outcomes and to plan well-tailored intervention programs aimed at facilitating the expression of sensitive caregiving towards infants.

References

1. Papoŭsek, H., Papoŭsek, M. (2002). *Intuitive parenting*. In: M. H.Bornstein, Ed. Handbook of parenting: Vol. 2. 2nd ed (pp. 183-203). Mahwah, NJ: Lawrence Erlbaum Associates.
2. Bornstein, M. H. (2016). Determinants of Parenting. *Developmental Psychopathology*. Four, 5, 1-91.
3. Senese, V. P, De Falco, S., Bornstein, M. H., Caria, A., Buffolino, S., & Venuti, P. (2013). Human Infant Faces Provoke Implicit Positive Affective Responses in Parents and Non-Parents Alike. *PlosOne*, 8(11), e80379. doi:10.1371/journal.pone.0080379
4. Swain, J. E., Kim, P., Spice, J., Ho, S. S., Dayton, C. J., Elmadih, A., & Abel, K. M. (2014). Approaching the biology of human parental attachment: brain imaging, oxytocin and coordinated assessments of mothers and fathers. *Brain Research*, 1580, 78-101.
5. Barnow, S., Lucht, M., & Freyberger, H.-J. (2005). Correlates of aggressive and delinquent conduct problems in adolescence. *Aggressive Behavior*, 31, 24–39.
6. Beck, J. E., & Shaw, D. S. (2005). The influence of perinatal complications and environmental adversity on boys' antisocial behavior. *Journal of Child Psychology and Psychiatry*, 46, 35–46.
7. Putnick, D. L., Bornstein, M. H., Lansford, J. E., Chang, L., Deater-Deckard, K., Di Giunta, L., . . . Bombi, A. S. (2012). Agreement in mother and father acceptance-rejection, warmth, and hostility/rejection/neglect of children across nine countries. *Cross-Cultural Research*, 46, 191–223. doi:10.1177/1069397112440931
8. Barrett, J., & Fleming, A. (2011). Annual Research Review: All mothers are not created equal: neural and psychobiological perspectives on mothering and the importance of individual differences. *Journal of Child Psychology and Psychiatry*, 52(4), 368-397.
9. Esposito, G., Valenzi, S., Islam, T., Bornstein, M. H. (2015). Three physiological responses in fathers and non-fathers' to vocalizations of typically developing infants and infants with Autism Spectrum Disorder. *Research in Developmental Disabilities*, 43-44, 43-50. doi: 10.1016/j.ridd.2015.06.007
10. Belsky, J. (1984). The determinants of parenting: A process model. *Child Development*, 55, 83-96.
11. Swain, J. E., Kim, P., Spice, J., Ho, S. S., Dayton, C. J., Elmadih, A., Abel, K. M. (2014). Approaching the biology of human parental attachment: brain imaging, oxytocin and coordinated assessments of mothers and fathers. *Brain Research*, 1580, 78-101.

12. Higley, E., & Dozier, M. (2009). Night time maternal responsiveness and infant attachment at one year. *Attachment & Human Development*, 11(4): 347–363
13. Kim, P., Feldman, R., Mayes, L.C., Eicher, V., Thompson, N., Leckman, J.F., & Swain, J.E., (2011). Breastfeeding, brain activation to own infant cry, and maternal sensitivity. J. Child Psychol. *Psychiatry* 52, 907–915.
14. Leerkes, E.M., Parade, S.H., & Gudmundson, J.A. (2011) Mothers' Emotional Reactions to Crying Pose Risk for Subsequent Attachment Insecurity. *Journal of Family Psychology*, 25(5), 635-43. doi: 10.1037/a0023654.
15. McElwain, N.L., & Booth-Laforce, C. (2006) Maternal sensitivity to infant distress and non-distress as predictors of infant-mother attachment security. *Journal of Family Psychology*, 20(2), 247-55.
16. Lorenz, K. Z. (1971). *Studies in animal and human behaviour*. Vol 2. London: Methuen & Co.
17. Brosch, T., Sander, D., Scherer, K. R. (2007). That baby caught my eye… Attention capture by infant faces. *Emotion*, 7(3), 685-689.
18. Caria A, de Falco S, Venuti P, Lee S, Esposito G, et al. (2012) Species-specific response to human infant faces in the premotor cortex. *NeuroImage*, 60(2), 884-893.
19. Bornstein, M. H., Costlow, K., Truzzi, A., & Esposito, G. (2016). Categorizing the cries of infants with ASD versus typically developing infants: A study of adult accuracy and reaction time. *Research in Autism Spectrum Disorders*, 31, 66-72.
20. Zeifman, D. M. (2001). An ethological analysis of human infantcrying: Answering Tinbergen's four questions. *Developmental Psychobiology*, 39(4), 265–285.
21. Esposito, G., & Venuti, P. (2010). Developmental changes in the fundamental frequency (f0) of infants' cries: a study of children with Autism Spectrum Disorder. *Early Child Development and Care*, 180(8), 1093-1102.
22. Esposito, G., Nakazawa, J., Venuti, P., & Bornstein, M. H. (2013). Componential deconstruction of infant distress vocalizations via tree-based models: a study of cry in autism spectrum disorder and typical development. *Research in Developmental Disabilities*, 34(9), 2717-24. doi: 10.1016/j.ridd.2013.05.036.
23. Senese, V.P., Venuti, P., Giordano, F., Napolitano, M., Esposito, G., & Bornstein, M.H. (2017). Adults' Implicit Associations to Infant Positive and Negative Acoustic Cues: Moderation by Empathy and Gender. *Quarterly Journal of Experimental Psychology*, 70(9), 1935-1942. doi: 10.1080/17470218.2016.1215480
24. Venuti, P., Caria, A., Esposito, G., De Pisapia, N., Bornstein, M.H., & de Falco, S. (2012). Differential brain responses to cries of infants with autistic disorder and typical development: an fMRI study. *Research in Developmental Disabilities*, 33(6), 2255-64. doi: 10.1016/j.ridd.2012.06.011
25. Esposito, G., & Venuti, P. (2009). Comparative Analysis of Crying in Children with Autism, Developmental Delays, and Typical Development. *Focus on Autism and Other Developmental Disabilities*, 24(4), 240-247.
26. Greenwald, A.G., Nosek, B.A., & Banaji, M.R. (2003) Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology,* 85, 197–216.
27. Rutherford, H. J.V., Graber, K. M., & Mayes, L. C. (2016). Depression symptomatology and the neural correlates of infant face and cry perception during pregnancy. *Social Neuroscience*, 11(4), 467-474, DOI: 10.1080/17470919.2015.1108224
28. Iachini, T., Maffei, L., Ruotolo, F., Senese, V.P., Ruggiero, G., Masullo, M., & Alekseeva, N. (2012). Multisensory assessment of acoustic comfort aboard metros: an Immersive Virtual Reality study. *Applied Cognitive Psychology*, 26, 757-767. doi: 10.1002/acp.2856