Gender Differences in Automatic Motor Responses to Infant Cries

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Introduction:
Due to the biological relevance of infant-related stimuli for newborn survival and reproductive success, it has been suggested that infant-related stimuli should capture adult attention and automatically trigger physiological responses to prepare for action (Brosch et al., 2007). Recent functional magnetic resonance imaging (fMRI) studies have revealed increased activity in the premotor cortex in response to infant-related sensory stimulation (Caria et al., 2012; De Pisapia et al., 2013; Venuti et al., 2012). This finding was interpreted as the loading of an appropriate and specific behavioural/motor program response to the alerting stimuli.

However, neuroimaging lacks the temporal resolution to determine whether these motor activations are the product of early automatic responses or of late, cognitively mediated responses. Indeed, physiological signatures of automatic bottom-up responses can be observed in very early phases of stimulus processing, between 100 and 250 ms after stimulus onset (Barchiesi and Cattaneo, 2012).

In order to verify the hypothesis that affiliative stimuli automatically evoke motor plans, in the present study, we measured the presence and the time course of covert modulation of motor cortex excitability by recording the motor evoked potentials (MEPs) associated to single-pulse Transcranial Magnetic Stimulation (TMS), in an event-related paradigm. Such paradigm allows to collect data with high temporal resolution and to disentangle bottom-up automatic responses from top-down cognitively mediated ones.

Methods:
We applied single-pulse TMS (spTMS) to participants' motor cortex, time-locked to the audio presentation of infant cries, and we recorded motor evoked potentials (MEPs) from two upper-limb muscles. The time course of motor modulation was assessed from 0 to 250 ms from sound onset, in six steps of 50 ms in 10 females and 10 male non-parent subjects aged 25-38 years. Responses were recorded from a proximal muscle (biceps brachii - BB) and a distal muscle (first interosseus dorsalis - 1DI) of the right upper limb. Stimuli were five different baby cries sounds and ten control sounds obtained increasing baby cries in pitch by 200 and 400 Hz. Moreover, a post-hoc control experiment was realized to better control for the specificity of infant cries. In this case, a different group of 10 non-parent female participants (age range 18-39) were exposed to control stimuli obtained through the scrambling of the original raw and pitch-modified baby cries used in the main experiment.

Results:
The ANOVA on the data from the ID1 muscle showed a Sex*Isi*Cry 3-way interaction, F(10, 180)=2.80, p=0.003. To investigate this interaction, the design was split in two Isi*Cry ANOVAs, each with data from one sex only. The analysis of males yielded only a main effect of ISI, F(5, 45)=4.1570, p=0.003. By contrast, the analysis performed on females showed a main effect of ISI, F(5, 45)=6.02, p<0.001 and a 2-way Isi*Cry interaction F(10, 90)=5.23, p<0.001. Using the control experiment data, the ANOVA on the ID1 muscle yielded a significant 3-way interaction between Group (experimental stimuli versus scrambled experimental stimuli) * Isi * Cry (F(10,
180) = 2.67, \( p = 0.005 \). The analysis on the group who listened to scrambled cries by means of a 2-way ISI*CRY ANOVA did not show any significant result.

**Conclusions:**
The data of the present study documented the presence of early motor responses that are specific to baby cries in adult non-parents. Such finding is in accord with the literature on mutual inter-subjectivity that typically regulates parent-infant interaction (Beebe, 2000). The finding was restricted to female participants. Finding automatic responsiveness to baby cries in nullipara women lends further support to the idea of an "alloparental care" predisposition in females, but not in males, similar to several mammalian species which feature cooperation in infant care (Briga et al., 2012).

**Social Neuroscience:**

Social Interaction

**Reference**


Briga M., Pen I., Wright J. (2012), 'Care for kin: within-group relatedness and allomaternal care are positively correlated and conserved throughout the mammalian phylogeny'. Biology Letter, vol. 8, pp. 533-536.

