Electrophysiological correlates of self-awareness development early in life

Irene Ronga, Alice Rossi Sebastiano e Francesca Garbarini
Manibus Lab, Dipartimento di Psicologia – Università degli Studi di Torino

The ability to identify the self-body and the emergence of self-awareness are crucial steps to establish successful interactions with the environment. From an evolutionary point of view, it would be a great advantage to acquire such a self-awareness as soon as possible. Here, in a series of three different EEG studies, we explore the emergence of bodily-self awareness in human newborns. In two preliminary EEG studies, we monitored the responses to auditory (EXP. 1) and to tactile stimuli (EXP. 2). In EXP. 3, by exploiting multisensory integration phenomena, we measured the responses to audio-tactile events, when auditory stimuli occur close to *vs.* far from the body. In EXP 1, we measured the responses to more or less consonant auditory stimulation in newborns (N=16), with the aim of identifying the auditory stimulation protocol able to induce the best signal-to-noise ratio. Our results indicated that consonant sounds represent the most promising stimuli in triggering EEG responses. In EXP. 2, we explored the responses to tactile stimuli in sleeping *vs*. awake newborns and infants. In adults, this comparison has been employed as a model to investigate different conscious states, which are also associated with distinguishable patterns of EEG activity. By comparing newborns' EEG responses (N=16), to those of 3-month-old infants (N=9), we observed that both groups showed a very similar EEG pattern, with greater responses in sleep than in wakefulness. This finding seems promising in suggesting that a primitive electrophysiological dissociation between different conscious states might be observed already at birth. In EXP. 3, on the grounds of the preliminary results of EXP.1-2, we exploited audio-tactile integration mechanisms to investigate newborns' ability to identify the self-body and its position in space. According to the spatial congruency rule of multisensory integration, only multisensory stimuli occurring close in space are able to trigger super-additive responses. Therefore, the presence of greater super-additive responses when the auditory stimulus is delivered close to (*near condition*) *vs.* far from (*far condition*) the body, may be considered as an index of a functioning representation of the body position in space. In a population of healthy newborns, we compared the responses to the audio-tactile events in the near and in the far conditions. Super-additive responses were significantly greater in proximity to the body. We interpreted this result as a primitive coding of the self-body boundaries, suggesting that human newborns are somehow aware of their body and of its position in space.