Non-Contact Sociologic Research with Thermal Imaging Cameras. FLIR Thermal Imaging Camera Helps Show Maternal Empathy Problem

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Researchers that want to study neurovascular elements of human social interaction are often confronted with the limitations of commonly used methods in neuroscience. They often involve the application of electrodes or other contact measurement instruments on the skin of the test subjects, which interferes with spontaneous behaviour. Non-contact methods, such as functional magnetic resonance imaging, involve subjecting test subjects to active radiation and require the test subjects to remain still for extended periods of time.

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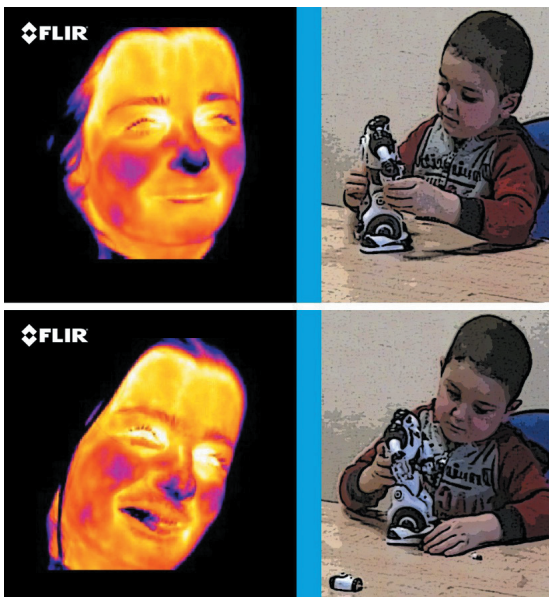
One solution to this problem is the use of thermal imaging technology. It is passive, so thermal imaging cameras record infrared radiation emitted by the subject without submitting them to radiation of any kind. Moreover, this technology allows the researcher to gather information in real time, allowing the test subjects to move naturally. "This technology turns out to be an excellent tool for studying the neurobiological foundations of social interactions, especially in ecological contexts, due to the contact-free nature of thermal imaging", said Dr Arcangelo Merla, Director of the Infrared Imaging Lab at the ITAB – Institute for Advanced Biomedical Technology, University of Chieti-Pescara (Italy).

Especially in one particular research the FLIR thermal imaging camera proved to be very useful, according to Merla. "We tried to establish a synchrony in autonomic responses between mother and child. The use of thermal imaging cameras allowed us to obtain reliable measures of autonomic responses recorded simultaneously for both children and their mothers without the disadvantages of most of the other methods for physiological data collection."



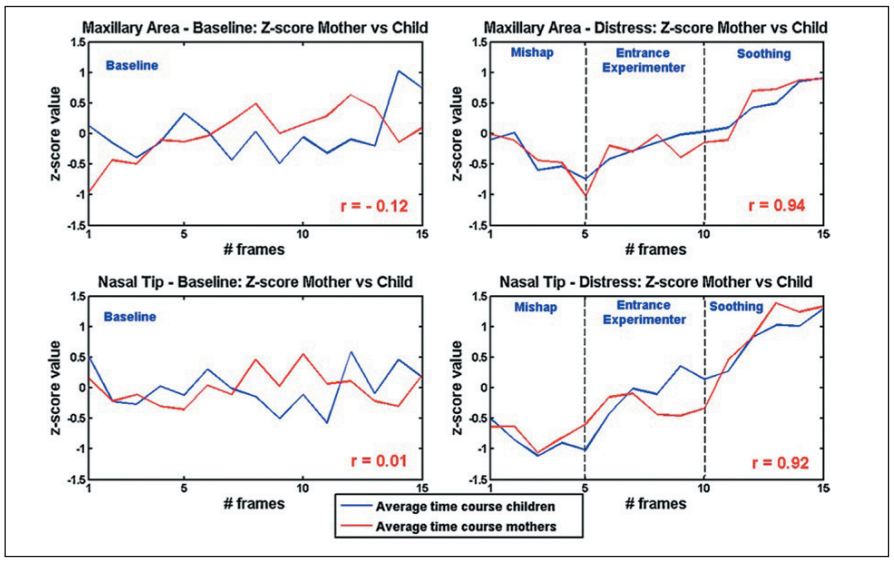
In this experiment the toy is prepared to brake during playing (mishap). The mother observes the scene from behind a one-way mirror. Both the child and the mother are observed using a thermal imaging camera.

Whereas the psychological side of social interactions has been studied quite extensively, the physiological side has been largely ignored. Despite the extensive interest in neuroscience on empathy and its relevance to infant development, previous studies investigated maternal empathy mainly by using verbal reports and, in a few cases, by functional neuroimaging. Few studies have reported on the possible involvement of physiological responses during parent-child interactions.

As Merla has had very positive experiences with the use of thermal imaging technology for several medical applications, such as diseases related to micro/macro circulatory, peripheral nervous, autoimmune, muscle-skeletal, and cutaneous systems, the suggestion to use of thermal imaging cameras as a measurement method for this research was an obvious one. "Thermal imaging records the thermal radiation that is emitted spontaneously by the human body. The body and mental responses are therefore purely ecologic."

Emotions and the Autonomic Nervous System

Autonomically-mediated visceral responses are proposed to be closely related to the experience of emotions. The vicarious response of empathy is generally referred to as a

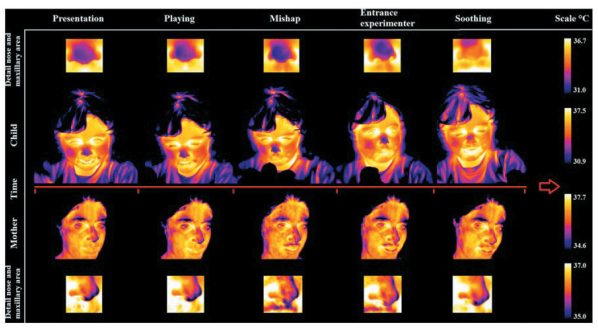


Graphical representation of temperature variations of the nasal tip and maxillary area averaged for a group of children and for a group of mothers. The graphs illustrate the absence of a correlation between thermal variations in the mother and the child during the neutral baseline phase (graphs on the left). By contrast, a strong correlation in thermal variations between children and their mothers is shown during the emotional phases of the experiment (graphs on the right).

common neural coding of the perception of one's own and the other individual's feelings. "It is therefore plausible that empathy also embodies a direct sharing of changes in body physiology between the involved individuals", explained Merla. "This would mean that variations in the thermal data reflect internal processes that are especially active when emotional stimuli are present."

Experiment setup

During the experiment, children were invited by the experimenter to play with a toy. The toy was designed to break during play, giving the impression that the child had accidentally broken it. Mothers were invited to observe their children in interaction with the experimenter through a one-way mirror from a separated room. Two highly sensitive cooled thermal imaging cameras of the FLIR SC 7000 Series were used to simultaneously monitor the child and the mother.



In these cut-outs of the thermal footage clear temperature variations in various facial regions of both the mother and the child can be observed after the toy was broken (mishap) and when the child was soothed afterwards by the experimenter.

In order to quantify thermal variations over time and their correlation between children and their mothers, changes in cutaneous temperature for specific facial regions of interest were calculated. These regions were selected according to previous studies in humans as well as primates: 1) the nasal tip and 2) the maxillary area. As the test subjects were moving around freely, however, tracking these facial regions proved to be slightly challenging. "Thermal imaging cameras from the FLIR SC7000 series allow very fast data acquisition", Dr Merla said. "We developed a tracking

algorithm at our laboratory and applied that to the thermal imaging video footage, allowing us to ensure the proper localisation of the defined facial ROI on each of the processed frames."

Results

"The present study provides two main results" Dr Merla said. "First, it showed that during the experiment the emotional distress caused by the 'breaking' of the toy lead to thermal variations in the specified facial ROI of the child. The facial thermal modulations observed in the mothers were surprisingly similar to those observed in the child. Second, facial thermal modulations of the mothers clearly correlated with corresponding modulations of their children. Thus, mother-child dyads showed a significant and situation-specific synchronicity between the autonomic reactions individually exhibited by each partner."

"Thanks to the flexibility of the FLIR SC7000 Series thermal imaging cameras physiological correlates of emotional reactions were investigated in an interactive and ecological experimental context without interfering with spontaneous behaviour", concluded Merla. "We thus proved that thermal imaging can be used to study the neurobiological foundations of social interactions, especially in ecological contexts by exploiting the contact-free nature of thermal imaging."

Reference: Ebisch SJ, Aureli T, Bafunno D, Cardone D, Romani GL, Merla A. Mother and child in synchrony: thermal facial imprints of autonomic contagion. Biological Psychology, vol. 89, p. 123-129. http://www.sciencedirect.com/science/article/pii/S0301051111002523

Pushing Boundries in Blood Micro-Analysis

Horiba Medical, specialists in automated in vitro diagnostic systems for haematology and chemistry analysis, has launched the Microsemi CRP haematology analyser. Developed by Horiba Medical in Japan, 'emi' means 'smile' in Japanese and stands for easy to use, maintenance free and intelligent. After a highly successful release in Japan, this unique instrument is now available in Europe. This compact, easy-to-use addition to the Micros range simultaneously provides a complete blood count (CBC) and C-reactive protein (CRP) from just 18µl of blood - all in just 4 minutes.

The Microsemi CRP provides information of great clinical value enabling quicker and more accurate medical decisions to ultimately reduce hospitalisation times and patient costs. Its powerful CRP analysis allows the screening of patient samples to detect the presence of inflammation caused by bacterial infections, or other treatable inflammatory disease. Measurement is possible immediately after blood sample collection, making this analyser the ideal choice for emergency testing situations. The Microsemi CRP can also be used to assess infection and inflammatory conditions that require progressive observation. Furthermore, its micro-sampling capabilities are ideal for paediatric blood analysis, requiring just 10µL for CBC and 18µL for CBC+CRP, and can be used with capillary, as well as venous blood samples.

Comprehensive and efficient on-board software, colour touch screen, alongside fast and easy access to results adds to the Microsemi CRP's success. Design features have created an environmentally-friendly model (using a non-cyanide reagent for haemoglobin measurement) that is incredibly compact, lightweight and quiet. The Microsemi CRP is easy to use and does not require specialised staff. All these traits make this analyser well-equipped to support changes occurring within the NHS focussed on easing the patient journey.

According to Cleve Wright, UK General Manager, Horiba Medical: "With over 2000 instruments successfully being used in Japan to date, UK clinicians can now benefit from the Microsemi CRP's accuracy, convenience and ability to support early and rapid diagnosis of patients."

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