

## Family's economic situation influences brain function in children

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Children of low socioeconomic status work harder to filter out irrelevant environmental information than those from a high-income background because of learned differences in what they pay attention to, according to new research published in the open access journal *Frontiers in Human Neuroscience*.

Numerous studies in the past few years have begun to reveal how poverty affects <u>brain development</u> and function. In 2008, Amedeo D'Angiulli of Carleton University in Ottawa, Canada and his colleagues used electroencephalography (<u>EEG</u>) to measure the brain wave patterns associated with an auditory <u>selective attention</u> task in children of high and <u>low socioeconomic status</u> (SES).

They found that the two groups of children exhibited differences in theta brain waves in the frontal lobe, which plays an important role in attention. This suggested that each group of children recruits different <u>neural mechanisms</u> for this particular type of task, and that the lower SES children allocate additional resources to attending to irrelevant information.

"Socioeconomic environment shapes the way our neurocognitive functions develop in childhood and influence the way we learn to process information when we are adults so that we can be well adapted in a certain specific type of <u>social environment</u>," says D'Angiulli.

For their latest study, D'Angiulli and his colleagues recruited 28 children



aged 12-14 from two schools in neighborhoods of disparate socioeconomic status. One of them was attended predominantly by children from a high income background, and the other largely by children from a low income background.

The researchers performed the study at the schools during an ordinary school day. Working in a mobile lab – a van equipped with all the apparatus needed – they took saliva samples from the participants throughout the day, to measure changes in the levels of the <u>stress</u> hormone cortisol, and asked them to complete three questionnaires about their emotional and motivational state, at different times.

In the afternoon, the participants' brain waves were recorded while they performed a task in which they heard different sounds being played simultaneously into both ears, and were required to press a button as fast as possible when they heard one particular sound.

There were no significant differences between the two groups in the accuracy or reaction time during the task. The researchers did, however, observe differences in <u>brain wave patterns</u> between the two groups. Higher SES children exhibited far larger theta waves in response to sounds they attended to than to than those they should have ignored. In the lower SES children, however, this pattern was reversed – the theta waves evoked by the unattended sounds were much larger than those for the attended sounds.

There were also significant differences between the two groups in the contributions of the left and right hemispheres – lower SES children exhibited stronger theta waves in the right <u>frontal lobe</u> in response to attended sounds.

Overall, the lower SES children had higher cortisol levels than the higher SES children during the school day, but the differences before and after



the attention task were small, suggesting that the stress response of both groups to the task was similar. And the questionnaires revealed that both groups experienced similar levels of boredom and motivation throughout the day and a similar increase of boredom before the attention task.

The findings suggest that lower SES children have to exert more cognitive control to avoid attending to irrelevant stimuli than higher SES <u>children</u>, and that doing so therefore requires more mental effort. This may be because they live in more threatening environments, in which it might be advantageous to pay attention to a broad range of environmental stimuli which are not unambiguous distractions, and may turn out to be important for survival.

"We are now studying how other domains that may be related to attention, such as decision-making, may differ in individuals with different socioeconomic background," says D'Angiulli.

**More information:** D'Angiulli, A., et al. (2012). Frontal EEG/ERP correlates of attentional processes, cortisol and motivational states in adolescents from lower and higher socioeconomic status. *Frontiers in Human Neuroscience*, DOI: 10.3389/fnhum.2012.00306

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