

development of psychometric and observational measures trying to capture individual interoceptive skills, focusing especially on the ability to orient attention to internal sensations. Nonetheless, despite growing interest in interoceptive attention (IAtt), little is known about neurofunctional correlates of our ability to redirect attention to internal sensations and consciously process them, as well as on potential objective biomarkers of IAtt performance.

Participants and Methods: This study included 36 volunteers who were asked to complete a heart-beat counting task (HCT), a common IAtt task. During both resting-state and HCT, central electrophysiological (EEG, 32 electrodes) and cardiovascular activity (ECG, I lead) were recorded. eLORETA was used to estimate both task-related and resting-state intracortical sources of EEG signals. Statistical non-parametric mapping (SnPM) was used to draw and investigate contrast statistical maps between rest- and task-related cortical current density.

Results: Contrast analyses comparing HCT and resting revealed higher Alpha frequency current density estimates during the task, with primary cortical seed in the right parahippocampal gyrus. Regression analyses of the relationship between IAtt scores and task-related changes in intracortical current density during HCT revealed a positive relationship for the Beta frequency bands with primary cortical seeds in the cingulate gyrus and insula.

Conclusions: Findings add to available literature by further specifying the electrophysiological signature of interoceptive attentiveness, and suggest specific electrophysiological markers as objective measures of individual IAtt skills.

Categories: Cognitive Neuroscience

Keyword 1: electroencephalography

Keyword 2: awareness

Keyword 3: sensory integration

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10 Pupil Dilation During the Stroop Task Offers a Sensitive and Scalable Biomarker of Locus Coeruleus Integrity

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Objective: Neuronal dysfunction of the locus coeruleus (LC), the primary producer of norepinephrine, has been identified as a biomarker of early Alzheimer's disease (AD) pathophysiology. Norepinephrine has been implicated in attentional control, and its reduced cortical circulation in AD may be associated with selective attentional difficulties. Additionally, greater pupil dilation indicates greater effort needed to perform a cognitive task, and greater compensatory effort to perform the digit span task has been found in individuals at risk for AD. In this study, we examined associations between a neuroimaging biomarker of the LC and pupil dilation during the Stroop task as a sensitive measure of attentional control.

Participants and Methods: 64 older adults without dementia were recruited from the San Diego community (mean [SD] age = 74.3 [6.3]; 39 cognitively unimpaired and 25 with mild cognitive impairment). All participants underwent magnetic resonance imaging of the LC and generated behavioral data from a computerized Stroop task that included 36 incongruent trials (e.g., GREEN presented in red ink), 36 congruent trials (e.g., GREEN presented in green ink), and 32 neutral trials (e.g., LEGAL presented in green ink) in a randomized presentation. Mean pupil dilation for each trial (change relative to baseline at the start of each trial) was measured at 30 Hz using the Tobii X2-30 system (Tobii, Stockholm, Sweden) and averaged within each Stroop condition. Paired t-tests assessed for differences in mean pupil dilation across incongruent and congruent Stroop conditions. Iterative re-weighted least squares regression was used to assess the association between a rostral LC contrast ratio measure derived from manually marked ROIs and mean pupil dilation during incongruent trials

divided by congruent trials, adjusting for age, sex, and education. Follow-up analyses also assessed the association of these variables with mean reaction time (RT) for incongruent trials divided by congruent trials.

Results: Mean pupil dilation significantly differed across conditions ($t = 3.74$, mean difference = .13, 95% CI [.06, .20]) such that dilation was higher during the incongruent condition (mean [SD] dilation = .18 [.38] mm) relative to the congruent condition (mean [SD] dilation = .05 [.35] mm). A significant association was observed between pupil dilation and LC contrast ratio, such that increased levels of mean dilation during incongruent trials relative to congruent trials were observed at lower levels of LC contrast ratio (i.e., lower LC integrity; $r = -.37$, 95% CI [-.55, -.13]). This association was not observed for mean dilation during only congruent trials ($r = -.08$, 95% CI [-.31, .18]). Additionally, neither LC contrast ratio [$r = .24$, 95% CI [-.02, .46]] nor mean incongruent/congruent pupil dilation ($r = .14$, 95% CI [-.13, .37]) were associated with incongruent/congruent RT.

Conclusions: Findings suggest that increased pupil dilation during a demanding attentional task is indicative of increased compensatory effort needed to achieve the same level of performance for individuals with reduced LC biomarker integrity. Pupillometry assessment offers a low-cost, non-invasive, and scalable biomarker of LC dysfunction that may be indicative of preclinical AD.

Categories: Cognitive Neuroscience

Keyword 1: neurophysiology

Keyword 2: neuroimaging: structural

Keyword 3: attention

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11 Language Development of Primary-School-Aged Children with Autism Spectrum Disorder.

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Objective: Delayed speech and language development is one of the main diagnostic criteria for autism spectrum disorders (ASD) and is found almost in all children with ASD.

Language development in children with ASD may differ from the norm both quantitatively (delayed speech development, reduced vocabulary, scarcity of speech and limitation in its use) and qualitatively (echolalias, violation of speech grammatical structure, difficulties in the communicative use of speech). Studying different aspects of language development in ASD is very important as it provides opportunities for finer diagnostics, as well as for targeted correction of communication disorders.

Participants and Methods: The study included 34 primary-school-aged children, who were diagnosed ASD using ADOS-2, diagnostic groups included "autism" (24 children) and "autism spectrum" (8 children). Speech development was assessed using the "Korablik" test on 9 parameters: distinguishing sounds; understanding and generating nouns, verbs and syntax; text understanding; sentences repetition. Kaufman test battery (KABC-II) and the Wechsler test (WISC-III) were used to assess non-verbal intelligence.

The sample was divided into two subgroups according to an educational program recommended by PMPC (Psychological, Medical and Pedagogical Commission). Group 1 included 15 children, attending program 8.1, which is recommended for children with ASD who reach developmental milestones before starting study. Group 2 included 19 children attending program 8.2, which is recommended for children with ASD who do not reach developmental milestones before starting study.

Results: In general, all children were the best successful in understanding and generating nouns, understanding verbs, and the least successful in understanding text and searching for sound in the word. Comparing subgroups using Mann-Whitney test revealed significant differences in all measured speech parameters, except for word repetition and noun generation. Group 2 demonstrated uneven results for separate subtests - minimum scores in some subtests coexisted with maximum in others. The group also showed uneven scores distribution inside the subtests, for example, half of the