Poster 1-080

DOES REWARD PREDICTION ERROR (RPE) MODULATE PHASE CONNECTIVITY DURING A DECLARATIVE LEARNING TASK?

Kate Ergo; Esther De Loof; Tom Verguts
Ghent University

Descriptors: reward prediction error, declarative learning, EEG connectivity

For proper cognitive functioning, the (human) brain must continuously make predictions. One of the features we make predictions about, is reward. Whenever a mismatch occurs between predicted and obtained reward, we experience a reward prediction error (RPE). Recent studies from our lab, using a Swahili-Dutch declarative memory (word-pair learning) paradigm (De Loof et al., 2018; Ergo et al., 2019), showed that signed RPEs (SRPEs) enhance recognition. Time-frequency analysis revealed that SRPEs were accompanied by alpha frequency suppression and theta and beta frequency increase, both immediately and after a one-day delay. SRPEs thus seem important for the formation of declarative memories, on both behavioral and neural levels. In the current EEG study, we investigated if SRPE modulates phase reset, and in which frequency band. During reward feedback encoding, we found that inter-trial phase clustering (ITPC) correlated with SRPE in the delta and alpha frequency band (cluster-corrected). This pattern suggests a modulation of phase reset by SRPE, and might imply that SRPE enables coordinated transfer of information between brain regions. Furthermore, the data showed increased inter-site phase clustering (ISPC) between frontal (FCz) and motor cortex (C5/C6) during reward feedback encoding. Together, these findings suggest that RPEs enable the brain to learn more efficiently by synchronizing relevant cortical areas.

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Poster 1-081

ACTIVATION OF V4 AND VO1 AREAS DURING RETRIEVING OF COLOR AND SHAPE INFORMATION FROM VISUAL WORKING MEMORY

Anton Rogachev[1]; Stanislav Kozlovskiy[1]; Alexander Vartanov[1]; Julia Marakshina[2]; Andrey Kiselnikov[1]
[1]Lomonosov Moscow State University, [2]Psychological Institute of Russian Academy of Education

Descriptors: V4, VO1, visual working memory

The role of human visual cortex in retrieving of color and shape information from visual working memory was studied. Participants (N = 22, mean age = 19.6, SD = 1.8, 13 females) were being presented with a picture of the color blot (8 different shapes and 9 colors) for 400 ms time period. After a delay of 900 ms the matrix of 4 different color blots was presented for 900 ms. The instruction was to recognize the stimulus. The experiment consisted of 3 series. Participants were asked to remember either color or shape, or both. Stimuli were presented 100 times in each series. A 19-channels EEG was recorded and visual evoked potentials were calculated for each stimulus in all trials. To reveal sources of activation in 25 visual cortex areas (Wang et. al, 2015) in each hemisphere the dSPM algorithm (Dale, 2000) and Brainstorm software (Tadel, 2011) were used. Activation of left and right hV4 areas of visual cortex was revealed in all tests requiring color information retrieval after 200 ms from the start of the blot matrix presentation. This type of activation was not found in any other series. Activation of VO1 area (anterior to V4) in both hemispheres was also presented during shape recognition after 200 ms from the stimulus onset. This type of activation was absent at the same latency in other series. We suggest that color and shape characteristics of visual image are processed independently in working memory in areas hV4 and VO1, respectively.

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Poster 1-082

HIGH RUMINATORS USE DIFFERENT NEURAL PROCESSES DURING A RECOGNITION MEMORY TASK

Nicole Forner; Robert Ross
The University of New Hampshire

Descriptors: Episodic memory, Brain oscillations, Cognitive flexibility

Rumination occurs when an individual becomes "stuck" and cannot navigate away from an unwanted thought. A high tendency to ruminate is linked to altered functioning of oscillations in the alpha (8-12Hz) and beta (13-30Hz) bands. Alpha and beta power dynamics are crucial for various cognitive functions, including episodic memory. Our study uses EEG recorded during a source memory task to assess how oscillatory dynamics in alpha and beta may change as a function of tendency to ruminate along with memory for contextual details (n = 43). The task instructs participants to remember an object and the side of the screen the object is presented on during study. They are then tested for their memory of the object and the context. Analysis of accuracy reveals that memory for contextual details is lessened for participants with a high tendency to ruminate paired with higher anxiety. During retrieval high ruminators exhibit less power decrease in the beta band 250-1500ms post cue over right posterior parietal areas when successfully remembering just the object or both the object and context in comparison to low ruminators. Alpha power shows less power decrease 1000-1250ms post cue over parietal areas when a high ruminator recalls the object and context, but there is a greater power decrease when they remember the object, but not the context. Similar dynamics are observed during encoding. These oscillatory differences suggest that high ruminators may encode a less detail rich memory trace and they may recruit more neural resources to focus retrieval when an attempt appears to be failing.

Poster 1-083

ALPHA ACTIVITY IS NOT REQUIRED FOR MAINTANENCE OF INFORMATION IN WORKING MEMORY

Yuri Pavlov[1,2]
[1]Ural Federal University, [2]University of Tübingen

Descriptors: working memory, EEG, alpha activity

Sustained neural firing during delay periods is widely considered as the neurophysiological basis of short-term maintenance of information in working memory (WM). However, mounting evidence suggest that information can be retained in WM in the absence of detectable neural activity related to the maintained information. I hypothesized that the time is a crucial factor to activate either sustained neural firing or activity-silent mechanisms to support maintenance of WM content. In a verbal WM paradigm the participants (N = 198) had to memorize sets of letters. Despite continuous and growing interest to the topic of neural correlates of WM, the number of verbal WM studies using delay periods longer than 4 s is limited. I used a longer delay period of 6 s. EEG alpha power in posterior sites in the first 3 s, second 3 s of the delay period and encoding interval was compared. Similarly to the previous studies, I found a decrease of alpha during encoding and an increase during first 3 seconds of the delay period. However, after the first 3 s the level of activity returned to the baseline level. The effect was extremely strong ($F(2, 266) = 263.46$, etasq = .63, $p = 2.2 \times 10e\text{-}58$). It did not depend on the WM load, type of the task (simple maintenance task or maintenance with manipulations) or individual differences in performance. I can conclude that alpha activity is important for encoding and consolidation but not for continuous maintenance of information in WM. The results support the hypothesis of the time related differentiation between the two proposed mechanisms of WM.

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