

CT 1.2.1

Brain network topology during successful memory encoding in a real-life experiment

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Introduction

The present study investigates the brain behavior by estimating the functional connectivity changes during the visualization of television (TV) commercials within a neutral documentary. In the light of these preliminary remarks, the aim was to elucidate if TV commercials that will be remembered by the subjects several days after their showing generate different cortical networks when compared to those related to the TV spots that will be forgotten. To achieve this, EEG recordings were first performed in a healthy group of five subjects and the respective cortical activity was achieved by using advanced high-resolution EEG methods including realistic MRI-constructed head models (Babiloni *et al.*, 1997, 2005). Then, we estimated the functional connectivity patterns among the Regions of Interest (ROIs) for this real-life experiment by means of the Partial Directed Coherence (Baccala' and Sameshima, 2001). Finally, we evaluated the topological-weighted properties of the cortical networks by calculating their global- and local-efficiency indexes (Latora and Marchiori, 2001), which return an appropriate measure for the inverse of the average shortest path $1/L$ within the network and for the clustering index C , respectively. Figure 1 summarizes the present experimental design.

Results

In the light of the comparison performed with random graphs, the cortical networks exhibited high average values of scaled global- and local-efficiency during the visualization of the video-clips that will be not remembered (FRG condition), reflecting a small-world configuration ($E_g/E_{g-r} \sim 0.813$ and $E_l/E_{l-r} \sim 1.808$), characterized by an optimal architecture for the information processing. During the visualization of the video-clips that will be remembered (RMB condition), the same indexes appeared significantly lower ($E_g/E_{g-r} \sim 0.699$ and $E_l/E_{l-r} \sim 1.29$) and the cortical networks rather present a weak pattern of communication characterized by a non-homogeneous distribution of the functional links and few clustering connections between the considered brain areas. This difference was especially evident for E_l in the Alpha (7-12 Hz) frequency band and for E_g in the Gamma (30-40 Hz) band.

Discussion

The structure of the cortical network presented significant differences during the visualization of the TV spots that will be remembered with respect to those that will

be forgotten. In particular, the presence of attentional and semantic processes during the successful encoding of TV spots led to a significant reduction of the network communication efficiency. In a real-life context, such a reduction could represent a predictive measure of accurate recalls of TV spots.

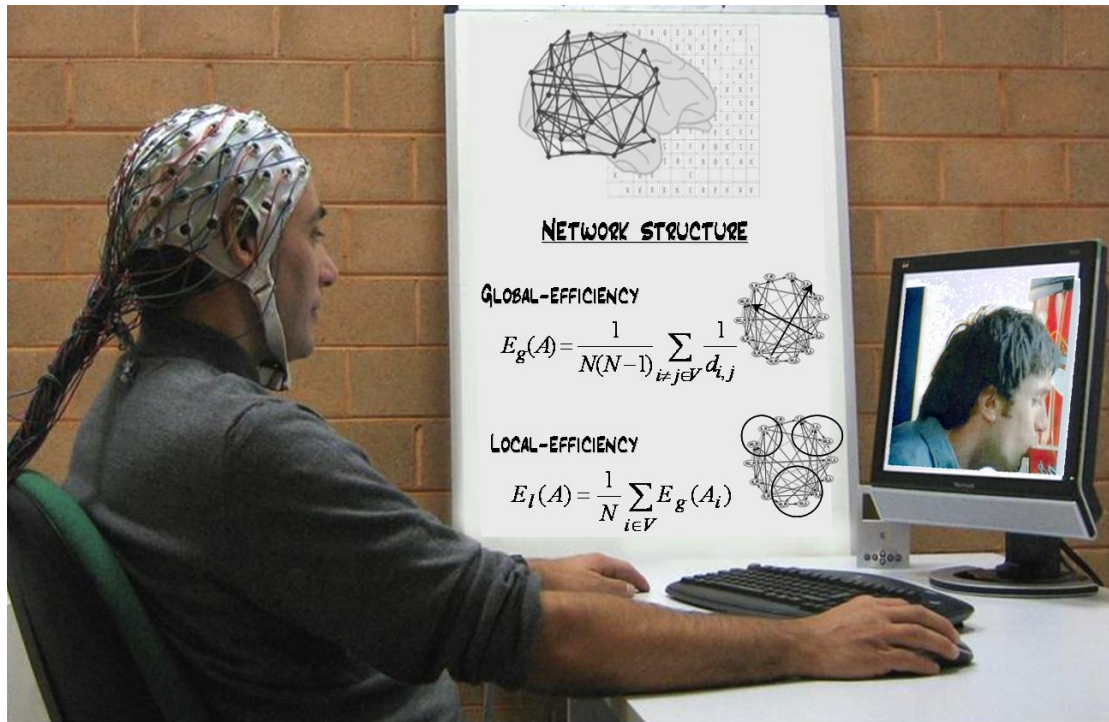


Fig.1. Representation of the experimental design. EEG signals were recorded during a real-life experiment based on the watching of different TV commercials within a neutral documentary.

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