How Much Time Does Our Brain Need to Relax?

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The human brain is one of the vital and mysterious organs of the body. It is in charge of all conscious and unconscious body movements, growth, memory, recall, etc. Challenges in brain studies, such as its well-protected structure and electro-chemical operation, restrict researches. As more studies are done, more unknowns of our brain are revealed. This leads to advancements in robust learning skills, focusing, productivity, and cures for brain diseases. In short, it provides increases the quality of life. The data used in brain studies are mostly collected through four well-known data acquisition methods: Electroencephalography (EEG), Positron-Emission Tomography (PET), Functional Magnetic Resonance imaging (fMRI), and functional Magnetic Resonance Spectroscopy (fMRS). In EEG, electrical activity is recorded from the surface of the brain. These data acquisition methods can be employed in order to acquire information from subjects, who perform some given tasks. For instance, subjects may be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories or be asked to look at pictures in different categories.

The success of the relaxation period affects the EEG signals acquired from the following tasks. One major purpose of the given relaxation time is to eliminate the influence of one task from another. In the mental task analysis studies, it is desired that the brain reaches the typical relaxation level prior to given tasks. Thus, mental tasks can be examined without the influence of the previous tasks or fatigue. So, how much time does our brain need to relax? Is offering a fixed relaxation time between mental tasks a right practice?

Teager energy given in (1) may give hints about the brain’s relaxed state. $x(n)$ represents the EEG signal and $N$ represents the frame size. We calculated the Teager energies of five mental tasks that were depicted in the Figure below. The EEG data of 23 years old male subject was used. The data was collected by Badara et al. in 2017 by using 10-20 electrode placement system [3]. The subject had three sessions on the same sitting. Sessions were separated by a 30-second relaxation time. Each session has five different scenarios consisted of: “task 1: relaxation (30 s)”, “task 2: memorization of a list of ten words (15 s)”, “task 3: memorization of a list of ten numbers (15 s)”, “task 4: watching a set of images (60 s)”, and “task 5: recalling the words and numbers memorized earlier (60 s).” The calculated Teager energies (shown in red dots in the Figure) of the EEG frames in the relaxation state shows that the brain does not reach its typical relaxation state after performing mental tasks. Teager energies of the relaxation period of the session 3 are higher than that of the session 2. Similarly, the relaxation period in session 2 has higher Teager energies than that of session 1. The brain needs longer relaxation periods between different mental tasks to reach its typical relax state.

$$\text{TEO} = \frac{1}{N} \sum_{n=1}^{N} [x^2(n) - x(n+1)x(n-1)]$$  (1)
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Conflict of Interest
No conflict of interest.

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