



Analytic information processing style in epilepsy patients



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ABSTRACT

Relevant to the study of epileptogenesis is learning processing, given the pivotal role that neuroplasticity assumes in both mechanisms.

Recently, evoked potential analyses showed a link between analytic cognitive style and altered neural excitability in both migraine and healthy subjects, regardless of cognitive impairment or psychological disorders.

In this study we evaluated analytic/global and visual/auditory perceptual dimensions of cognitive style in patients with epilepsy.

Twenty-five cryptogenic temporal lobe epilepsy (TLE) patients matched with 25 idiopathic generalized epilepsy (IGE) sufferers and 25 healthy volunteers were recruited and participated in three cognitive style tests: "Sternberg-Wagner Self-Assessment Inventory", the C. Cornoldi test series called AMOS, and the Mariani Learning style Questionnaire.

Our results demonstrate a significant association between analytic cognitive style and both IGE and TLE and respectively a predominant auditory and visual analytic style (ANOVA: p values < 0.0001).

These findings should encourage further research to investigate information processing style and its neurophysiological correlates in epilepsy.

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1. Introduction

The concept of cognitive style was defined by cognitive psychologists during the 1950s [1] as a term that underlines the preferred individual manner habitually chosen to activate the brain functions in cognitive processing. Two main cognitive style's dimensions (or levels) are recognized according to Robert Sternberg among various styles: the global and the analytic ones [2].

Analytic cognitive style is a specific manner of information processing characterized by high activation of attention, continuous evaluation of stimuli and by the habit of dealing with details and fine points [2]. It can be present since childhood but it can be modified during the person's life [2,3].

As Sternberg emphasized [2], analytic style is not an ability, or a personality trait. It has been found to be independent from intelligence, neuroticism and from psychopathology. It has been defined simply a favorite manner of perceiving and learning, focusing a great deal of

attention on each single element of an object or a situation with consequently greater evaluation of stimuli and a continuous arousal state [3]. On the contrary, global individuals overlook details perceiving stimuli by taking a holistic view of situations [2,3].

A clear link between cognitive style and brain activity was previously demonstrated by neurophysiological investigations and greater generalized cortical activation (increased EEG generalized gamma activity) in analytical individuals compared to global ones, has been shown [4]. Whereas, as it has been reported, global individuals are generally less aroused showing more alpha synchronization than analytic ones [4].

Recently, our work has highlighted a relationship between lack of neural habituation of evoked visual potentials and analytic style, suggesting that the lack of habituation may be the electrophysiological correlate of the impairment of a biological mechanism aimed at protecting the brain against sensory overload during information processing, leading to a disruption of brain energy balance [5]. On this basis we have investigated the possible relationship between cognitive style and neurological disorders. We found a strong correlation between analytic style of learning and both migraine and cluster headache suggesting a potential role of this cognitive behavior in their pathogenesis [6,7].

In this paper we report the results of a study focused on cognitive information processing style in epilepsy. As of today this issue has not

Abbreviations: TLE, Temporal lobe epilepsy; IGE, Idiopathic generalized epilepsy; VCS, Visual cognitive style; ACS, Analytic cognitive style; TSI, Thinking style inventory; EEs, Epileptic Encephalopathies; MTL, Mesial Temporal Lobe Epilepsy.

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received particular attention from epileptologists. Geschwind in the 1970s [8], put forward the idea that the personality of subjects suffering from temporal lobe epilepsy (TLE) is characterized by some typical traits among which he included an exaggerated attention to details which is the main feature of an analytic cognitive style [2,3]. Geschwind's concept of TLE personality was not accepted by the epileptologic community because of the psychopathological significance attributed by the author to this characterization, which does not correspond to the clinical experience. It is worth noting that the analytic cognitive style evaluated by the present study, does not necessarily imply psychological disorders and is distinguishable from personality [2,5] constituting simply a choice and being malleable [5]. Cognitive alterations may be observed in some epilepsies either as symptoms of the neurological disorders responsible for epileptic seizures or as consequences of seizure induced plastic changes in neural circuitry or as an unwanted effect of antiepileptic drugs [9–11].

In this study we aimed at investigating from a cognitive behavior perspective, cognitive aspects in epilepsy, evaluating analytic/global and visual/auditory dimensions of information processing style in temporal lobe epilepsy (TLE) and idiopathic generalized epilepsy (IGE) patients.

2. Patients and methods

At our Epilepsy unit of the Sapienza University of Rome, we consecutively enrolled 25 TLE patients with no MR evidence of brain lesion (Table 1) during a 1-year period, from May 2013 to May 2014 and matched them with 25 IGE patients (Table 1) and 25 healthy volunteers recruited among the staff of our department. Enrolled epileptic patients (cryptogenic), were diagnosed and followed at our epilepsy unit. Exclusion criteria were the presence of concomitant major psychiatric disorders and any neurological progressive disease. Written informed consent was obtained from all the recruited subjects. The study was approved by the local ethical committee.

Table 1

CAE: Childhood absence epilepsy JAE: Juvenile Absence Epilepsy JME: Juvenile Myoclonic Epilepsy. EMA: Eyelid myoclonia with absences SGM: Sporadic Grand-Mal GTC: Generalized tonic-clonic seizure AEDs: Antiepileptic Drugs.

General characteristics of the patients population		
<i>Idiopathic Generalized Epilepsy (IGE) (N 25)</i>		
Sex	Male/Female	7/18
Age	Mean (range)	37.7 (16–71)
Age at seizure onset	Mean (range)	12.1 (4–22)
Epilepsy syndrome	CAE	3 (12%)
	JAE	7 (28%)
	JME	7 (28%)
	EMA	2 (8%)
	GMoA	6 (24%)
Seizure type	Myoclonic	10 (40%)
	Absences	15 (60%)
	GTC	19 (76%)
	Number of AEDs	Mean (range)
Response to therapy	Complete	22 (88%)
	Partial	3 (12%)
<i>Temporal Lobe Epilepsy (TLE) (N 25)</i>		
Sex	Male/Female	12/13
Age	Mean (range)	38.4 (21–73)
Age at seizure onset	Mean (range)	22.7 (4–47)
Seizure type	Acoustic	18 (72%)
	Confusional	1 (4%)
	Dysphasic	3 (12%)
	Experiential	2 (8%)
	Vertiginous	1 (4%)
	Number of AEDs	Mean (range)
Response to therapy	Complete	12 (48%)
	Partial	13 (52%)

All patients underwent EEG recording in basal conditions during hyperventilation (3 Min), and intermittent light stimulation. The most effective frequencies were comprised from 12 to 16 Hz.

2.1. Psychological evaluation:

The instruments used to gather psychological cognitive behavioral data for the study consisted of:

- A clinical psychological diagnostic interview subdivided into three sessions with each subject.
- Participation in three tests, the Sternberg-Wagner Self-Assessment Inventory [2] the Test Series called AMOS [3] and the Learning Style Questionnaire [12]

Two sessions were held with each participant. In the first session, the subject was tested, and in the second session, an interview was held to determine whether the test results coincided with the subject's self-evaluation.

The Sternberg-Wagner Self-Assessment Inventory [2], also known as Thinking Style Inventory (TSI), is a reliable measurement system for assessing the thinking style proposed in Sternberg's theory and also shows good external validity.

In this diagnostic instrument, Sternberg [2] specifies that “a style is a favourite way of thinking” and is not an ability, but a preference with which the mind controls its own activity, a differentiation in the human way of perceiving, thinking, learning and remembering. Sternberg distinguishes the individuals who use a global style from those who use an analytic thinking style.

Those who use a global style prefer to deal with issues that are relatively wide and abstract and they usually ignore or dislike details, perceiving stimuli by taking a holistic view of situations, using mostly intuition. Analytical people, on the contrary, appreciate problems which require work with details, and perceive by focusing a great deal of attention on each single element of an object or a situation with, consequently, greater activation of memory and evaluation of stimuli. According to Sternberg we defined the subjects scoring in the high categories of analytic cognitive style (range 4, 5–7) as “analytic” [2].

Sternberg [2,6] also examined the correlation of the TSI with other tests, e.g., with the Myers Briggs type indicator and the Gregor style delineator. Score values are assigned to categories (from very low to very high), according to the ranges, different for males and females.

The AMOS test, designed by C. Cornoldi, has been used in this study because it includes the Cognitive Style Questionnaire (QSC) which focuses on the distinction between global and analytic style, and because there are common elements with the Sternberg's theory [3,6,7]. Both authors underlined that individuals usually score in intermediate value ranges between global and analytic styles, rarely in extreme ones, according to a unimodal and non-bimodal distribution [2,3].

QSC encompasses the use of a figure inspired by the Rey Complex Figure Test, including nine items, to indicate the preference toward a global (five items) or an analytic (four items) approach and also nine items to indicate the preference toward a visual or auditory (verbal) approach [2,3,7].

The Mariani Learning Style Questionnaire is usually utilized in a learning context, giving us an indication of the tendency to be left/analytic or right/global hemisphere dominant and also focused on the visual and auditory perceptual dimensions of cognitive style [12].

2.2. Statistical analysis

Sternberg, Amos and Mariani test data were analyzed by simple factorial analysis of variance (ANOVA) with group (Controls, IGE, TLE) as between-subjects factor using the StatView 5.0 PowerPC (SAS Institute Inc., Cary, NC, USA) and Prism 5.0a (GraphPad Software Inc., La Jolla, CA, USA) software packages. Fisher's PLSD Post hoc analysis was

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