

AN ERP STUDY ON THE FUNCTIONAL PROPERTIES OF THE VISUAL WORD FORM AREA

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In the last years several neuroimaging studies have focused their attention on a small zone in the left fusiform gyrus that is systematically active during processing of printed words. This region plays an active role in the elaboration of position and shape invariant representation of sequentially ordered graphemes (Cohen et al. 2004; Polk et al. 2002). Up to day, this small left posterior cerebral area is known as “Visual Word Form Area” and considered as the primary “gateway” to the reading system (Posner & Carr 1992). ERP and MEG studies also provide indications of a selective response of the left inferior occipitotemporal area to orthographic stimuli and identify the N1 component of latency, between 150-200 ms, as the electromagnetic manifestation of this activity (Bentin et al., 1999; Helenius et al., 1999; Proverbio et al., 2002; Salmelin et al., 2000). However, it is not clear yet if this region responds preferentially to words than pseudo-words and than letter-strings on the basis of their orthographic regularity.

The main goal of this study was to determine whether expertise, for equivalent cerebral maturation, could indeed produce different activation of this brain region during orthographic analysis of words. Reading mechanisms in right-handed adults of similar educational and cultural level were investigated. The aim was to compare the processing of modern Greek words and legal pseudo-words in mother-tongue Greeks (skilled readers) and monolingual Italian individuals (naïve readers) who had no familiarity with the Greek alphabet (see Tab 1).

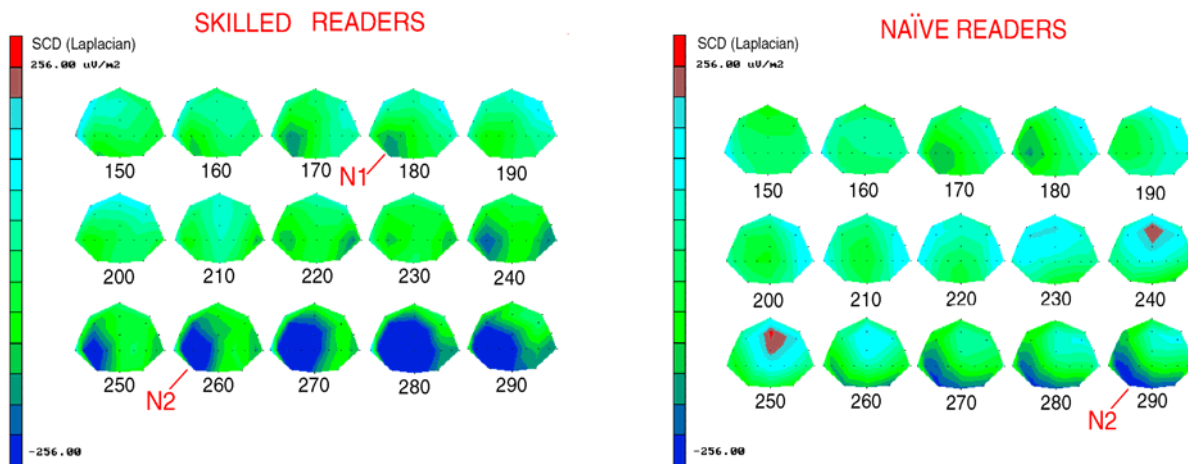
Length	WORDS		PSEUDO-WORDS	
	Target	Non-target	Target	Non-target
5	νομφί <i>fiancé</i>	βηχας <i>cough</i>	ζήφορο	δόμες
6	γάφουρα <i>bridge</i>	ζάχαρη <i>sugar</i>	χάφιας	Ξακκός
7	εκτροφή <i>breeding</i>	ισόγειο <i>ground floor</i>	καπήφρα	ρανήσσα

Table 1: Example of stimuli (length 5-7) belonging to the run in which the target symbol was φ (phi). For each run there were 15 words and 15 pseudo-words (5-10 letters).

ERPs were recorded while volunteers were engaged in a task involving the identification and response to target letters contained within neo-Greek words or pseudo-words. The unfamiliarity of

the Greek alphabet was reflected in the naïve readers by a lack of target letter recognition effect in the N165 component, in a delay of more than 100 ms in the onset of this effect (with respect to the onset in skilled readers) and in the absence of a left-sided lateralization of the subsequent N285 component (see Fig. 1).

Fig.1: Time series of scalp current density (SCD) maps obtained by subtracting ERP to non-target stimuli from ERP to target stimuli (difference waves), in the latency range between 140 and 260 ms.



The target/non-target difference was larger for words than for pseudo-words in skilled readers whereas stimulus type did not affect P300 in naïve readers. The cost to skilled readers for processing pseudo-words compared to real words was proven by the significant delay in RTs, by P300 data and by the presence of the N400 in response to pseudo-words only when they were targets. The amplitude of N400, in this case, probably indexing a difficulty in accessing lexical properties of words, is also a function of stimulus frequency, which is, of course, null for pseudo-words. However, the response speed was identical in the 2 groups. The data seem to suggest that the VWFA is alphabet-specific and that it is based on the shaping of visual area activity during acquisition of the ability to read a given symbolic code.

References:

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