# AUTOMATIC MEASUREMENT OF READING RELATED POTENTIALS IN DYSLEXIA

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**Abstract**

The problem of the automatic measurement of amplitudes and latencies in *reading related potentials* (*RRPs*) is here addressed. Our approach based on the Dynamic Time Warping technique, shows promising results for the development of an automatic measuring procedure.

## 1 Introduction

Developmental dyslexia is a neurological disorder characterized by reading difficulties despite average intelligence, adequate education and normal sensory acuity. This disorder can greatly affect the quality of life of patients. A powerful tool to investigate the reading process is the recording of *RRPs*, i.e. those brain dynamics that arise in response to a particular stimulus (in this case the presentation of alphabetical letters). The comparison of the values of amplitude and latency of some meaningful peaks in the *RRPs* in normal and dyslexic children has proven to be a valuable tool in the understanding of dyslexia [1, 2]. However, comparing *RRPs* from different subjects is difficult due to the high inter-individual variability of the morphology of the evoked response. Moreover this procedure is very time consuming and subjective to physician's judgment.

With this work we aim at developing a new technique to allow automatic measurements of important features, namely amplitude and latency, in reading related potentials [3].

## 2 Method

Our approach is based on the Dynamic Time Warping technique [4]: this method allows a nonlinear warping of two different sequences. The time axis of one time series (in this case a *RRP*) is locally shrunk or stretched in order to optimally match the time axis of another time series (a template) by minimizing a cost function. The maximum amount of shrink or stretch allowed by the algorithm is defined by the warping window. In order to deal with the high inter- and intra-subject variability, the amount of warp is linearly increased with increasing time, thus matching the latency variations within different subjects.

A set of measures collected from a normal population is used to compute a reference template to compare with the individual *RRP*.

This method was tested on a group of 32 normal subjects who underwent a letter presentation task (presentation of small or capital alphabetical letters), aged between 8 and 10 years.

## 3 Results and conclusions

Table 1 shows the percentages of correct measurements obtained for each peak. We show that using this method we achieved 83,92% of total correct measurements when compared with physician's scoring and very high sensitivity (85,93%), specificity (77,79%) and selectivity (84,59%).

| $N_1$ | $P_1$ | $N_2$ | $P_{2A}$ | $P_{2B}$ | $N_3$ | $P_4$ | $N_4$ | $P_{600}$ |
|---|---|---|---|---|---|---|---|---|
| 85,3 | 86,6 | 82,5 | 86,6 | 93,7 | 89,4 | 85,9 | 77,8 | 58,4 |

**Table 1 Percentages of correct measurements in some meaningful peaks: the worst performances are obtained in those waves with the highest latency variability.**

**References**

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