NEURODEVELOPMENTAL CORRELATES *OF IMPLICIT-EXPLICIT LEARNING MECHANISMS IN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT*

Evidence from event-related brain potentials

Autores: Ana Paula Soares[1], Francisco-Javier Gutiérrez-Domínguez[1], Margarida Vasconcelos[2], Helena M. Oliveira[1], David Tomé[3], Marisa Lousada[4] and Luis Jiménez[5]

[1]*Human Cognition Lab, CIPsi, School of Psychology, University of Minho, Braga, Portugal,* [2]*Psychological Neuroscience Lab, CIPsi, School of Psychology, University of Minho, Braga, Portugal,* [3]*ATC of Audiology, School of Health (ESS), Neurocognition lab group (CiR), Polytechnic Institute of Porto, Porto, Portugal,* [4]*CINTESIS, School of Health Sciences (ESSUA), University of Aveiro, Aveiro, Portugal,* [5]*Department of Psychology, University of Santiago de Compostela, Santiago de Compostela, Spain*

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Abstract

This project has the grant POCI-01-0145-FEDER-028212, started in June of 2019 ending in May of 2022, with researchers from ESS | P. PORTO, University of Minho and University of Aveiro. Aims to analyze the neurocognitive correlates of implicit-explicit learning mechanisms in preschool specific-learning impairment (SLI) children and to track their developmental trajectories until they enter primary school. Studies aiming to explore the nature and dynamics of procedural memory-declarative memory functioning in SLI using brain techniques and following the same children on time are inexistent. This project aims to address these issues by combining an artificial grammar paradigm with ERPs in a longitudinal design, which will contribute not only to clarify the role of procedural memory deficits-declarative memory compensation on SLI, but also to the development of effective intervention programs for children who are at risk of dyslexia.

Introdução

The environment in which we live is characterized by a series of sounds, objects, and events that do not occur randomly. The ability to pick up these regularities in time and space is a fundamental skill of our cognitive system to structure the world in a regular and predictable way, and to constantly develop adaptive responses to it The mechanism by which we are capable of extracting those regularities, even without intention and/or awareness of doing it, is called statistical learning (SL). The SL can be implicit and explicit and studies lack in correlating the neural mechanisms with event-related potentials (ERPs) in children with specific learning impairment (SLI).

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Goals

This project aims to analyze the neurocognitive correlates of implicit-explicit learning mechanisms in preschool SLI children and to track their developmental trajectories until they enter primary school. A key question in psycholinguistic research is whether the language impairments observed in SLI are due to deficits in implicit learning mechanisms, and at what extent declarative system can compensate for these deficits, helping SLI children to overcome their difficulties and to prevent severe difficulties in reading-writing. Moreover, this project aims to address these issues by combining an artificial grammar paradigm with ERPs in a longitudinal design, which will contribute not only to clarify the role of procedural memory deficits-declarative memory compensation on SLI, but also to the development of effective intervention programs for children who are at risk of Dyslexia.

Methods

The neural mechanisms underlying SL under other learning conditions remain largely unknown. Here, we investigated the neurofunctional correlates of SL using triplets (i.e., three-syllable nonsense words) with a mean TP of 1.00 (easy "words") and 0.50 (hard "words") in an SL task performed under incidental (implicit) and intentional (explicit) conditions. ERPs (N100, N250 and N400) were recorded while participants listened first to a continuous auditory stream made of the concatenation of four easy and four hard "words" under implicit instructions, and subsequently to another auditory stream made of the concatenation of four easy and four hard "words" drawn from another artificial language under explicit instructions.

In the N400 ERP component, we found an effect of type of "word" showing that easy "words" elicited larger amplitudes as compared to hard "words" (see figure), which might suggest facilitated access to these specific words' representations in memory and/or more successful integration of those representations in higher-order language structures. Also, significant differences in the N100 were found as a result of the interaction between transitional probability instructions, and the amount of exposure to the auditory stream. Taken together, our findings suggest that triplets' predictability impacts the emergence of "words" representations in the brain both for statistical regularities extracted under incidental and intentional instructions, although the prior knowledge of the "words" seems to favor the recruitment of different SL mechanisms.

With project´s tasks 8-10 approaching, we can correlate results with literacy skills assessment that will clarify the role of procedural memory deficits-declarative memory compensation on children with SLI.

Task	Task Denomination
1	Recruitment and selection of participants (SLI and TD controls). (2019)
2	Stimuli selection. (2019)
3	Setup of the experimental tasks and paradigms. (2019)
4	Preschool data collection 1 (SLI and TD controls, experimental session 1). (2020)
5	Preschool data collection 2 (SLI and TD controls, experimental session 2). (2021)
6	Preschool data analysis (SLI and TD controls, experimental sessions 1 and 2) and research dissemination. (2021)
7	Primary school data collection 1 (SLI and TD controls, experimental session 3). (2021)
8	Primary school data collection 2 (SLI and TD controls, experimental session 4). (2022)
9	Primary school data collection 3 (SLI and TD controls, literacy skills assessment). (2022)
10	Primary school data analysis (SLI and TD controls, experimental sessions 3 and 4, and literacy skills assessment) and research dissemination. (2022)

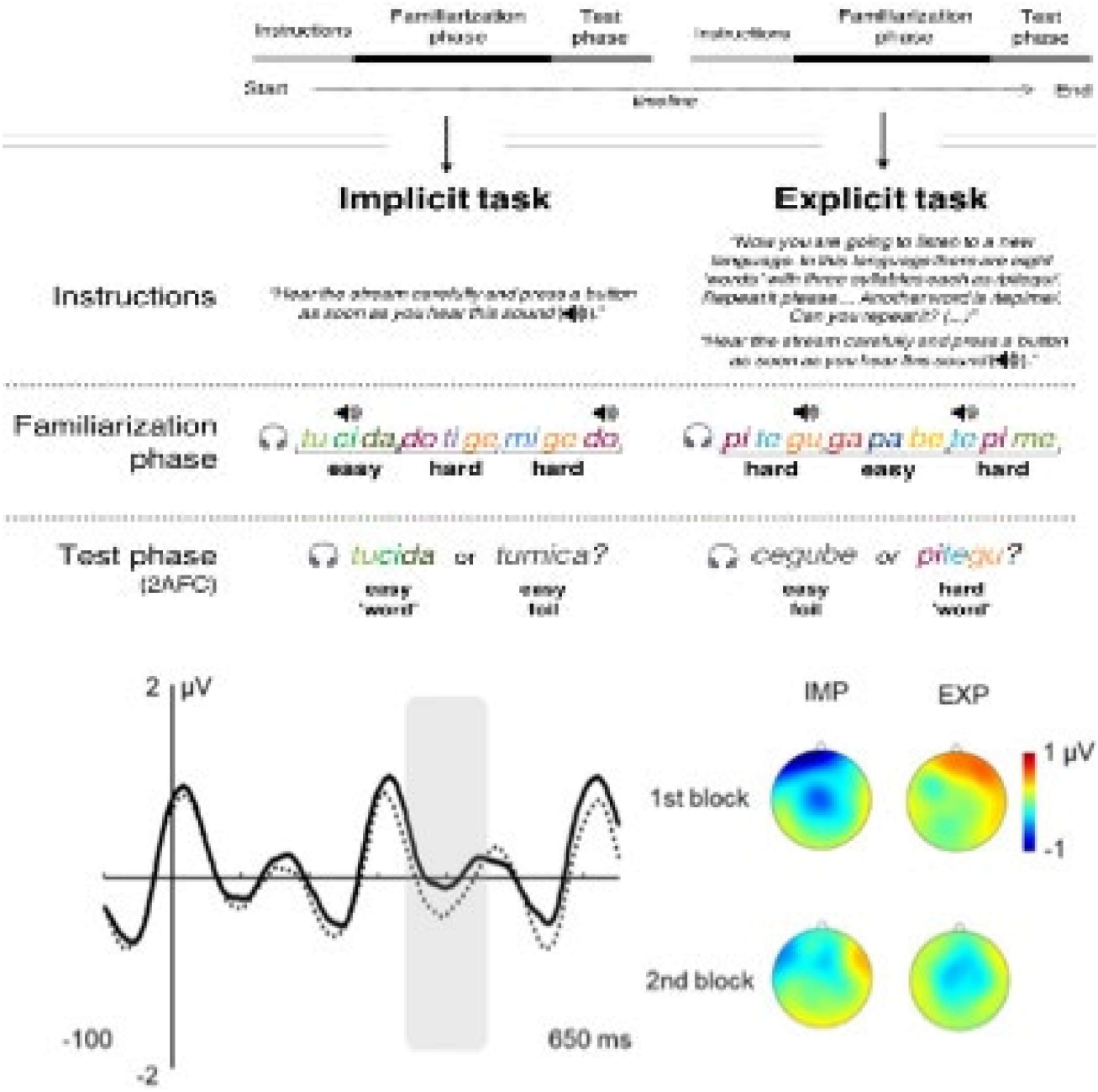

Figure. Effect of type of "word" in the N400 time window (solid line: hard; dotted line: easy) and voltage map of the difference between easy and hard "words".

References related to the project

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