IWORDD 2023

International Workshop on Reading and Developmental Dyslexia

June 7th -9th, 2023

DONOSTIA-SAN SEBASTIAN

BASQUE COUNTRY, SPAIN

PROGRAM SUMMARY

Wednesday, June 7th	Thursday, June 8th
08:00 - 08:45 Registration & Welcome Coffee **08:45 - 09:00** Opening Remarks **09:00 - 10:00** Keynote 1: Charles Hulme **10:30 - 11:20** Oral Session 1 **11:20 – 11:50** Coffee break **11:50 – 13:00** Symposium 1 **13:00 – 14:00** Lunch **14:00-15:00** Poster Session 1 & Coffee break **15:00-16:20** Oral Session 2 **16:20-17:20** Keynote 2: Silvia Brem	**09:00 - 10:00** Keynote 3: Franck Ramus **10:00 - 11:20** Oral Session 3 **11:20 - 11:50** Coffee break **11:50 - 13:00** Symposium 2 **13:00 – 14:00** Lunch **14:00-15:00** Poster Session 2 & Coffee break **15:00-16:20** Oral Session 4 **16:20-17:50** Debate: Usha Goswami & Anne-Lise Giraud **17:50-18:00** Closing Remarks ……. ****** **20:00** - BUS Conference venue - Cider House **20:30** – Conference Dinner **23:00** – BUS Cider House - Hotel

** For Conference Dinner Registrees ONLY

WELCOME

Welcome to the fourth edition of the International Workshop on Reading and Developmental Dyslexia in San Sebastián!

iWORDD aims to bring together researchers interested in understanding the causes and manifestations of typical and atypical reading development. This fourth edition of iWORDD features a group of speakers who address current theoretical issues faced by research on reading with a specific focus on how to validate and test the causal theories using longitudinal designs and neuroimaging in informative ways.

Important perspectives on developmental dyslexia and reading acquisition will be covered by three keynote speakers, a debate, two theme symposiums and several oral presentations. Two additional poster sessions will offer the research community further opportunities to gain a broad overview of the theoretical perspectives currently governing research in the field.

With its limited size, we hope that iWORDD will encourage interactions among researchers and move the field forward while outlining future directions for the investigation of reading acquisition and developmental dyslexia.

Ultimately the aim of iWORDD is twofold: to generate new ideas that advance our field and to highlight innovative thinking that can have a positive impact on clinical practice and education. After two full days of scientific exchange, a third day, open to a broader audience, will be devoted to tackle the important challenge of linking theory to practice.

WELCOME

We would like to express our deep gratitude to the people involved in the organization of iWORDD whose support and expertise have made this event possible: Miguel Arocena, Leire Arietaleanizbeascoa, Maialen Garcia, Oihana Vadillo, , all members of the BCBL's administrative team, as well as the numerous BCBL scientists, staff and students who have assisted with innumerable aspects of the conference. Finally, we would like to thank our sponsors, whose support is so important for this event.
We hope that you will enjoy the workshop and this opportunity to enjoy local Basque culture and the gastronomy of San Sebastián!

Marie Lallier, Amaia Carrión-Castillo, Manon Jones and Manuel Carreiras
iWORDD organizing committee

TABLE OF CONTENTS

CONFERENCE PROGRAM – WEDNESDAY, JUNE 7th

8:00-8:45 Registration

8:45-9:00 Welcome

09:00 – 10:00 Keynote 1: Charles Hulme: "Learning to Read: The critical role of oral language skills for both decoding and comprehension"

10:00 – 11:20 Oral session 1

10:00-10:20 (O.S.1.1.) Early predictors of written language skills in children with Developmental Language Disorders (DLD). *Prisca Martin, Philippe Prevost, Elisabeth Schweitzer & Racha Zebib*

10:20-10:40 (O.S.1.2.) The Role of Morphology in Early Reading and Spelling in Hebrew. *Ravit Cohen-Mimran & David L. Share*

10:40-11:00 (O.S.1.3.) The stability and developmental interplay of word reading and spelling: A cross-linguistic longitudinal study from kindergarten to grade 4. *Bjarte Furnes, Rebecca Treiman, Stefan Samuelsson & Åsa Elwé*

11:00-11:20 (O.S.1.4.) Orthographic Learning: One unitary system or two separate constructs (reading vs. spelling)?. *Eduardo Onochie-Quintanilla, Marie Lallier & José Ignacio Navarro-Guzmán*

11:20 – 11:50 Coffee Break

11:50 – 13:00 Invited symposium 1: Chair: Simone Gori: "Visual attention and reading: cause or consequence?"

11:50-12:20 (S.1.1.) Visual Attention deficit as a cause of developmental dyslexia. *Simone Gori*

12:20-12:40 (S.1.2.) Gene x environment interplay in developmental dyslexia treatment. *Sara Mascheretti*

CONFERENCE PROGRAM – WEDNESDAY, JUNE 7th

12:40-13:00 (S.1.3.) Video Game-Based Interventions for Improving Reading Skills through Executive Functions and Action-Based Mechanics. *Angela Pasqualotto*

13:00 – 14:00 Lunch

14:00 – 15:00 Coffee and Posters Session 1

15:00 – 16:20 Oral session 2

15:00-15:20 (O.S.2.1.) BRAID-Acq, a new single-route Bayesian model of reading acquisition. *Alexandra Steinhilber, Emilie Ginestet, Sylviane Valdois & Julien Diard*

15:20-15:40 (O.S.2.2.) Reading efficacy enhancement in adults with dyslexia: the combination of Action Video Games and parietal tRNS. *Sara Bertoni, Sandro Franceschini, Martina Mancarella, Giovanna Puccio, Luca Ronconi, Simone Gori, Gianluca Campana & Andrea Facoetti*

15:40-16:00 (O.S.2.3.) Effects of Self-teaching in Context and Isolation Training on Orthographic Learning. *Monyka L. Rodrigues & Sandra Martin-Chang*

16:00-16:20 (O.S.2.4.) Executive Functions Mediate Fine Motor Skills' Contribution to reading and spelling achievement. *Afnan Khoury-Metanis & Asaid Khatib*

16:20 – 17:20 Keynote 2: Silvia Brem: "Letter-speech sound processing in the brain – the key to reading acquisition"

CONFERENCE PROGRAM – THURSDAY, JUNE 8th

09:00 – 10:00 Keynote 3: Franck Ramus: "Good practices in the investigation of developmental dyslexia"

10:00 – 11:20 Oral session 3

10:00-10:20 (O.S.3.1.)How do we falsify causal theories of dyslexia? *Xenia Schmalz, Yi Leung & Claudio Mulatti*

10:20-10:40 (O.S.3.2.) Low-level multisensory integration deficits in dyslexia at behavioral and neural levels. *Agnieszka Glica, Katarzyna Wasilewska, Bartosz Kossowski, Jarosław Żygierewicz & Katarzyna Jednoróg*

10:40-11:00 (O.S.3.3.) Source reconstruction of clinical resting-state EEG reveals differences in power and functional connectivity in children with developmental dyslexia. *David Garnica-Agudelo, Stuart D.W. Smith, Daniel van de Velden, Christina Stier, Knut Brockmann, Sascha Schroeder, Nicole Neef & Niels Focke*

11:00-11:20 (O.S.3.4.) Neurobiology of Reading Disabilities and Comorbid Disorders: Genetic findings and Stem Cell Models. *Cathy Barr, Kaitlyn Price, Karen Wigg, Yu Feng, Kirsten Blokland, Margaret Wilkinson, Elizabeth Kerr, Sharon Guger, Maureen Lovett, Lisa Strug & Maria Carol Marchetto*

11:20 – 11:50 Coffee Break

11:50 – 13:00 Invited Symposium 2: Chair: Sendy Caffarra: "Longitudinal studies in reading acquisition"

11:50-12:10 (S.2.1.) Neurodevelopmental trajectories of letter and speech sound processing. *Iliana I. Karipidis*

12:10-12:30 (S.2.2.) Short-term neurobehavioral changes during letter and speech sound learning. *Milene Bonte*

CONFERENCE PROGRAM – THURSDAY, JUNE 8th

12:30-13:00 (S.2.3.) Reading instruction is linked to changes in audiovisual and category-selective visual cortex. *Sendy Caffarra*

13:00 – 14:00 Lunch

14:00 – 15:00 Coffee and Posters Session 2

15:00 – 16:20 Oral session 4

15:00-15:20 O.S.4.1. A systematic investigation of phonological predictors of Chinese developmental dyslexia with a machine learning approach. *Ning Ding, Peng Peng, Jiuqing Tang, Yiran Ding, Sen Li & Jingjing Zhao*

15:20-15:40 O.S.4.2. Do early musical impairments predict later reading failure? A longitudinal study of pre-readers with and without familial risk for dyslexia. *Manon Couvignou, Hugo Peyre, Franck Ramus & Régine Kolinsky*

15:40-16:00 O.S.4.3. Spectro-temporal encoding differences in the auditory cortex of typical and dyslexic readers. *Francesco Gentile, Kiki van der Heijden, Federico De Martino, Augustin Lage-Castellanos & Milene Bonte*

16:00-16:20 O.S.4.4. Neural responses to natural and enhanced speech edges in children with and without dyslexia. *Kanad Mandke, Sheila Flanagan, Annabel Macfarlane, Georgia Feltham, Fiona Gabrielczyk, Anji Wilson & Usha Goswami*

16:20 – 17:50 Debate: Usha Goswami and Anne-Lise Giraud: "Dyslexia in the two hemispheres: Insights from neural oscillations". Chair: Nicola Molinaro

Usha Goswami - Phonology and the Right Hemisphere: A Temporal Sampling Perspective

Anne-Lise Giraud - The role of the phonemic sampling scale in speech processing and reading

17:50 –18:00 Closing remarks

For Conference Dinner Registrees ONLY:

20:00 – 20:20 Bus transfer San Sebastian – Conference Dinner

20:30 – 23:00 CONFERENCE DINNER

23:00 – 23:20 Bus transfer to San Sebastian

CONFERENCE PROGRAM - POSTER SESSION I

14:00-15:00 Wednesday, June 7th

PS. 1. 1. Reading in English: German in childhood and Latin in adolescence. *Arturo Hernandez, My Nguyen, Yinan Xu & Kevin Brown*

PS. 1. 2. Literacy and reading skills of Arabic speaking children with poor linguistic skills. *Jasmeen Adwan & Asaid Khateb*

PS. 1. 3. Cognitive mechanisms underlying reading in Spanish. *Amaia Carrión-Castillo, Marie Lallier & Manuel Carreiras*

PS. 1. 4. Pauses as a reading predictor in the standardized assessment of reading skills. *Nina Zdorova & Ivan Shirokov*

PS. 1. 5. A case of severe selective developmental letter-identification impairment dyslexia. *Marie Lubineau, Cassandra Potier-Watkins, Hervé Glasel & Stanislas Dehaene*

PS. 1. 6. The effect of a specialized Cyrillic dyslexia font, Antidyslexia, on word recognition times. *Yana Nikonova, Viktoria Koltuntseva, Alexandra Burdyna, Alisa Lezina, Alexandra Cherevik & Svetlana Alexeeva*

PS. 1. 7. Effect of linguistic properties of words in reading and writing. *Soledad Assis, Camila Zugarramurdi & Juan Valle-Lisboa*

PS. 1. 8. The influence of orthographic depth on learning and consolidating novel written words. *Catherine Clark, Simone Lira Calabrich, Tianjiao Lee, Sara Guediche, Marie Lallier & Manon Jones*

PS. 1. 9. Why are we making errors during visual word recognition? Analysis of error distribution during lexical decision in good and poor readers. *Fanny Grisetto, Clémence Roger & Gwendoline Mahé*

PS. 1. 10. Predictors of reading and writing in a transparent orthography during primary school: Testing for Dual Route and Interactive models. *Gorka Ibaigarriaga, Joana Acha & Manuel Perea*

PS. 1. 11. PREVENIR: An oral language intervention program in kindergarten for improvement later reading abilities. *Raquel Balboa, Esteban Peñahera, Shafaq Rubab, Alfonso Igualada, Nadia Ahufinger, Mònica Sanz-Torrent & Llorenç Andreu*

CONFERENCE PROGRAM - POSTER SESSION I

14:00-15:00 Wednesday, June 7 th

PS. 1. 12. Phonemic Perception Skills in Preschool Children with the Familial Risk for Developmental Dyslexia. *Tatiana Eremicheva, Anna Elagina, Svetlana Dorofeeva & Ekaterina Shcheglova*

PS. 1. 13. Examining the relationship between phonological working memory, word reading and spelling in beginning and competent readers. *Claudia Laskay-Horváth, Orsolya Pachner & Ferenc Kemény*

PS. 1. 14. Repetition of pseudowords and sentences with pseudowords in children with dyslexia: evidence for the phonological deficit hypothesis?. *Petra Ramljak, Marija Jozipović & Mirjana Lenček*

PS. 1. 15. Phonological awareness is a critical determinant of reading and writing abilities in children with DLD. *Llorenç Andreu, Nadia Ahufinger, Raquel Balboa, Laura Ferinu, Josue Garcia Arch & Mònica Sanz-Torrent*

PS. 1. 16. Acoustic Durations of Speech Production of Children with DLD. *Robert Cavaluzzi, Sandy Abu El Adas & Marie Lallier*

PS. 1. 17. Can Rapid Automatized Naming be used for intervention programs targeting reading fluency?. *Marjolaine Cohen, Laura Alaria & Athanassios Protopapas*

PS. 1. 18. An environmental dimension to Rapid Automatized Naming (RAN). *Racha Zebib, Carole El Akiki, Marjorie Guézennec & Sarah Tabourel*

PS. 1. 19. Double trouble: phonological deficit and double deficit hypotheses are viable in Croatian. *Marija Jozipović, Mirjana Lenček & Maja Kovačević*

PS. 1. 20. Cognitive correlates of reading in Braille and print readers. *Katarzyna Jednoróg, Gabriela Dzięgiel-Fivet & Joanna Beck*

PS. 1. 21. The effect of visuo-attentional training on the acquisition of reading in the Arabic language. *Alaa Ghandour, Sylviane Valdois & Emmanuel Trouche*

PS. 1. 22. Effects of visual noise (fog) on the recognition of words in traffic signs in adults with and without dyslexia. *Pilar Tejero Gimeno, Eva María Rosa Martínez & Javier Roca Ruiz*

PS. 1. 23. Do adults with dyslexia differ in the capacity and duration of iconic memory?. *Laura Royo, Javier Roca & Pilar Tejero*

CONFERENCE PROGRAM - POSTER SESSION I

14:00-15:00 Wednesday, June 7th

PS. 1. 24. Perceptual Span during Silent Reading in Russian Adults and Children. *Vladislava Staroverova & Anastasiya Lopukhina*

PS. 1. 25. Correlates of cognitive control during artificial letter-speech sound learning in typical and dyslexic readers. *Cara Verwimp, Patrick Snellings, Reinout Wiers, Jurgen Tijms & Milene Bonte*

PS. 1. 26. The short-term effects of play on reading and sensorimotor skills in young adults. *Andrea Facoetti, Sara Bertoni, Giovanna Puccio & Sandro Franceschini*

PS. 1. 27. Two cups of coffee to improve text reading abilities, semantic association and to make activities more fun. *Giovanna Puccio, Sandro Franceschini, Sara Bertoni, Francesca Fusina, Alessandro Angrilli & Andrea Facoetti*

PS. 1. 28. Workplace cognition in adults with dyslexia: Evidence from a virtual reality office setting. *James Smith-Spark, Rebecca Gordon & Ashok Jansari*

PS. 1. 29. Metaphor processing in dyslexia: weakness or strength?. *Rita Cersosimo*

PS. 1. 30. Do psycholinguistic and discourse features determine the choice of keywords? Evidence from text adaptations for people with dyslexia. *Marija Jozipović, Mirjana Lenček, Sara Košutar & Gordana Hržica*

PS. 1. 31. Dyslexia Screening Methods among Juvenile Offenders in the United States. *Rebecca Wiseheart, Kristina Arutyunyan, Arpit Nagra & Taylor Woods*

PS. 1. 32. Comparing online versus in person assessment of learning skills in children. *Chiara Mauri, Valentina Lampis, Chiara Dondena, Martina Villa, Chiara Cantiani & Sara Mascheretti*

PS. 1. 33. Investigating print exposure and self-perception of reading in adults with developmental dyslexia. *Ciara Egan*

CONFERENCE PROGRAM - POSTER SESSION II

14:00-15:00 Thursday, June 8th

PS. 2. 1. Interactions between parental education and dyslexic susceptibility variants and genes on reading abilities in Chinese children: Evidence for differential-susceptibility model. *Jingjing Zhao, Qing Yang, Chen Cheng & Zhengjun Wang*

PS. 2. 2. Intergenerational transmission effects of parental education and reading history on children's reading abilities: Differential influences from mothers and fathers. *Jingjing Zhao, Ning Ding, Sen Li & Yuxiao He*

PS. 2. 3. Shaping your world: A qualitative examination of the role of the unshared environment in monozygotic twins with discordant reading difficulties. *Georgia Gerike, Daria Khanolainen, Minna Torppa & Jarmo Hämäläinen*

PS. 2. 4. The READ1 deletion and neural activation during magnocellular-dorsal visual tasks: An fMRI in developmental dyslexia. *Valentina Lampis, Denis Peruzzo, Alessio Toraldo, Alice Giubergia, Martina Villa, Chiara Andreola, Filippo Arrigoni & Sara Mascheretti*

PS. 2. 5. The effect of parental stress on child´s long term language and literacy outcomes: A contextual explanatory model. *Joana Acha, Florencia B. Barreto & Enrique Arranz*

PS. 2. 6. Binaural Temporal Fine Structure sensitivity development in children with developmental dyslexia. *Sheila Flanagan, Angela Wilson, Fiona Gabrielczyk, Georgia Feltham, Kanad Mandke & Usha Goswami*

PS. 2. 7. Seeds of literacy: Auditory rise time discrimination in infancy and pre-reading abilities in preschool. *Marina Kalashnikova, Denis Burnham & Usha Goswami*

PS. 2. 8. Can speech perception problems cause phonological short-term memory dysfunction*?. Harriet J Smith, Rebecca A Gilbert & Matthew H Davis*

PS. 2. 9. Speech disfluencies in children with developmental dyslexia: how do they differ from typical development?. *Stéphanie Maziero, Aurélie Pistono, Yves Chaix & Mélanie Jucla*

PS. 2 10. Children and adults with developmental dyslexia are impaired in Incidental learning of complex sound categories. *Hadeer Derawi, Lori L. Holt, Avi Karni & Yafit Gabay*

CONFERENCE PROGRAM - POSTER SESSION II

14:00-15:00 Thursday, June 8th

PS. 2. 11. The relationship between speech production and phonological processing in children learning to read. *Sandy Abu El Adas & Marie Lallier*

PS. 2. 12. Visual and auditory temporal processing in relation to attention and noise exclusion in adult university students with dyslexia. *Martina Mancarella, Andrea Facoetti, Jan Wouters & Pol Ghesquière*

PS. 2. 13. Disentangling the relationship between phonological awareness, executive functions and rhythmic abilities : A pilot study. *Nora Jamoulle & Pol Ghesquière*

PS. 2. 14. The contribution of listening effort to cortical tracking of speech and its relation to phonological and reading skills in distinct adverse conditions. *Hadeel Ershaid, Mikel Lizarazu, Drew McLaughlin, Maria Koutsogiannaki & Marie Lallier*

PS. 2. 15. Cortical tracking of language structures: Modality-dependent and supra-modal responses. *Manli Zhang, Lars Riecke & Milene Bonte*

PS. 2. 16. DyslexNet - building a neural network for classifying dyslexia from cortical activity. *Anastasia Klimovich-Gray*, Ander Barrena*, Eneko Agirre & Nicola Molinaro*

PS. 2. 17. Brain responses to intervention for reading disability: An Event-Related Potential Study. *Lisa Levinson, Paul Smith, Chaille Maddox, Dakota Egglefield, Christina Wusinich & Karen Froud*

PS. 2. 18. Examining phonological awareness and reading impairment in school age children with resting EEG. *Soujin Choi, Silvia Clement-Lam & Elizabeth Norton*

PS. 2. 19. Dynamic behavioral and neural correlates of learning progress during a letter-speech sound learning task. *Yuewei Cao, Francesco Gentile, Manli Zhang, Eva Ružička, Anna Berti, Sofia Conaway & Milene Bonte*

PS. 2. 20. Ortho-Semantic Learning of Novel Words: An event-related potential study of grade 3 children. *Alena Galilee, Lisa Beck, Clara Lownie, Catherine Mimeau, S. Hélène Deacon & Aaron J. Newman*

PS. 2. 21. Resting state EEG related to reading skills in children with developmental dyslexia. *Brittany Lee, Daniel Kleinman, Kelsey Davinson, Kimberly Cuevas & Nicole Landi*

CONFERENCE PROGRAM - POSTER SESSION II

14:00-15:00 Thursday, June 8 th

PS. 2. 22. Phonological and visuo-attentional deficits in developmental dyslexia: A combined eye movement and ERP study. *Aikaterini Premeti, Maria Pia Bucci & Frédéric Isel*

PS. 2. 23. Influence of enhanced perceptual features on development of neural specialization for Arabic print in early readers. *Roaa Alsulaiman & Tracy Centanni*

PS. 2. 24. Thalamic features successfully differentiate readers with and without dyslexia. *Francisco Carrera-Arias, Garikoitz Lerma-Usabiaga, Carmen Vidaurre, Manuel Carreiras & Pedro Paz-Alonso*

PS. 2. 25. The role of occipitotemporal cortex in speech processing as a function of typical and atypical literacy development. *Agnieszka Dębska, Marta Wójcik, Katarzyna Chyl & Katarzyna Jednoróg*

PS. 2. 26. Voxel-based morphometry in children with dyslexia and healthy controls: a comparison of pipelines. *Ekaterina Shcheglova, Tatiana Bolgina, Ekaterina Iskra & Olga Dragoy*

PS. 2. 27. Does white matter integrity mediate the relationship between SES and reading skills?. *Martina Villa, Nabin Koirala, Meaghan Perdue, Lee Branum-Martin & Nicole Landi*

PS. 2. 28. Neural adaptation patterns of phonology and orthography processing in developmental dyslexia. *Marta Wójcik, Katarzyna Jednoróg & Agnieszka Dębska*

PS. 2. 29. A new perspective to account for the causal relationship between statistical learning and developmental dyslexia. *Teng Guo, Samantha Ruvoletto, Marie Boyer & Daniel Zagar*

ABSTRACTS

[K-1]

Learning to Read: The critical role of oral language skills for both decoding and comprehension

Charles Hulme [1]

[1] University of Oxford

When thinking about learning to read it is critical to distinguish between decoding and comprehension. According to the Simple View of Reading, reading for meaning depends on two separable skills: decoding and language comprehension. I will review recent work providing very strong support for the Simple View of reading. In addition I will present less widely recognised evidence that the development of decoding also depends upon early language skills. Early language problems and speech problems in the preschool years both place children at risk of problems in learning to decode when they enter school. This evidence has important implications for the teaching of reading, and for the identification and prevention of reading problems.

[K-2]

Letter-speech sound processing in the brain – the key to reading acquisition

Silvia Brem [1]

[1] Universität Zürich

Fluent reading develops over the course of many years as a result of extensive practice. A crucial initial step of reading acquisition is learning the associations between speech sounds and the corresponding letters. While these associations are usually acquired rapidly within the first year(s) of reading acquisition, full automatization of letter-speech sound associations and improving reading fluency skills takes several years. Deficient integration and automatization of letter-speech sound pairs have been associated with poor reading skills and developmental dyslexia. Audiovisual binding of language information in the brain is thus fundamental to successful reading acquisition and relies on a distributed brain network that includes superior temporal, parietal and occipitotemporal areas among others. In this presentation, I will summarize current insights from our longitudinal and cross-sectional studies using electroencephalography and functional magnetic resonance imaging to show how initial letter-speech sound learning as well as prolonged reading practice and expertise over the elementary school years shape the brain networks involved in visual and auditory language processing to allow fluent and efficient reading. Furthermore, I will elaborate on how function and connectivity of the brain's reading network depends on children's reading skills. Insights about developmental deviations in children with poor reading skills may help understand when and how to best support children with reading impairments´.

[K-3]

Good practices in the investigation of developmental dyslexia

Franck Ramus [1]

[1] Laboratoire de Sciences Cognitives et Psycholinguistique

In dyslexia research, like in other scientific fields, there is a replication crisis: some results that were thought to be firmly established cannot be reproduced. How bad is it? What can be done about it? How should we change our practices in order to produce more reliable research that can be built upon?

DEBATE: Dyslexia in the two hemispheres: Insights from neural oscillations

Phonology and the Right Hemisphere: A Temporal Sampling Perspective

Usha Goswami [1]

[1] University of Cambridge

Recent insights from auditory neuroscience provide a new perspective on how the brain encodes speech. Using these recent insights, I have been exploring some key factors underpinning individual differences in children's development of language and phonology, studying both infants and children with and without dyslexia. Individual differences in phonological processing skills are one of the key cognitive determinants of children's progress in reading and spelling, as well as being implicated in dyslexia across languages. I will describe the neural oscillatory "temporal sampling" theoretical framework that informed our data collection, and discuss how we have been applying Temporal Sampling theory to language acquisition. Via a selective overview of findings from our infant longitudinal studies, SEEDS and BabyRhythm, as well as two different longitudinal dyslexia projects with children aged 7 – 11 years, I will aim to demonstrate that changes in right hemisphere effects over the developmental trajectory appear to be intrinsic to the efficiency of phonological processing.

References Goswami, U. (2019). Speech rhythm and language acquisition: An amplitude modulation phase hierarchy perspective. Annals of the New York Academy of Sciences, e14137. Goswami, U. (2022). Language acquisition and speech rhythm patterns: An auditory neuroscience perspective. Royal Society Open Science, 9, 211855 Mandke, K., Flanagan, S., Macfarlane, A., Wilson, A.M., Gabrielczyk, F.C., Gross, J. & Goswami, U. (2022). Neural sampling of the speech signal at different timescales by children with dyslexia. NeuroImage, 253, 119077. Ní Choisdealbha, A., et al. (2022, in preparation), Neural phase angle from two months when tracking speech and non-speech rhythm linked to language performance from 12 to 24 months. https://psyarxiv.com/vjmf6/

The role of the phonemic sampling scale in speech processing and reading

Anne-Lise Giraud [1]

[1] Geneva University

On-line speech processing heavily relies on the precise coordination of neural processes at different temporal scales and on their alignment on the acoustic signal. Three scales are key in this process, the theta one for flexibly tracking speech syllable boundaries, the low gamma one for aligning phonemic-scale segments into syllables boundaries, and the beta scale for interfacing with higher level representations including articulatory ones. In this presentation, I will present experimental and theoretical/computational results that support the contribution of each of these neural temporal scales to speech processing, and review the limitations of the neural oscillation framework in supporting the language function. I will discuss the phenotypical implications when neural oscillation phenomena are disrupted in neurodevelopmental disorders, with a focus on dyslexia and autism spectrum disorders, as well as the possible impact of interventions on the clinical outcome.

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[S-1]

Visual attention and reading: cause or consequence?

Theme Speaker: **Simone Gori**

[S-1.1]

Visual Attention deficit as a cause of developmental dyslexia

Simone Gori [1]

[1] Department of Human and Social Sciences, University of Bergamo, Bergamo, Italy

Reading is a unique, cognitive human skill crucial to life in modern societies, but, for about 10% of the children, learning to read is extremely difficult. They are affected by a neurodevelopmental disorder called dyslexia developmental dyslexia (DD). Although the dominant view posits that DD arises from a deficit in phonological processing, emerging evidence suggest that DD could be caused by visual attentional deficit producing a cascade effect on higher processes. After several years of correlational studies suggesting the importance of the visual attentional processes in reading acquisition the last decade was characterized by both longitudinal and remediation studies that proved the causal role of the visual attentional deficit in the arise of DD. The results necessarily reshaped our knowledge about the origins of DD, the possible treatments and even the possibility of early identification, opening for future prevention approaches.

[S-1.2]

Gene x environment interplay in developmental dyslexia treatment

Sara Mascheretti [1 2]

[1] Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy

[2] Child Psychopathology Unit, Scientific Institute IRCCS Eugenio Medea, Bosisio Parini, Lecco, Italy

Developmental dyslexia (DD) affects 7% of school-age children (M:F ratio of 1.5:1) and incurs disadvantages in education and occupation. Scientific progress concerning the etiology of DD evidenced the complex gene x environment (GxE) interaction. The DCDC2-READ1 deletion (DCDC2d) associates with reading (dis)ability and affects the functioning of the magnocellular-dorsal (MD) stream in humans and animals. DCDC2 modifies neural activity within the excitatory pathways. The MD stream mediates the function of the attention network. Difficulties in spatial and temporal attention shifting impair letter-to-speech sound integration increasing neural noise.

Recent studies demonstrated that action video games (AVGs) improve reading skills through their effects on the MD stream. Interestingly, mouse models of total/partial DCDC2 reduction affect motion perception, auditory processing and visual discrimination. Cutting-edge, round trip translation study must therefore gain momentum to unravel new insights behind the pathophysiology of DD, to assess GxE effects on DD-related endophenotypes, and to identify useful clues to foster the identification of new, personalized treatments.

[S-1.3]

Video Game-Based Interventions for Improving Reading Skills through Executive Functions and Action-Based Mechanics

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The process of learning to read is complex and depends not only on language abilities but also on executive functions (EFs). In the case of developmental dyslexia (DD), EFs deficits have been observed, which hinder reading acquisition. However, few studies have explored the potential of EFs training to improve reading acquisition. To address this gap, a video game-based intervention (Skies of Manawak; SOM) was developed to improve attentional control and several facets of EFs known to be crucial for reading. SOM is a video game that incorporates a unifying story arc and adaptive activities with action-based mechanics. SOM was tested with typically reading and dyslexic Italian children in two separate studies, and the results showed promising potential in improving EFs and reading skills. Soon, a novel version of this intervention (Legend of Hoa'manu – LOH) will undergo testing in three languages - French, German, and Italian - which will allow for cross-linguistic comparisons to be made.

[S-2]

Longitudinal studies in reading acquisition.

Theme Speaker: Sendy Caffarra

[S-2.1]

Neurodevelopmental trajectories of letter and speech sound processing

Iliana I. Karipidis [1]

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Learning to read in alphabetic languages starts with learning letter-speech sound associations and changes how the brain processes written and spoken language. We followed 102 children with varying reading skills in a mixed-longitudinal/cross-sectional design from the prereading stage to the end of elementary school over five time points to investigate the neural trajectories of letter-speech sound processing using simultaneous EEG-fMRI. We found an inverted U-shaped development of speech sound and letter processing in the left superior temporal cortex. Functional responses to letters in the left ventral occipitotemporal cortex showed a steep increase at the end of elementary school, when children had attained a high level of reading expertise, while the electrophysiological visual N1 response to letters demonstrated a faster development, already peaking after a few months of reading acquisition. The development of letter-speech sound processing will be discussed in the context of reading development and individual differences in learning.

[S-2.2]

Short-term neurobehavioral changes during letter and speech sound learning

Milene Bonte [1]

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The formation of efficient associations between visual and spoken language representations forms a fundamental step in the acquisition of reading. Although we have a fairly good understanding of how our brain processes already learnt associations and how this may differ in individuals with reading problems (dyslexia), we know very little about the short-term behavioral and neural changes that unfold during the learning process itself. In this talk I will discuss behavioral, EEG and fMRI data of children and adults obtained with different learning paradigms including text-based recalibration and audiovisual script learning. Together these data provide first evidence for diverging learning curves for letter-sound associations in individuals with/without dyslexia as well as possible modulatory effects of perceptual (phonological similarity) and general cognitive (attention skills) factors. Building on these data, I will propose a model of individual differences in neurobehavioral changes during letter-sound association learning and will discuss why a better understanding of these differences in young children may be crucial for predicting who will learn to read fluently and who will need extra support to prevent reading problems.

[S-2.3]

Reading instruction is linked to changes in audiovisual and category-selective visual cortex

Sendy Caffarra [1]

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Reading is a complex cognitive skill that have a profound impact on different areas of our brain. In this talk we will consider two aspects of reading-related neuroplasticity. In a first MEG experiment we will see how brain areas that are typically involved in audiovisual integration are progressively tuned for recently acquired sound-to-letter correspondences. In a second longitudinal MEG experiment we will focus on the visual cortex and test how category-selective visual areas are shaped by the experience of learning to read. Diffusion MRI were also analyzed to test for changes in the structure of the brain's white matter pathways. Overall, these findings support the idea that even short reading training selectively change brain responses in the audiovisual and ventral occipitotemporal cortex. These results support the idea that different brain areas go through rapid adjustments during the acquisition of an extremely advanced and evolutionary recent cognitive skill, such as reading.

[OS-1.1]

Early predictors of written language skills in children with Developmental Language Disorders (DLD)

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Children with DLD are at increasing risk of written language difficulties. However, the main predictors of reading outcomes in this population remain unclear. In typically developing (TD) children, main predictors of future reading skills have been shown to be letter knowledge, phonological awareness, and rapid automatized naming. Few longitudinal studies have compared early predictors of reading skills in children with and without DLD, especially in French-speaking children. We assessed 25 kindergarteners with DLD (Mean age = 5;6; SD = 0;4) and 25 TD controls, matched on age, socioeconomic status and nonverbal ability, on oral language skills, letter knowledge (LK), phonological awareness (PA), rapid automatized naming (RAN), working memory, and graphic skills. Reading and spelling abilities were assessed 8 months later at the beginning of first grade. The results revealed lower performance in children with DLD on all skills assessed in kindergarten, as well as on reading and spelling in first grade. Moreover, the pattern of associations between the skills assessed in kindergarten and written language skills in first grade differed between the two groups, showing that the key predictors of written language in children with DLD are not identical to the ones observed in TD children.

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[OS-1.2]

The Role of Morphology in Early Reading and Spelling in Hebrew

Ravit Cohen-Mimran [1] & David L. Share [1]

[1] University of Haifa

Learning to read and spell is a complex and challenging process, partly because it relies on multiple aspects of metalinguistic abilities such as phonological and morphological awareness. The present study examined the contribution of morphology to early spelling and reading in a highly transparent orthography - pointed Hebrew. In reading, letter-to-phoneme correspondence is highly consistent, but in spelling, phoneme-to-letter correspondences are often one-to-many with the vast majority of Hebrew words containing phonemes which could be spelled with alternate letters that often depend on morphological constraints (Ravid, 2012). We, therefore, predicted that morphological awareness would make a greater contribution to individual differences in early spelling than to reading. In a large-scale longitudinal study of native Hebrew-speaking children (n = 680), we tested this prediction by assessing morphological and phonological awareness at the end of the preschool year, and word reading and spelling in Grade 1. Hierarchical regression analyses revealed that after controlling for age, general intelligence, and phonological awareness, morphological awareness contributed a significant additional 6% variance to word spelling but only 2% to word reading. The results are discussed within the framework of Share's (2008) Functional Opacity Hypothesis, which we extend to reading and spelling.

[OS-1.3]

The stability and developmental interplay of word reading and spelling: A cross-linguistic longitudinal study from kindergarten to grade 4

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[1] University of Bergen, Norway

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[3] Linköping University, Sweden

We investigated the stability and developmental interplay of word reading and spelling in samples of Swedish (N = 190) and U.S. children (N = 488) followed across four time points: end of kindergarten, grades 1, 2, and 4. Cross-lagged path models revealed that reading and spelling showed moderate to strong autoregressive effects, with reading showing a stronger predictability over time than spelling. Regarding the developmental interplay, we found a bidirectional relationship between reading and spelling from kindergarten to Grade 1. However, starting in Grade 1, reading predicted subsequent spelling beyond the autoregressor but not the other way around. In all analyses, the findings were very similar across orthographies. Children were further divided into subtypes with word reading deficits, spelling deficits, or combined reading and spelling deficits to investigate the stability of these deficit subtypes over time. Results showed that reading and spelling deficits were relatively stable in the combined group However, neither reading deficits (irrespective of spelling deficits) nor spelling deficits (irrespective of reading deficits) were stable over time and across samples. These patterns of findings were very similar across orthographies. The theoretical and practical implications of these findings will be discussed.

[OS-1.4]

Orthographic Learning: One unitary system or two separate constructs (reading vs. spelling)?

Eduardo Onochie-Quintanilla [1], Marie Lallier [2] & José Ignacio Navarro-Guzmán [1]

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According to Share's (2008) self-teaching hypothesis on Orthographic Learning (OL), phonological recoding enables the reader to develop the orthographic representations necessary for words to be, both 1) read lexically, and 2) spelled accurately. However, does learning to spell a word (OL-Spelling) and automatizing the reading of a word (OL-Reading) rely on the same learning process?

This study aims to i) examine whether there is one single OL system or two OL systems (OL-Spelling vs. OL-Reading), ii) identify potential cognitive predictors of OL-Reading and OL-Spelling, and iii) explore the interaction between OL and orthographic depth. Participants will be approximately 200 children (100 English- and 100 Spanish- speaking) in Grade 3. Repeated reading of non-words (10 exposures) will assess the children's ability to automatise word reading (OL Reading), while an orthographic choice test assesses the extent to which the spelling of those non-words has been learned (OL Spelling). Phonemic awareness, naming speed (RAN), visual attention and vocabulary will also be assessed. Preliminary results in Spanish only, reveal a non-significant correlation between OL-Reading and OL-Spelling. The unique contributions made by different cognitive skills to OL-Spelling and OL-Reading will be discussed. So far, these results can be interpreted as evidence of two OL systems.

[OS-2.1]

BRAID-Acq, a new single-route Bayesian model of reading acquisition

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The self-teaching theory of reading acquisition hypothesizes that successful phonological decoding of novel words is critical for their learning. Current computational models implementing this theory assume that knowing the novel word phonological form is a prerequisite for accurate learning, which is at odds with behavioral observations. Further, these models adopt a dual-route architecture, assuming that sublexical processing relies on graphemic parsing and grapheme-phoneme mappings. We present the BRAID-Acq model, a new Bayesian model of reading acquisition with a single-route architecture. BRAID-Acq can learn novel words regardless of previous knowledge of their phonological or orthographic forms and without relying on any predefined psycholinguistic unit. Instead, visuo-attentional exploration allows parsing novel words into segments that can vary in length and do not necessarily match with linguistic units. We show that, provided with semantic context, BRAID-Acq is able to differentiate novel words from poorly decoded irregular words. We present simulations covering a wide variety of ecological situations for novel word reading. Experimental results also account for dimensions seldom considered by previous models, such as the gradual dynamics of lexical orthographic trace learning, the acquisition of novel phonological words, or the effect of visuo-attentional characteristics on learning performance and error patterns.

[OS-2.2]

Reading efficacy enhancement in adults with dyslexia: the combination of Action Video Games and parietal tRNS

Sara Bertoni [1 2], Sandro Franceschini [2 3], Martina Mancarella [4], Giovanna Puccio [2], Luca Ronconi [5], Simone Gori [1], Gianluca Campana [2] & Andrea Facoetti [2 3]

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Neuroplasticity can be increased in adulthood through the transcranial random noise stimulation (tRNS). Moreover, literature has demonstrated the effectiveness of action video-games (AVG) training in enhancing attention and reading skills. Thus, we tested whether the combination of tRNS and AVG could be more efficient than AVG only to improve reading skills in adults with dyslexia. In this randomized controlled trial 20 adults with DD followed an AVG training for 15 hours. Half of the participants were stimulated with bilateral posterior parietal tRNS, the other half were in the sham (placebo) condition. Words reading, pseudowords decoding and attentional blink (AB) were measured before and after the training. Results demonstrated that only the AVG+tRNS group showed an enhancement in pseudoword decoding efficiency and in AB. These reading improvement was long lasting after four months. An enhancement in word reading efficiency was recorded in both groups. Moreover, the reduction of AB predicted the pseudowords decoding improvement, whereas the reduction of the distractibility predicted the word reading improvement. By boosting the efficiency of visuo-temporal attention networks, AVG training enhances phonological decoding skills only when bilateral posterior parietal cortex was stimulated.

[OS-2.3]

Effects of Self-teaching in Context and Isolation Training on Orthographic Learning

Monyka L. Rodrigues [1] & Sandra Martin-Chang [1]

[1] Concordia University

When learning to read, children are regularly exposed to words with novel symbols and spellings in stories and lists. Here, we investigated the differential effects of self-teaching in and out of context on the formation of orthographic representations. Adults read different sets of words written in a false orthography across three experiments (N = 100). Reading practice took place in both context and isolation. We experimentally manipulated print exposure. Half of the participants trained with a small set of 24 words, the others trained with a large set of 86 words over six trials, with delayed reading and spelling post-tests. Reading in context bolstered reading accuracy during and after training. Yet the highest spelling scores were noted following training in isolation. Further, self-teaching a large set of diverse words in isolation increased reading accuracy, closing the gap with context. Overall, self-teaching in context helped establish orthographic representations that suppo rted reading accuracy. Whereas, reading in isolation refined orthographic representations which enabled spelling accuracy—especially when training with a large set of words. This signals the scope and limitations of reading in context and highlights the faciliatory effect of reading amount.

[OS-2.4]

Executive Functions Mediate Fine Motor Skills' Contribution to reading and spelling achievement

Afnan Khoury-Metanis [1 1] & Asaid Khatib [1 1]

[1] University of Haifa

Early reading and spelling skills among preschoolers and kindergarteners are strong predictors of children's later school achievement. Identifying the precursors of children's early literacy skills can help early childhood educators to understand what knowledge and skills should be emphasized in promoting reading and spelling at different learning stages. In recent years, there has been a renewed interest in the role of fine motor skills (FMS) in children's reading and spelling. In most of the studies, relationship between FMS and reading and spelling do not indicate if the relationship is direct or mediated by executive functions (EFs). This study aims to obtain a deeper understanding of the potential interrelations between FMS and EFs and early literacy in Arabic-speaking children. Therefore, we used structural equation modeling to investigate the longitudinal relationship between FMS in kindergarten and reading and spelling in first grade among 212 Arabic-speaking children. We also used structural equation modeling to examine the contribution of EFs as possible mediators of this relationship.

Results indicated that FMS directly impacted reading and spelling in the first grade. However, their influence vanished when EFs were included in the second model, indicating that their relationship with literacy was fully mediated through EFs performance.

[OS-3.1]

How do we falsify causal theories of dyslexia?

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In understanding developmental dyslexia, many studies have attempted to find neuro-cognitive deficits that lead to reading impairments. Such theories range from theories of a visual processing deficit (e.g., Pammer & Vidyasagar, 2010) to theories of a statistical learning deficit (e.g., Gabay et al., 2015). Many of these theories are contentious, as there is no consensus about whether many of the findings are replicable and robust to methodological artifacts. Failures to replicate are often attributed to heterogeneity of the population or low statistical power. Conversely, positive findings are often considered to be an artifact of the inflated false positive rate in psychological sciences (Simmons et al., 2016). This leaves us in a stalemate position, where mixed findings are difficult to interpret. In this contribution, aim to address the question: What kind of data can provide evidence for a neuro-cognitive deficit theory? We aim to develop a framework of how researchers can derive and test hypotheses about a causal deficit, while accounting for heterogeneity of the manifestation of developmental dyslexia.

[OS-3.2]

Low-level multisensory integration deficits in dyslexia at behavioral and neural levels

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Reading acquisition involves the integration of auditory and visual stimuli thus low-level multisensory integration might contribute to disrupted reading in dyslexia. Previous studies provided mixed results, which could be due to different stimuli (linguistics/non-linguistic), task requirements (with/without temporal processing), or group composition (male/female ratio). We investigated multisensory integration using simple detection of stimuli in unisensory (60ms white flash in visual and 60ms 1000Hz tone in auditory condition) compared to multisensory conditions. Besides studying the effect of dyslexia, we also investigated potential sex differences in 88 adolescents (44 with dyslexia and 44 typical readers) matched in sex and age. Additionally, continuous EEG was recorded during task performance to investigate early components of event-related potentials related to sensory processing.

We observed a smaller gain in reaction times in multisensory compared to unisensory conditions only in males with dyslexia as revealed by significant sex-by-diagnosis interaction when violations of the race model were examined. At the neural level, we observed differences between dyslexic and control groups in N1 and N2 components, with control group presenting greater differences in neural response between multisensory and sum of unisensory conditions. Our results suggest low-level multisensory integration deficits in dyslexia, which seem more severe in males.

[OS-3.3]

Source reconstruction of clinical resting-state EEG reveals differences in power and functional connectivity in children with developmental dyslexia

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Background: Developmental dyslexia is a neurodevelopmental disorder characterized by significant difficulties in reading and spelling. Despite lacking routine neuroimaging markers for dyslexia, recent resting state electroencephalography (EEG) studies have detected atypical functional connectivity in children with dyslexia compared to controls. These methods are based on measures of EEG data at a sensor-level, but it remains unclear if routine clinical resting-state EEG can be used to detect source-level differences in power or functional connectivity (FC) between children with dyslexia and controls. It is also unknown if differences in these EEG metrics correlate with difficulties in reading and spelling.

Methods: Using retrospective data, we investigated the source-reconstructed power and FC of 70 children with recently diagnosed dyslexia and 50 typically developing controls. We analyzed 50 seconds of awake resting-state routine clinical EEG in five frequency bands (1-29 Hz) using power, imaginary part of coherency (ImCoh), and weighted phase lag index (wPLI). Additionally, we calculated correlations between power or FC and IQ, reading, and spelling performance. Results: Children with dyslexia

had an increase in alpha FC with a focus on the left fronto-temporo-parietal and right inferior fronto-temporal regions. Decreases in theta FC were observed in left temporo-parieto-occipital and right parieto-occipital regions. Furthermore, children with dyslexia demonstrated lower power in delta and theta within the left parieto-occipital regions. An age-stratified sub-analysis indicated that children with dyslexia in 5th-8th school grades exhibit greater alpha FC in left and right fronto-temporo-parietal regions. Finally, lower scores in spelling showed a positive and significant association to theta power within left parieto-occipital regions in dyslexia. Conclusions: Significant group differences in power and FC in the theta to alpha range in left cortical language and visual regions, as well as in multiple RSNs, suggest abnormal oscillations as a pathophysiological sign of dyslexia reading and spelling deficits. These findings demonstrate the potential of source-reconstructed clinical routine EEG data to inform clinicians about brain network alterations in neurodevelopmental disorders such as dyslexia. Keywords: Dyslexia, Electroencephalography, Functional Connectivity, Brain Network, Source reconstruction, Reading, Spelling.

[OS-3.1]

Neurobiology of Reading Disabilities and Comorbid Disorders: Genetic findings and Stem Cell Models

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Reading disabilities (RD) represent a major health, social, and educational handicap. Comorbid psychiatric disorders are common in children with RD, particularly ADHD, impacting academic achievement and social development. We performed a genome-wide association study for word reading (WRAT) on two samples, one selected for reading difficulties from Toronto and the other a population-based sample (Philadelphia Neurodevelopmental Cohort). Based on the findings from this study, and previous biological research, we then performed a Hypothesis-Driven GWAS. The results indicate overlap for genes previously identified for educational attainment, neurodevelopmental and psychiatric disorders, particularly ADHD and autism spectrum disorder (ASD). ASD was an exclusion criterion for the Toronto sample, thus the overlap indicates shared genetic contributions to language difficulties. We also identified overlap with genes involved in neuronal migration. This supports the a priori hypothesis that alterations in neuronal migration during neurodevelopment contribute to the risk of RD. To test this, we created stem cells from two children with severe RD and their strong reader siblings. Derived neural cells from RD children migrated significantly faster than their siblings supporting migration alterations. The results identify overlap for risk genes for neurodevelopmental and ADHD and support previous evidence from neuroanatomical studies for altered neural migration.

[OS-4.1]

A systematic investigation of phonological predictors of Chinese developmental dyslexia with a machine learning approach

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It has been widely accepted that phonological awareness (PA), rapid automatized naming (RAN), and verbal short-term memory (VSTM) deficits are three core facets of phonological deficit in developmental dyslexia (DD) of alphabetic orthographies. Yet, whether phonological deficit is also the core deficit in developmental dyslexia of Chinese, a logographic writing system, has been largely debated. The current study aimed to systematically investigate the three facets of phonological deficit in Chinese DD with a combination of logistic regression analysis, latent profile analysis, and SHapley Additive exPlanations (SHAP) as a machine learning approach. A total of 128 children with developmental dyslexia and 135 age-matched children were selected to participate in seven phonological tasks: two PA tasks (phoneme deletion, onset rime deletion), three RAN tasks (digit, object and color), and two VSTM tasks (spoonerisms, digit span). Results revealed that PA and RAN played major roles in predicting Chinese DD, while VSTM played a minor role. There were three subtypes of phonological deficits: severe PA deficit, moderate RAN deficit, and mild VSTM deficit. The current results provide important evidence for phonological deficit in Chinese DD and shed light on the diagnosis and intervention of Chinese DD.

[OS-4.2]

Do early musical impairments predict later reading failure? A longitudinal study of pre-readers with and without familial risk for dyslexia

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Previous research has shown a triple association between music, phonology, and literacy skills, but the developmental mechanisms that may link these abilities are not well understood. The present longitudinal study examined the hypothesis that early musical skills predict later literacy development via a mediating effect of phonology. To this aim we examined 130 children, 31 of whom presented a familial risk for developmental dyslexia (DD). Their abilities in the three domains were assessed longitudinally, using a comprehensive battery of behavioral tests in kindergarten, first grade, and second grade, and were analyzed with structural equation models. The results point towards a moderate predictive role of music ability to literacy performance via phonology. In addition to their verbal difficulties, children with familial risk for DD consistently underperformed children without such familial risk in music processing. However, early musical skills did not add significant predictive power to later literacy failure beyond phonological skills and family risk status. We debate the clinical implications of these findings and discuss their potential to inform the recently documented comorbidity between DD and congenital amusia.

[OS-4.3]

Spectro-temporal encoding differences in the auditory cortex of typical and dyslexic readers

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Dyslexia is often associated with difficulties in processing the sound structure of language. In the present study, we used an encoding approach to investigate whether these difficulties relate to atypical spectro-temporal analysis of speech and other sounds in the auditory cortex. Eleven dyslexic and eleven typical readers (22.3 ± 5.4 years, age/gender/education matched) performed an event-related 7T-fMRI experiment where they listened to 288 sounds divided in six categories: speech, quilts (i.e., speech-like spectro-temporal modulations but unintelligible) animals, nature, music, and voices. A first ANOVA analysis showed an interaction between Group and Sound-Categories in the left anterior Superior Temporal Gyrus (STG) and Planum Polare (PP). In particular, we observed that both regions responded to animal, nature, music and voice sounds equally in both typical and dyslexic reader. BOLD activations related to speech and quilts instead were larger in typical than dyslexic readers. Interestingly, the encoding analysis revealed that in dyslexic readers the response to speech and animals sounds was more accurately predicted in the right STG and Planum Temporale than in typical readers. Results further suggested that this effect originated from an underlying difference in their auditory cortical selectivity to specific spectro-temporal characteristics of the sounds.

[OS-4.4]

Neural responses to natural and enhanced speech edges in children with and without dyslexia

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Atypical speech entrainment seen in developmental dyslexia likely arises in part from reduced sensitivity to amplitude rise times, the sensory cues that trigger neural entrainment. Accordingly, enhancing these characteristics of the speech signal may enhance speech processing by children with dyslexia. To investigate this possibility, we applied an envelope modulation enhancement (EE) algorithm to a 10-minute story read in child-directed speech, enhancing the low-frequency envelope information and amplitude rise times. Children listened to this EE story and the same story as natural speech (NS) while MEG was recorded. The results revealed a significant main effect of both speech condition (NS vs EE), $F(1,37) = 76.54$, $p<.001$, $\eta p2 = .674$ and frequency band (delta vs theta) $F(1,37) = 4896.06$, $p<.001$, $\eta p2= .992$. Spectral power was higher overall in both groups in the delta band than in the theta band, and spectral power was higher overall for the EE speech. The EE story affected neural processing in the power domain for children with dyslexia, particularly in the delta band (0.5-4 Hz) in the superior temporal gyrus. This may suggest that prolonged experience with EE speech could ameliorate some of the impairments shown in speech-brain entrainment by children with dyslexia.

[PS-1.1]

Reading in English: German in childhood and Latin in adolescence

Arturo Hernandez [1], My Nguyen [1], Yinan Xu [1] & Kevin Brown [2]

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To date, few studies have looked at the role of word etymology in lexical access. To fill this gap, we created a database of over 20,000 English words that included reaction times and other variables that are important for word recognition. Three different results will be presented. First, analysis of age of acquisition shows that early learned words have mostly Germanic origins whereas later learned words have mostly Latin origin. Second, results from behavioral data reveal that etymology accounts for reaction times and accuracy during a word reading task in native and nonnative English speakers. Third, phonological network analyses revealed that the giant component (largest connected subgraph) had an overrepresentation of Germanic words. Furthermore, there was additional segregation into Germanic majority and Latin majority communities. Finally, Latin-based words, on the other hand, were in several smaller clusters. Taken together these findings support a bidialectal view of English in that Germanic words serve as the base of lexical processing starting in childhood and persist until adulthood. Implications for models of word recognition in English will be discussed.

[PS-1.2]

Literacy and reading skills of Arabic speaking children with poor linguistic skills

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The development of literacy and reading is a critical milestone for academic achievements and future wellbeing. Identifying children at risk for reading difficulties before the start of formal reading instruction might promote early interventions, remedial education, and might reduce negative consequences.

This study aimed at investigating the relationship between different linguistic profiles at kindergartens and literacy (including letter naming and word recognition) and reading skills (including CV, frequent words, complex words, and pseudo-words). A large sample of 1160 Arabic-speaking children in kindergartens performed a battery of tasks tapping phonological awareness (PA), morphology, syntax, and vocabulary. Factor analysis based on the whole sample was conducted to classify these tasks. Different profiles were constituted and compared across literacy tasks in kindergarten and reading tasks in first grade using non-parametric statistics. The analyses presented in this study showed a clear distinction between PA and non-phonological tasks. Based on this classification, four profiles were constituted: poor language (PL), poor phonology (PPh), poor language and poor phonology (PLPPh), and typical language and typical phonology (TLTPh). Profiles' comparison revealed that both phonological and non-phonological tasks were crucial for literacy development in kindergarten and for reading skills in first grade.

[PS-1.3]

Cognitive mechanisms underlying reading in Spanish

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Reading relies on several foundational skills, including manipulating speech sounds, rapid and efficient access to lexical representations and orthographic knowledge. However, the extent to which these skills explain reading performance varies across developmental stages and languages.

Using a large cross-sectional simple of children (N=2207, primary grade 2 to secondary grade 2) we performed a comprehensive examination of how seven reading-related cognitive predictors influence reading performance in Spanish. A principal component analysis grouped all available tasks, resulting in three phonological components including phonological access, phoneme awareness accuracy; phonological short term memory, and two orthographic components including the encoding of letter identity and letter position within orthographic strings. All components are significant predictors for reading efficiency. Most effects are stable across grades but accuracy in phonological awareness had a significantly stronger effect in lower grades. Sensitivity analyses confirm that the effects are robust across specific reading measures (i.e. words vs nonwords; accuracy vs latency). Thus, phonological and orthographic components contribute to reading in Spanish in a mostly stable manner across childhood to adolescent. Only the accuracy of phonological awareness performance shows a developmental change that reflects the importance of the phonological route, which starts to significantly decrease as readers become more expert.

[PS-1.4]

Pauses as a reading predictor in the standardized assessment of reading skills

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Reading prosody (Chung & Bidelman, 2022; Kim et al., 2021; Walters et al., 2020) and pauses specifically (Dahhan et al., 2017) were shown to be strong predictors of reading in children. However, prosody measures are not widely used in standardized tests of reading assessment and dyslexia diagnosis and are rather considered secondary measures after reading speed and reading comprehension. The current study fills this gap by testing pauses as a reading predictor in a group of 445 children from grades 1-4 (46 children with dyslexia and 399 typically reading children) on material from the Standardized Assessment of Reading Skills in Russian (SARS, Kornev, 1997). The study is currently undergoing PRAAT analysis with the extraction of pause duration from a one-minute audio recording of text reading from each child. Then, a statistical analysis will be run in R. If pause duration predicts reading in our cohort as expected, we consider further research, recruiting more children with dyslexia, applying machine learning algorithms for dyslexia diagnosis, and implementing them into the standardized assessment as a reading measure that is less time-consuming and fully independent of the instructor's annotation.

[PS-1.5]

A case of severe selective developmental letter-identification impairment dyslexia

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In this study, we examine the case of SL, an 11-year-old child in 5th grade with a letter-identification deficit. SL was sent to our lab for a dyslexia examination. As he made many letter omissions and substitutions and was overall unable to read the test, we followed-up with an exam of letter name knowledge for all 26 single letters, presented in upper and lower case. Overall, SL's percentage error for was 35%. Furthermore, SL was strained to complete the task, time to task completion was almost 2 minutes. Follow-up tests showed that his selective deficit does not affect identification of numbers or objects. SL also has great difficulty writing letters but not numbers. As in a previous case of letter identification dyslexia, SL's confuses similar letters (e.g., 'p', 'q', 'b' and 'd'). Furthers test characterize SL's dyslexia and explore the factors that make it difficult for him to identify letters. We also seek to determine if the locus of his dyslexia is located in the visual analyser stage or in phonological processing, per the Dual Route Model of Reading describing different possible dyslexias (Friedmann & Coltheart 2018). SL's case provides a rare opportunity to better understand single-letter processing.

[PS-1.6]

The effect of a specialized Cyrillic dyslexia font, Antidyslexia, on word recognition times

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Several dyslexia-friendly fonts (e.g.Dyslexie) for the Latin alphabet have been developed recently. The first studies testing these fonts showed controversial results, however, none of them measured visual skills for participants with dyslexia. About 30% of people with dyslexia have visual deficiency that dyslexia-friendly fonts were aimed to overcome. In this study, we made an attempt to determine how a specialized font interacts with subjective proneness to visual noise of a participant during word reading. We explored Antidyslexia, a new monospaced Cyrillic dyslexia-friendly font that was unknown to the participants in comparison with a familiar proportional Times New Roman (TNR) font.

12 Russian-speaking adolescents with a high risk of dyslexia took part in the lexical decision experiment. There were 25 high-frequency words and 25 pseudowords in each font. After the experiment participants were asked a few questions about the presence of visual noise symptoms (e.g. rows/words/letters jump) during every-day reading. Mixed linear models showed an advantage TNR over Antidyslexia (significant main effect of font), however, this advantage disappeared with increase of visual noise symptoms (significant interaction between font and visual difficulties). We assume that for a larger sample of dyslexics with visual difficulties Antidyslexia would surpass control fonts. Funded by RSF#23-28-00752

[PS-1.7]

Effect of linguistic properties of words in reading and writing

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Reading acquisition depends on a number of factors, such as general cognitive abilities, preliteracy skills and teaching methods. In addition, the linguistic properties of the words that children are confronted with during reading acquisition are key to the success of the process. In the present study, we assessed the effect of linguistic properties of words on reading and writing performance in 97 first grade Spanish-speaking children. We studied six key linguistic properties: number of letters, number of phonemes, frequency, orthographic structure, consistency of grapheme-phoneme correspondences (G2P) when reading and consistency and predominance of phoneme-grapheme correspondences (P2G) when writing. Results indicate that linguistic properties differentially influence the reading and writing of words. For reading, the critical factors are number of letters and G2P. For writing, the critical factors are P2G, orthographic structure and, to a lesser extent, number of phonemes. This factors, and specially their differential role in reading and writing, should be taken into account when designing literacy interventions.

[PS-1.8]

The influence of orthographic depth on learning and consolidating novel written words

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Orthographic grain size is known to influence readers' decoding strategies. Whilst readers of opaque orthographies (e.g., English) rely on larger orthographic units (e.g., morphemes, letter clusters), readers of most other European languages rely on smaller units. Much less is known about whether orthographic grain size influences orthographic learning and the consolidation of these lexical orthographic representations in long-term memory. Here, we conducted an online study in which readers learned novel written words in a paired association task testing orthographic learning across five learning cycles. The following day, we used an old-new word recognition task to test how well novel words had been consolidated in long-term memory. Monolingual English readers learned English-like written words. Bilingual Welsh-English readers – who are in possession of one transparent and one opaque orthography - learned English-like and Welsh-like novel words (manipulated by bigram frequency) in separate tasks. We will present early data pertaining to the following: Bilinguals learning novel words with Welsh vs. English characteristics will show whether orthographic transparency modulates written word learning and longer-term consolidation. Monolingual and bilingual English-specific data will reveal whether bilinguals' learning of English-like items is implicitly influenced by their knowledge of a transparent orthography, signaling a grain-size accommodation strategy.

[PS-1.9]

Why are we making errors during visual word recognition? Analysis of error distribution during lexical decision in good and poor readers

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The aim of this study was to investigate the origin of errors during visual word recognition in good and poor readers. To do so, Conditional Accuracy Functions (CAF), used in conflict tasks such as the Simon task, were used to distinguish fast and impulsive errors from slow and decision-making errors, by analyzing error distributions as a function of RTs. After having completed reading and reading-related tests, 36 students performed a lexical decision task and a Simon task. Results showed that errors in pseudowords were mostly observed on short RTs, as in incongruent trials, suggesting that performing lexical decisions requires control of irrelevant representations. Error rates in words were constant through RTs, as for congruent condition, in good readers only. Accuracy in words decreased with long RTs in the poor readers group. This result is consistent with the Multiple Read-Out model: the more time passes without word recognition, the greater is the probability that words are categorized as pseudowords. The lack of word recognition would be more frequent in poor readers, characterized by poor reading habits in elementary school potentially leading to weak lexical representations. In visual word recognition, only one of the two types of errors depends on reading skills.

[PS-1.10]

Predictors of reading and writing in a transparent orthography during primary school: Testing for Dual Route and Interactive models

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There is evidence of the influence of sublexical and lexical skills on reading and writing, but these have been usually tested in isolation and in different samples. This study tested the predictive relation of these skills in the same sample according to the assumptions of two models of reading. Dual Route models predict that lexical and sublexical reading skills are grounded on independent mechanisms. In contrast, the Distributed Parallel Processing connectionist model assumes that these skills are associated. Model predictions were tested in a sample of 117 children aged 8 to 10 years learning to read and write in a transparent orthography. Children were assessed in lexical skills (vocabulary, lexical identification), sublexical skills (letter knowledge, pseudoword decoding), and in word reading and writing accuracy. Structural equation models revealed that: (1) Lexical identification was a direct predictor of reading and writing, suggesting a preeminence of lexical strategies; (2) Lexical identification was influenced by vocabulary skills; and (3) there was no influence of decoding on vocabulary or lexical identification. The findings support the Dual Route model as a means to understand reading and writing acquisition skills in Spanish children. Results are interpreted in terms of the transparency of Spanish orthography.

[PS-1.11]

PREVENIR: An oral language intervention program in kindergarten for improvement later reading abilities.

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There is broad agreement that children's general oral language ability in preschool can be considered a unitary factor in predicting future reading development in primary education. This study comprised a pretest-posttest design to evaluate the effectiveness of a Tier 1 intervention program to improve phonological awareness (PA), vocabulary (VC) and morphosyntax (MS). The participants were 65 5-to-6 year-old Spanish-Catalan bilingual children from two public schools with similar educational projects models, working methodologies, equivalent socio-economic and cultural context. The children of one school were randomly allocated as the experimental group and received a total of 30 sessions of intervention. The program comprised three 60-minute sessions per week, one for each component (PA, VC, M) applied by a trained research assistant during 10 weeks. The children of the other school were assigned as a control group and did not receive any intervention. The results indicate that the experimental group showed greater gains in general oral expressive language, phonological awareness, vocabulary but not in morphosyntax in comparison to the control group. A systematic and organized intervention program at an early age boosts different oral language skills. It is expected that these improvements will facilitate later reading abilities in primary education.

[PS-1.12]

Phonemic Perception Skills in Preschool Children with the Familial Risk for Developmental Dyslexia.

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It is already proven that phonemic awareness plays an essential role in forming the reading skills in children. Previous studies showed that insufficient development of phonemic perception skills can negatively influence children's reading behavior, which can be resulted in the development of dyslexia [Vellutino et al. 2004]. Another acknowledged predictor of developmental dyslexia is a familial risk. Children with familial risk can struggle with phoneme discrimination and manipulation [Schaadt, Männel 2013]. This particular project aimed to investigate features of phonemic perception skills in Russian-speaking children 5-to-6 years of age, who were divided in two groups: children without literacy impairments and children at a familial risk of DD. 68 children took part in this research, however, the final sample consisted of the results from 58 children (50 neurotypical participants and 8 participants with familial risk). Phonemic perception skills were assessed using three phonological tests from the RuToPP battery [Dorofeeva et al. 2020]. Intermediate results are the following: t-tests of the results for each subtest between two groups showed "Phoneme discrimination" ($t=0.99$, p-value>0.05), "Lexical decision" ($t=0.72$, p-value>0.05), "Phoneme detection" ($t= 0.15$, p-value>0.05). Regression analysis showed that the familial risk is not a valuable predictor for children's phonemic perception skills (Estimates$=-0.02$, p-value>0.05).

[PS-1.13]

Examining the relationship between phonological working memory, word reading and spelling in beginning and competent readers

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The aim of the study was to investigate the relative contribution of phonological working memory to literacy of beginning (2nd grade) and advanced (6th grade) Hungarian readers. Reading performance was assessed using a one-minute word and pseudoword-reading task; spelling with spelling-to-dictation task, and phonological working memory with a nonword repetition task. Regression analyses demonstrated that the phonological working memory explains 15% of the variance in word-reading in beginning readers. Such a relationship cannot be found among sixth graders. Furthermore, phonological working memory explained 5% variance of pseudoword reading in beginning readers. Again, no such results were observed in advanced readers. Overall, the our preliminary results demonstrates the importance of phonological working memory early in reading development. Later on, however, the disengagement of phonological skills is required to obtain expertise in reading.

[PS-1.14]

Repetition of pseudowords and sentences with pseudowords in children with dyslexia: evidence for the phonological deficit hypothesis?

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Dyslexia is a language-based disorder (Snowling, 2013) that affects reading fluency and comprehension (APA, 2014), the cause of which is not agreed upon. Most hypotheses of cause are based on phonological deficits (Ramus, 2003; Swan & Goswami, 1997). The aim of this study is to investigate phonological processing in typically developing - TD (N = 68) and children with dyslexia - DYS (N= 68) from elementary school using pseudoword (PW) and sentences with pseudowords (SwP) repetition tasks. As we hypothesized, significant differences were found between the two groups in both PW ($Z = -3.605$; $p < .01$) and SwP repetition ($Z = -7.213$, $p < .01$), with TD (M(SD)PW = 11.67(.68), M(SD)SwP= 3.34(1.42)) performing better than DYS (M(SD)PW = 11.01 (1.25), M(SD)SwP = 1.50 (1.47)). However, not all inherent features of pseudowords were associated with children's performance (e.g., PW length was significantly connected to performance of DYS ($r = -.7$, $p > .05$), but not the TD). Our results are consistent with previous studies (see Zhang & Peng, 2022) and compatible with phonological deficit theories. This is an ongoing study - further analysis will investigate linguistic features that influence children's results, also regarding the peculiarities of the Croatian language.

[PS-1.15]

Phonological awareness is a critical determinant of reading and writing abilities in children with DLD

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Oral language ability is an important predictor of reading and writing development. This study examines the role of oral language skills as longitudinal predictors of reading (decoding and comprehension) and writing (orthography and written expression) in children with Developmental Language Disorder (DLD). A total of 58 Catalan-Spanish speaking children, 31 children with DLD and 27 typical development children with participated in a two-wave longitudinal study. In T1, all participants were assessed using the Nonverbal Kaufman Brief Intelligence Test, Non-word repetition test (NWRT) and CELF-4-Spanish. Two years later, all the children were assessed in reading and writing abilities using PROLEC-R and PROESC. Results showed an advantage of the TD group in decoding, reading comprehension, orthography and written expression. For children with DLD, phonological awareness and expressive vocabulary were predictors of decoding and phonological awareness, and concepts and following directions were significant predictors of reading comprehension. Additionally, NWRT and phonological awareness were significant predictors of orthography, and NWRT and word association were predictors of written expression performance. Our findings show that oral language difficulties in children with DLD affect their reading and writing learning and highlight the role of phonological awareness in literacy development.

[PS-1.16]

Acoustic Durations of Speech Production of Children with DLD

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[1] BCBL

Developmental language disorder (DLD) is often associated with poor phonological processing and reduced duration awareness of phonological segments. We examined whether a phonological deficit impacts word and vowel duration, and if suprasegmental stress affects syllable duration differently in speech production of children with DLD and typically developing (TD) peers. We investigated total word duration as well as stressed and unstressed vowel duration. Thirty-eight Basque-Spanish bilinguals, 4 to 9 years old, participated in this study: 19 children with DLD and 19 TD children. Participants completed a nonword repetition task in Basque, containing nonwords varying from 2-5 syllables. For correctly repeated items, data were obtained for the duration production of the whole nonword as well as for stressed and unstressed vowels. Stressed and unstressed duration ratios by word were also calculated. We hypothesized that children with DLD have longer productions for word total durations and show reduced effect of stress in their productions compared to TD children. Group effects were analyzed on total duration and vowel stress duration to better understand speech production in children with DLD.

[PS-1.17]

Can Rapid Automatized Naming be used for intervention programs targeting reading fluency?

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Rapid automatized naming (RAN) is among the most reliable predictors of reading. However, RAN is rarely used for other purposes than assessment and a very limited number of intervention studies with RAN have been conducted. To date, only two have produced significant and convincing results. The present study investigated the effects of a RAN intervention program with dyslexic participants, using objects and digits RAN tasks.

Forty-two dyslexic children aged 8-12 took part in the study. Children trained online at home under parental supervision four times a week over six weeks. One-third of the participants participated in a RAN-objects training, one-third in a RAN-digits training, and the last third was put on a waiting list, to do puzzles. During the training, all participants did the same lessons – provided by the experimenters – with their Speech and Language Therapists (SLP). Pre and post-test sessions were conducted by SLP. Children were post-tested twice: immediately after the intervention and four months later. Data collection has just finished, and results will be computed and presented at the conference. Dyslexic children will be compared to 122 typically developed children in the same age range who underwent the same training protocol.

[PS-1.18]

An environmental dimension to Rapid Automatized Naming (RAN)

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Rapid Automatized Naming (RAN) has been identified as one of the main predictors of reading performance in typically developing children and in children with reading disorders. According to several authors, the correlation between RAN and reading can be explained by shared underlying cognitive processes such as processing speed, visual processing and phonological abilities. We assessed 57 French-speaking children in their last year in kindergarten (mean age: 5;8 years; SD: 3,7 months) with two RAN tasks (colors and objects) and several other tests assessing phonological abilities, processing speed, oral language, nonverbal ability, working memory, concept of print, verbal fluency and early reading and writing skills. Significant correlations were found between performance on RAN tasks and most of these skills. However, when Home Literacy Environment (HLE) was controlled for, all the correlations became non-significant, except for the ones with reading, as it may be expected, and verbal fluency. While the persistent correlations with verbal fluency could be explained by similar underlying processes between both tasks, the no longer significant correlations with the remaining measures suggest that environmental factors play an important role in RAN performance. These factors have been generally neglected in previous studies exploring the underlying processes in RAN.

[PS-1.19]

Double trouble: phonological deficit and double deficit hypotheses are viable in Croatian

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An increasing amount of research focused on importance of language development for (early) reading (Bishop & Snowling, 2004; Catts & Kambi, 2005). Nevertheless, the specificity of literacy pre-skills in preschool children with (risk for) development of language and/or literacy difficulties in Croatian have not been fully explored. Our aim was to examine the characteristics of phonological processing children at risk for developing reading disorder. Using the screening Test for assessing reading and writing pre-skills (PredČiP; Kuvač Kraljević & Lenček, 2011), preschool children at risk for developing reading disorder/dyslexia (DYS; N = 20) were singled out due to poor performance in the Phonological Awareness block (PA), which is consistent with the phonological processing deficit theory of dyslexia cause (Reid, 2016; Swan & Goswami, 1997). Those children were paired with their typically developing peers (TD; N = 19). Statistically significant positive correlation between children performance on PA and rapid automatized naming (RAN) ($r = .433$; $p > .01$) was found. Results are in line with the double deficit hypothesis (Wolf & Bowers, 1999). This is a preliminary study, but it already shows the need for examination of all components of phonological processing in research and practice, especially in Croatian as transparent language.

[PS-1.20]

Cognitive correlates of reading in Braille and print readers

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The cognitive correlates of reading are similar between different scripts; however, the strength of the relationships may change depending on the writing system. We compared Braille to print reading in 53 early blind and 53 sighted Polish-speaking subjects (age: 9-60) who acquired reading using different sensory modalities. Polish Braille offers a good opportunity for a direct comparison of visual and tactile reading since every Braille letter and symbol has its exact analogue in the Polish alphabet and the phoneme-grapheme mappings are conserved.

Blind subjects turned out to be more proficient in phonological awareness (PA) tasks than sighted subjects. Additionally, the relationship between PA and reading was different between the groups and interacted with age. In the blind, PA explained a significant proportion of variance of reading efficiency in school-aged Braille readers only. Rapid automatized naming (RAN) turned out to explain a significant amount of reading skills variance, independently of the reading modality. Tactile reading seems to alter behavioral and cognitive correlates of reading. Change in the modality of reading does not seem to change the trajectory of literacy development, however, it may change the pace at which reading is acquired.

[PS-1.21]

The effect of visuo-attentional training on the acquisition of reading in the Arabic language

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The Arabic script is ranked among the most complex scripts after Chinese, Korean, and Japanese. Several studies have shown the negative impact of Arabic orthographic complexity (letter diacritics and allography) on letter identification, reading, and writing skills. The goal of this research is to develop tools for training cognitive visuo-attentional processes in order to improve children's letter identification, reading, and writing skills. Lebanese first and second graders will participate, divided into an experimental group (N=120) and a "business-as-usual" control group (N=120). The experimental group will receive 36 sessions of visuo-attentional training, each lasting about 20 minutes. The students' performance progress will be evaluated (pre-post training comparison) in comparison to untrained control group. The data collection is currently being held. We expect that the experimental group gains significantly more than the untrained group on measures of visuo-attentional span, letter identification, and reading-writing skills. The validation of the effects of this visuo-attentional training protocol in normal readers will open avenues for future research with dyslexic children. The objective is to offer a first experimental validation of the training protocol, followed by validation on a larger scale in ecological conditions.

[PS-1.22]

Effects of visual noise (fog) on the recognition of words in traffic signs in adults with and without dyslexia

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Fog can considerably affect the information we can obtain from traffic signs while driving. On the other hand, some psycholinguistic studies have found interactive effects of noisy visual stimuli and dyslexia on word recognition, in particular, the impact of visual noise in a lexical decision task is higher in children with dyslexia than in controls. Therefore, the effects of fog on word recognition can be expected to be greater in adults with dyslexia than in normal-reading individuals, which would be of particular relevance to the driving context. To test this hypothesis, we carried out an experiment comparing the effects of visual fog on the recognition of city name signs in adults with dyslexia and normal-reading adults, matched in age, gender, intelligence, and driving experience. Participants were presented with traffic signs showing a word to decide if it was a city name or an invented name (lexical decision). The signs were presented dynamically, simulating the visual expansion of the sign for a driver approaching to it. Stimulus quality (fog or clear) was manipulated by block within-participants. We analysed the interaction between stimulus quality and dyslexia on both response accuracy and response latency.

[PS-1.23]

Do adults with dyslexia differ in the capacity and duration of iconic memory?

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3 ERI-Lectura

Iconic memory retains, for a short time, visual information of a stimulus. Some previous studies have reported results suggesting that individuals with dyslexia differ from controls in IM, but the question remains unclear. The present study addressed the issue focusing on two main aspects of IM: capacity, and duration. A sample of adults with dyslexia and a control group completed two partial report tasks. In both tasks, on each trial, six different stimuli in a circular array were briefly presented. Then, a cue indicating the target/s was given. Participants responded by using a keyboard. All stimuli were 'pseudoletters', i.e., new visual characters, not requiring phonological processing. In one of the tasks (IM capacity experiment), the participant was asked to identify the three stimuli which were at the upper or lower part of the array, as indicated by acoustical cues. The percentage of correct identifications was analysed as a function of group. In the other task (IM duration experiment), the participant was asked to identify the stimulus that was at a particular location, indicated by a small line, and cue delay was manipulated within participants. The percentage of correct identifications was analysed as a function of group and cue delay.

[PS-1.24]

Perceptual Span during Silent Reading in Russian Adults and Children

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Perceptual span is the amount of information that people can perceive within one fixation. The aim of our study is to describe the standard size of the perceptual span in Russian as well as evaluate whether different language skills contribute to it. 86 young adults and 41 schoolchildren of grades 3-4 completed a battery of linguistic tests and an eye-tracking task with a moving window paradigm. We found that adults' perceptual span consisted of 14 characters to the right of the fixation point, whereas children's span was about 10 characters to the right of the fixation point. Neither in adults, nor in children the size of the perceptual span correlated with language skills.

[PS-1.25]

Correlates of cognitive control during artificial letter-speech sound learning in typical and dyslexic readers

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Despite the high co-occurrence of dyslexia and ADHD, it remains ununderstood how attentional processes influence the initial formation of the neurocognitive reading network, i.e., setting-up mappings of written onto spoken language representations. We aimed to mimic this initial phase of reading acquisition using an artificial letter-speech sound (L-SS) learning paradigm and assessing three relevant correlates of cognitive control. (1) To manipulate goal-directedness, 71 school-aged children with dyslexia and 59 age-matched controls received goal-directed or implicit instructions before the L-SS learning task. (2) Post-error slowing was examined in addition to behavioral learning outcomes, and (3) feedback-related negativity (FRN) ERPs were assessed as a measure of performance monitoring. Most children were able to learn the new script, but with large inter-individual variability and without main effects of instruction or reading group (children with dyslexia vs. controls). Individual differences in learning outcomes will be further investigated by examining the association between the FRN and children's individual behavioral performance. More insight into these neurocognitive mechanisms is highly relevant for understanding the mechanisms that underlie potential audiovisual integration deficits at the early reading stage that hamper reading fluency, and how these can be translated into clinical practice and education.

[PS-1.26]

The short-term effects of play on reading and sensorimotor skills in young adults

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Mammals, and in particular humans, spend a large part of their childhood playing. Video-gaming has become one of the most diffused forms of play. The transient cognitive enhancement driven by positive emotions linked to play induces a cascade effect on reading and sensorimotor skills of children with developmental dyslexia and coordination disorder. Since the play activity is maintained in humans even after childhood, we hypothesized that the beneficial effect of fun play could be observed also in adults. We compared the short-term effects induced by a puzzle board game and by Mario Kart video-game in sensorimotor and reading skills in 62 young adults of which sixteen were identified as poor readers because their reading abilities were lower -2 standard deviation.Mario kart, which was the funnier and more activating game, enhanced sensorimotor abilities in the entire sample of participants, whereas a reading speed improvement was observed mainly in the poor readers. Thus, also in young adults with poor reading skills, fun play appears to increase reading speed, probably enhancing their sensorimotor neural network.

[PS-1.27]

Two cups of coffee to improve text reading abilities, semantic association and to make activities more fun

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The psychostimulant effects of caffeine have been investigated through numerous studies that have shown improvement in global perception of stimuli, typically associated with the right brain hemisphere. To investigate the cognitive and psychophysiological effects of caffeine, we involved a sample of 54 healthy young adults in a crossover double-blind, randomized placebo-controlled trial. We supposed that 200mg of caffeine could improve reading and semantic abilities in connection with an improvement of positive emotion. We administered caffeine or a placebo to the participants and invited them to play a board game for 25 minutes. At the end of the game session, we asked them to evaluate the game and their activation state. Then, we administered text reading and semantic association tasks. Our study shows an improvement in reading speed and in the ability to find semantic associations between words following the administration of a single dose of caffeine. Even more interesting is the effect on heart rate variability and perceived emotion: participants report that the same game activities performed during the two experimental sessions are more fun only after caffeine intake. These effects are not related to sleep deprivation or other types of self-perceived psychophysiological activation.

[PS-1.28]

Workplace cognition in adults with dyslexia: Evidence from a virtual reality office setting

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While the need to support the cognition of adults with dyslexia in workplace settings is recognised, there is a lack of direct evidence to indicate where it should be focused. To address this gap in the literature, cognition in a non-immersive virtual reality office environment was investigated. The tasks were designed to draw upon two important areas of cognition in everyday life, executive function (higher-order cognitive abilities) and prospective memory (memory for delayed intentions). Adults with and without dyslexia were asked to imagine that they were an office worker on their first day of work tasked with setting up a room for a meeting according to certain instructions and constraints. The adults with dyslexia produced lower levels of performance in planning, selective thinking, and prospective memory when it was either time- or event-based, while not differing from adults without dyslexia in other areas. The profile of cognitive performance obtained from this virtual office environment indicates where support for adults with dyslexia can be most appropriately focused in the workplace (either through strategy usage or through technology) and how areas of strength can be harnessed to improve cognition at work and thus enhance job satisfaction and advancement.

[PS-1.29]

Metaphor processing in dyslexia: weakness or strength?

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Several studies have tried to explain the underlying causes of deficiencies in figurative language tasks in people with neurodevelopmental disorders. As far as dyslexia is concerned, observed issues have been attributed to difficulties in language competence, such as reduced semantic knowledge, but also to pragmatic impairments. This contribution wants to shed light on how adults with dyslexia process metaphors, and whether individual differences in executive functioning affect online and offline metaphor comprehension. We conducted a first study with eye-tracking where participants had to select the picture that best corresponded to the metaphorical sentence they were listening to, and a second one that measured automatic metaphor processing through a semantic judgment task. Findings showed that dyslexics need more time to reach the metaphorical meaning, but their eye-patterns and answers were comparable to those of non-dyslexic people. Thus, dyslexic adults seem not to be impaired – just slower – in metaphor comprehension. A third study (planned for Spring 2023) is aimed at considering metaphors in context. Since this figure is frequently used to convey abstract meanings with concrete imagery, we are going to investigate whether metaphor is an aid or an obstacle to text comprehension and information retention in students with dyslexia.

[PS-1.30]

Do psycholinguistic and discourse features determine the choice of keywords? Evidence from text adaptations for people with dyslexia

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Keywords (KWs) capture the main ideas of a text (Rello et al., 2014). Highlighting KWs is an effective reading strategy for people with dyslexia (PwD, Ikeshita et al., 2018). To facilitate text comprehension, it is recommended that KWs should be frequent and familiar words (Domíniguez, 2014; Scot, 1997). The properties of the KWs selected by experts have hardly been investigated. The aim of this study was to investigate (psycho)linguistic features of KWs selected by speech and language pathologists - SLPs (N = 78) as experts in language adaptation of materials for PwD.

The material was descriptive discourse from the Croatian standardized high school exit exam. Results revealed individual differences in the selection of KW. There was no correlation between the selection of KWs and their subjective frequency in Croatian. A moderate positive significant correlation was found between the selection of KWs and their familiarity ($r = .39$, $p < .01$). This study showed that psycholinguistic features of words cannot alone explain the selection of KWs. Further qualitative analyses revealed that role in discourse and informativeness are important for the selection of KWs, which is consistent with the explanation that KWs facilitate comprehension in context (Pressley et al., 1981).

[PS-1.31]

Dyslexia Screening Methods among Juvenile Offenders in the United States

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Purpose: Recent legislation requires the US Federal Bureau of Prisons to screen inmates for dyslexia during intake. However, implementation has been challenging. To clarify best practices for identifying dyslexia among juveniles held in correctional facilities, we synthesized the research on how literacy screenings have previously been conducted in this population.

Method: Following PRISMA-ScR guidelines, this scoping review identified screening methods from studies conducted in US prisons between 1990-2022. Nine studies met our inclusionary criteria and were systematically examined for screening methodology, quality of screening tools, operational definitions, and prevalence of reading disability. Results: Five screening methods were identified: computerized screening, self-report, parent-report, review of school records, and norm-referenced measures. Two studies reported reliability/validity; none reported sensitivity/specificity. No two studies used the same criteria to define reading disability, so prevalence estimates varied widely. Conclusion: Reading ability is a predictor of recidivism, so it is important to identify and treat reading problems in prison populations. Though the US incarcerates more individuals than any other nation, surprisingly few empirical studies have been conducted which report literacy screening methods in this population. Identifying best practices for implementing psychometrically sound dyslexia screening programs in US prisons requires additional research, likely informed by studies conducted internationally.

[PS-1.32]

Comparing online versus in person assessment of learning skills in children

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Background: Interactive telemedicine applications have been progressively introduced in clinical assessment of learning dis(ability). However, there is still a lack of research focusing on the validity of this methodology in assessing Specific Learning Disorder (SLD). We investigated the validity of a remote assessment of learning disabilities. Methods: Seventy-nine children including 40 typical children-TC (18 males, age 11.5±1.06) and 39 children with SLD (24 males, age 12.3±1.28) took part in the study. Each participant underwent the same neuropsychological battery (assessing reading -accuracy, speed and comprehension, writing and math) twice, once during an in-person session and once during a remote videoconference. Four groups were defined based on the presence/absence of SLD diagnosis and the administration order (i.e, Remote/In-person or In-person/Remote). Repeated Measures ANOVAs were run to analyze the interaction between diagnosis, assessment type and administration order, controlling for the learning effect (second vs. first assessment). Results: The assessment modality did not reveal any significant difference for any of the assessed skills; a main effect of diagnosis and of learning effect were found for all the assessed skills. Conclusion: These findings demonstrate that the use of remote screening is reliable. Accordingly, its use can be hypothesized at least for research purpose.

[PS-1.33]

Investigating print exposure and self-perception of reading in adults with developmental dyslexia

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Within the dyslexia literature the Matthew effect (which suggests that the gap between good and poorer readers widens across time) has been significant in understanding the trajectory of reading development. This is thought to lead to readers with dyslexia engaging less with text, in particular for enjoyment. Here we present preliminary results which examine the relationship between print exposure (measured via the Author Recognition Task), and self-perception of reading ability and enjoyment in highly compensated adults with dyslexia. We found no differences between adults with and without dyslexia for print exposure. On self-report measures however adults with dyslexia rated their own reading ability and enjoyment as being lower than that of their peers. We interpret these results in the view of participants' self-perception of reading difficulty influencing their reading self-concept, which may then negatively affect their reading habits and reading enjoyment.

[PS-2.1]

Interactions between parental education and dyslexic susceptibility variants and genes on reading abilities in Chinese children: Evidence for differential-susceptibility model

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While genetic and environmental factors have been shown as predictors of children's reading ability, the interaction effects of identified genetic risk susceptibility and specified environments for reading ability have rarely been investigated. The current study assessed potential gene-environmental (G×E) interactions on reading ability in 1589 Chinese school-aged children. The gene-environment interactions on character recognition and reading fluency among Chinese children were investigated by an exploration analysis between parental education (PE) and the risk single-nucleotide polymorphisms (SNPs) which were discovered by previous genome-wide association studies of developmental dyslexia (DD), as well as between PE and cumulative genetic score (CGS) of 13 SNPs in KIAA0319 and CGS of 20 SNPs in DRD2, two well-known dyslexic susceptibility genes. Re-parameterized regression analysis was employed to test competitive G×E theories of diathesis-stress and differential-susceptibility. Results showed that dyslexic susceptibility variant of rs281238 and DRD2 exhibited significant interaction with PE on character recognition of Chinese children, while KIAA0319 exhibited significant interaction with PE on reading fluency of Chinese children. The re-parameterized regression analysis suggested that these G×E interactions all conformed to the differential-susceptibility model. These results offer the initial supports for differential-susceptibility model for G×E in reading ability.

[PS-2.2]

Intergenerational transmission effects of parental education and reading history on children's reading abilities: Differential influences from mothers and fathers

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Parents have important genetic and environmental influences on the offspring, known as intergenerational transmission effects. Specifically, parental education and reading history have been shown strong intergenerational transmission to children's reading abilities. Yet, how parental education and reading history impacted children's reading abilities has been rarely investigated. Here, we recruited 764 Chinese families with children aged 9 to 11 years to explore this issue. Parents self-reported their educational levels and reading histories using Adult Reading History Questionnaire (ARHQ), which involves three dimensions: current reading, dyslexia symptoms and memory. Children's reading, phonological and morphological skills were measured. Results showed that for mothers, dyslexia symptoms predicted children's reading and phonological skills (genetic influence), while current reading predicted children's morphological skills (environmental influence). In contrast, for fathers, only current reading weakly predicted children's phonological speed (environmental influence). In addition, mother's dyslexia symptoms influenced children's reading abilities through mediation of children's phonological skills (genetic influence) and chain mediation of mother's education to children's phonological skills (environmental influence). Comparatively, parental current reading was largely influenced by parental education before it exerted influences to children's reading-related skills (environmental influences). Our results shed light on intergenerational transmission of reading abilities and suggest differential influences from mothers and fathers.

[PS-2.3]

Shaping your world: A qualitative examination of the role of the unshared environment in monozygotic twins with discordant reading difficulties

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Purpose: The main purpose of the project is to pinpoint key environmental factors that are unique to the environment of monozygotic twins with reading difficulties when compared to their typically performing concomitant When looking at within-pair comparisons of the discordant pair, diversity in cognitive profiles suggest multiple genetic and environmental pathways exist which can lead to reading difficulties later in life. The main purpose of this poster is to pinpoint key environmental factors that are unique to the environment of monozygotic twins with reading difficulties when compared to their typically performing concomitant. We looked at MZ twin pairs where only one of the twins had difficulties and the other twin typical reading skills (discordant pair, n = 40) and characterized qualitative differences in environmental contexts. The role of school support is explored, alongside peer group selection and post-secondary pursuits.

[PS-2.4]

The READ1 deletion and neural activation during magnocellular-dorsal visual tasks: An fMRI in developmental dyslexia

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Background: Reading (dis)ability is a complex heritable trait. The READ1 deletion (READ1d) has been associated with reading (dis)ability and a specific neurocognitive dysfunction tapping the magnocellular-dorsal (MD) stream in both subjects with developmental dyslexia (DD) and typical readers (TR). In a sample of children with reading ability ranging from DD to TR, we hypothesized that READ1d can be associated to alterations of brain activations during an fMRI MD task, i.e., sensitivity to motion coherence (MC). Methods: We performed a GLM analysis with neural activation as dependent variable, presence/absence of READ1d and sex as fixed effects, and reading skills, the interaction between reading skills and READ1d (Read*READ1d), IQ, attention and age as covariates, to test whether Read*READ1d was differentially associated with neural activation during MC. Results: Neural activation during the MC in the left frontal opercular area was significantly modulated by the Read*READ1d interaction, showing a reduced neural activation in children with DD. Conclusion: Our findings demonstrated that READ1d and reading skills jointly modulate the neural activations in brain areas involved in the reading brain network during fMRI MD tasks. In children with DD, the presence of READ1d led to hypoactivation compared to its absence; in TRs, the presence of READ1d seemed to have an irrelevant effect upon neural activations.

[PS-2.5]

The effect of parental stress on child´s long term language and literacy outcomes: A contextual explanatory model

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Multiple cognitive deficit models propose a multifactorial etiology to developmental disorders where the combination of risk and protective factors determines a child´s outcome. A contextual approach raises the possibility that environmental, particularly family related factors, may influence the development of basic skills which modulate long term linguistic and literacy abilities. This study explored the longitudinal influence of home literacy environment and family stress on the development of phonological processes involved in language and reading. 112 children (mean age 5,8 years) were tested on phonological short term memory and phonological awareness when they entered first grade and on decoding and vocabulary abilities one year later. Parents provided information about stress, home literacy activities and child´s ADHD symptoms. Structural equation models (SEM) were tested including parental stress and ADHD symptoms as predictors of phonological short term memory and vocabulary in Time 2 (language model), and of phonological awareness and decoding in Time 2 (reading model) . In both models, path weights revealed a direct influence of parental stress on both ADHD symptoms and phonological skills, which influenced later vocabulary and decoding outcomes. Results underlie the contribution of parental stress on the emergence of cognitive risk factors that hamper language and reading development.

[PS-2.6]

Binaural Temporal Fine Structure sensitivity development in children with developmental dyslexia.

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Binaural Temporal Fine Structure (bTFS) is important for attending to sound sources in challenging environments such as noisy classrooms. By the Temporal Sampling theory of developmental dyslexia (Goswami, 2011), perception of bTFS in speech may be preserved in children with dyslexia. The upper frequency limit of bTFS sensitivity was found to be significantly lower for typically-developing children than for young normal-hearing adults (YHNA) (Flanagan et al.,2021). Here we investigate the development of bTFS sensitivity in children with dyslexia, utilising the methods developed in Flanagan et al., (2021). 60 children with developmental dyslexia participated in the study (age 84-115 months). We assessed the highest frequency at which an interaural phase difference (IPD) of 30° and 180° can be distinguished from an IPD of 0°. Compared to YNHA, bTFS sensitivity was significantly worse ($p < .001$) for both levels of phase difference tested, replicating the findings of Flanagan et al. (2021) for children without reading impairments. Compared to the typically-developing children tested by Flanagan et al., (2021), who were matched in age, there was no significant difference in performance at either phase difference tested ($p>0.05$). These results suggest that development of binaural TFS is similar for poor readers and typically developing readers.

[PS-2.7]

Seeds of literacy: Auditory rise time discrimination in infancy and pre-reading abilities in preschool

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Amplitude rise time (ART) sensitivity is a significant correlate of individual efficiency of neural speech encoding and phonological and literacy skills. Specifically, this sensory ability is impaired in individuals with dyslexia and related to their phonological deficits. Our previous research showed that ART discrimination is also impaired in 10-month-olds at family risk for dyslexia (Kalashnikova et al., 2018). Here, we extend this finding in a longitudinal investigation of ART discrimination from infancy to pre-school in at-risk (AR; children with a dyslexic parent) and not at-risk (NAR) children, and its longitudinal and concurrent relations with children's language and pre-reading skills. Children completed ART discrimination tasks at 10 and 60 months, as well as standardized tests of phonological processing, letter knowledge, receptive vocabulary, and grammar at 60 months. Results showed significant correlations between 10-month ART sensitivity with 60-month phonological processing and letter knowledge, and 60-month ART sensitivity with concurrent phonological processing, letter knowledge, and receptive vocabulary. This indicates that early ART sensitivity plays a role in the development of reading-related abilities in AR and NAR children, but not general language abilities (no correlations with grammar were observed). We will discuss these findings in relation to Temporal Sampling theory (Goswami, 2011).

[PS-2.8]

Can speech perception problems cause phonological short-term memory dysfunction?

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Phonological short-term memory (pSTM) difficulties are characteristic of both dyslexia and Developmental Language Disorder. Perceptual deficit accounts attribute pSTM dysfunction to deficits in speech-sound processing, which may lead to inadequate phonological representations. We assessed this explanation by experimentally disrupting speech-sound discrimination in a pSTM task with typical adult listeners. We used automated audio-morphing to create syllables with varying perceptual ambiguity, drawn from 16 letter-letter ("B"-"P") and letter-word ("B"-"we") continua. When participants (N=36) recalled 6- and 8-item sequences of these syllables, recall was better for low-ambiguity speech than high-ambiguity speech. However, our simulation of a perceptual deficit only affected pSTM for letter-letter and not letter-word ambiguities. Letter-letter ambiguity again impaired recall in a second pSTM experiment (N=26), but didn't affect recall of low-ambiguity syllables within the same sequence. In summary, the effect of perceptual disruption on recall was restricted to highly confusable response alternatives, and did not recreate the pattern of performance observed in individuals with dyslexia and DLD. A further experiment found that individual differences in speech acuity were not strongly related to variation in pSTM span (N = 77). We conclude that poor speech-sound discrimination is not a convincing causal explanation for pSTM dysfunction in reading and language disorders.

[PS-2.9]

Speech disfluencies in children with developmental dyslexia: how do they differ from typical development?

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Background: Disfluency is a multifactorial concept that can be linked to several production levels, both in typical and atypical populations. In children, disfluency patterns are poorly informed: in Typical Development (TD), language-dependent discrepancies are reported and in Developmental Dyslexia (DD), the pattern of disfluency is not known.

Methods: Seven types of disfluencies were coded in autobiographical narrative: part-word repetitions; repetitions of monosyllabic words; filled pauses; abandoned utterances; other repetitions, substitutions and revisions. We compared the proportion of each disfluency in DD (N=25) and TD (N=21). Spearman correlations were performed between disfluencies, reading performance and age. Results: Our results showed that both DD and TD children mainly produced filled pauses, repetitions of monosyllabic words, and substitutions. In both groups, children had a high rate of disfluency (>10%). Correlations with reading performance were significant in the TD group only. Conclusion: Our study showed that DD in not characterized by a specific pattern of disfluency, and the type of disfluencies produced was stable in children aged from 8 to 12 years old. In contrast to other languages, our study suggest that French-speaking children have a high rate of disfluency, which calls for caution when interpreting disfluency in TD.

[PS-2.10]

Children and adults with developmental dyslexia are impaired in Incidental learning of complex sound categories

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Procedural learning mechanisms subserve the acquisition of speech categories especially under incidental learning conditions. We examined how child (10-11 years old) and adult (18-30 years old) participants with dyslexia and age-matched control participants, incidentally learn complex non-speech auditory categories. Participants performed a visual location detection task in which, unknown to them, sound categories predicted the visual target. Dyslexic adults gained less in practicing the visual task but developed as large a performance dependence on the sound categories, indicating incidental auditory category learning, as their typical peers; they were less adept in generalizing to novel sound exemplars. Dyslexic children showed no evidence for category learning, unlike their typical peers, despite intact perceptual acuity for similar sound exemplars. These results suggest a reduced propensity to generate nonlinguistic sound categories in incidental learning conditions in children with dyslexia. This reduced propensity may impact the resolution of phonological representations and, in turn, reading ability.

[PS-2.11]

The relationship between speech production and phonological processing in children learning to read

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It is widely accepted that the deficits in dyslexia stem from a broad deficit in perceiving and manipulating speech sounds. However, little is known about whether these deficits impact speech production in this population. This line of research is especially relevant considering the literature showing a robust relationship between speech perception and production. Here, we examine the relationship between phonological processing and speech production in children ages 6-7. Ten children speaking Spanish and Basque were tested on a battery of speech production tasks (picture naming, word/nonword repetition) in repeated productions and a battery of phonological processing tasks. Acoustic parameters associated tapping into production variability were extracted, where the main hypothesis is that higher variability rates will be associated with children with poorer phonological processing ability. Preliminary results from this experiment will be presented together with a discussion on how they relate to theories on the underlying deficits in individuals with poor reading skills and the relationship between perception-production in this dyslexia.

[PS-2.12]

Visual and auditory temporal processing in relation to attention and noise exclusion in adult university students with dyslexia

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Developmental dyslexia (DD) is one of the most prevalent neurodevelopmental disorders, defined as severe and persistent difficulties with accurate or fluent word recognition and spelling despite adequate instruction and remedial support, normal intelligence and no sensory deficits.

Prevalence estimates depend on the diagnostic criteria, but generally 5-7% of the population presents DD. While a core phonological deficit was the predominant explanation of DD for many years, growing evidence suggests that a single phonological deficit cannot fully explain the heterogeneous phenotype of this disorder. In this cross-sectional study 43 dyslexics and 20 controls, all adult university students, underwent a cognitive battery in which their phonological and orthographical skills, reading and spelling skills, intelligence and vocabulary were tested. Auditory and visual attention, temporal processing, and text-in-noise and speech-in-noise perception were also tested. Dyslexics were significantly less accurate than controls in temporal order judgement tasks in both modalities, with and without background noise. They were also less accurate in a visual search task. Dyslexic participants had a significantly higher text reception threshold than controls, and there was a trend, although not significant, for higher stream segregation threshold in the auditory modality. These results might indicate a cross-modal temporal processing deficit.

[PS-2.13]

Disentangling the relationship between phonological awareness, executive functions and rhythmic abilities : A pilot study

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Developmental dyslexia is a common neurobiological learning disability. However, the nature of the underlying multiple deficits remains unclear. Considerable research points to deficits in phonological awareness (PA) and executive functioning (EF), but few studies have explored the direction of the relationship between them. The temporal processing hypothesis suggests that speech sound processing in a specific time frame is crucial to PA skills. Given rhythm's significant role in the temporal processing mechanisms of both music and language, accumulating evidence points to music-based interventions as a promising tool in literacy development. Musical training offers a multimodal approach to enhancing both PA and EF, and shows near or far transfer effects in various cognitive functions such as reading, intelligence, auditory, motor, and temporal processing. However, a deeper understanding of the relationship between EFs, PA and rhythmic ability (RA) is necessary. To investigate this question, thirty 5-year-old Dutch-speaking children in the third year of kindergarten were evaluated on their cognitive inhibition (CI), RA and PA abilities. We expect to find a significant positive relationship between CI and RA, and PA and CI, in children with a musical background. A path analysis will explore the relation between these variables, accounting for the children's musical background.

[PS-2.14]

The contribution of listening effort to cortical tracking of speech and its relation to phonological and reading skills in distinct adverse conditions

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Listening effort varies with the difficulty of a listening condition. Two distinct adverse conditions affecting speech signals differently are background noise and reverberation. Yet, no studies have examined how varying levels of listening effort induced by those listening conditions could affect intelligibility and cortical speech tracking, a phenomenon that plays a critical role in phonological skills development. The aim of this study was to examine how these adverse conditions affect listening effort, intelligibility, and cortical speech tracking. Furthermore, relations to phonological and reading skills were examined, since the stability and quality of phonological representations accessed during speech listening might modulate listening effort and cortical speech tracking. Forty-nine normal hearing adults participated in the study. Electrophysiological responses were registered with electroencephalogram while listening to sentences presented in quiet, cafeteria noise, and reverberation. Listening effort was estimated subjectively using self-report and objectively using pupillometry. Results indicated that more distortion of the temporal envelope in reverberation led to higher listening effort reflected by higher subjective scores, increased pupil diameter, and stronger cortical speech tracking at delta band. Phonological and reading skills positively correlated only with subjective listening effort scores in cafeteria, suggesting a special role of expert language skills in processing this condition

[PS-2.15]

Cortical tracking of language structures: Modality-dependent and supra-modal responses

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Given the hierarchical nature of human language, it requires the mental parsing of various linguistic units. While cortical tracking of speech has been shown to be an integral part of auditory language parsing, the neurophysiological substrates for written language parsing are still unclear. To address this issue, in the present study we investigated modality-dependent and supra-modal cortical processes for spoken and written language tracking. We recorded electroencephalographic (EEG) responses from participants exposed to auditory and visual streams of either random syllables or tri-syllabic real words. Using a frequency-tagging approach, we analyzed the cortical tracking of physically presented (i.e., syllables) and mentally constructed (i.e., words) linguistic units and compared them between the two sensory modalities. We found that the cortical tracking of syllables is partially modality dependent: anterior and posterior scalp regions showed selective involvement in the tracking of spoken and written syllables, respectively. The cortical tracking of spoken and written words instead was found to involve a shared anterior region, suggesting a supra-modal process for word tracking. Our study shows a gradient of modality-(in)dependence during the online processing of auditory and written language, with modality-specific parsing of physical properties and supra-modal parsing of mentally constructed linguistic units.

[PS-2.16]

DyslexNet - building a neural network for classifying dyslexia from cortical activity

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Dyslexia is a reading disorder rooted in a phonological deficit that precedes formal reading tuition. This deficit has been linked to atypical cortical processing of speech in the right hemisphere that arguably contributes to reduced sampling of the auditory signal and downstream phonological deficits. These findings open doors for developing early diagnostic tools helping to identify dyslexia from speech-induced cortical activity prior to reading tuition. As an initial proof of concept we took a magnetoencephalography dataset (Lizarazu at al., 2016) consisting of 23 typical and 23 adult dyslexic readers (formal diagnosis) who listened to naturalistic Spanish sentences. We then developed a self-attention based transformer neural network that learned to classify the presence of dyslexia from speech-induced spatiotemporal cortical activity reaching 85.7% accuracy (88.56% when combined with the reading and phonological scores). During speech listening, cortical responses in the right fronto-temporal sensors contributed most to the dyslexia classification, while typical readers were better classified with the left fronto-temporal sensors. Our results show that using a custom-built neural network it is possible to identify adult dyslexia from cortical responses to speech alone. This work is a stepping stone to building similar tools for early dyslexia diagnosis in pre-reading children.

* both 1st authors

[PS-2.17]

Brain responses to intervention for reading disability: An Event-Related Potential Study

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We conducted a pretest-posttest intervention study over a single academic year (pre-pandemic), for students with and without reading disability aged 10-12 years (n = 21). Students who qualified for intensive reading intervention were enrolled in a reading intervention program, delivered in an afterschool setting three days a week. The study included three groups: typically developing advanced decoders (TDA, n = 7); typically developing decoders (TDD, n = 5); and students with reading disabilities (SRD, n = 9).

Using high-density electroencephalography (EEG) and a specific measure of word reading expertise, the N170 event-related brain potential, we investigated shifts in neural responses to real words, nonwords, and symbol strings, for all participant groups. A left-lateralized N170 effect (associated with word reading expertise) was observed for the TDA group only. Correlation analyses indicated that the amplitude of the N170 response to words was strongly correlated with scores on Phonic Inventory and Orthographic Choice Tasks. N170 lateralization was associated with phonological and orthographic knowledge, across participants. Hence, our findings indicate complementary interactions between orthographic knowledge and phonemic skills during development of the brain's reading network. We discuss these results in the context of reading development, disability, and intervention approaches.

[PS-2.18]

Examining phonological awareness and reading impairment in school age children with resting EEG

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Individuals with dyslexia commonly have phonological awareness (PA) impairments. EEG theta power (activity at 4-7Hz) is associated with processing syllable-level phonological information (Goswami, 2011; Hyafil et al., 2015) and is greater in dyslexia than typical groups during phonological processing tasks (Spironelli et al., 2006; Rippon & Brunswick, 2000; Klimesch et al., 2001). However, there is conflicting literature about how resting EEG theta informs us about PA. We aim to better understand the relation between PA and theta during rest. We collected data from 66 children age 8-11 years (19 impaired readers) and assessed PA, reading, and non-verbal IQ. Continuous EEG was recorded during rest and frontal theta activity was analyzed. We examined if resting theta power differed for impaired vs. typical readers and if it correlated with PA ability (accounting for age, non-verbal IQ, and clean number of epochs). Statistically, theta did not significantly differ by reading ability group or correlate with PA (ps > .2). These results suggest that theta may not be a valid brain marker for reading difficulties. The discordant findings in the literature may be explained by participant characteristics, sample size, and using exploratory than a priori analyses suggesting a rigorous approach for EEG studies.

[PS-2.19]

Dynamic behavioral and neural correlates of learning progress during a letter-speech sound learning task

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The acquisition of letter-speech sound (LS) associations is the cornerstone of literacy. A difficulty in forming these associations may form a crucial hurdle for individuals with dyslexia. So far, research on LS learning has focused on outcome measures, whereas little is known about the learning processes themselves. In the present EEG study, we investigated behavioural and brain changes while Dutch native speakers (18–27 years) actively learnt to map 6 novel letter symbols to 6 Dutch speech sounds across four 8-minute learning blocks. Presented symbol-sound pairs where either congruent (50%) or incongruent (50%, random mappings). We included phonologically similar (ba/da/pa) and dissimilar (fa/ka/la) sounds. Our preliminary results show significant behavioural learning across blocks, paralleled by two neural mechanisms. First, a sustained (400-800 ms) broadly distributed bilateral ERP congruency effect that starts to appear from block 2 onwards. Second, an early (<300 ms) more focal (left) fronto-temporal ERP congruency effect that starts to build-up more gradually from block 3. Both effects are driven by learning-related changes for congruent pairs. Next planned steps are to collect data of dyslexic readers, relate individual participants' behavioural to ERP learning trajectories and examine how the phonological similarity of the speech sounds influenced learning progress.

[PS-2.20]

Ortho-Semantic Learning of Novel Words: An event-related potential study of grade 3 children

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Earlier developmental event-related potential (ERP) studies demonstrated that both print tuning and lexical tuning for words are present in children at 8 years of age. Behavioural findings to-date support a self-teaching hypothesis suggesting that children's abilities to learn spellings and meaning of new words are predictive of their reading abilities. We investigated how the N170 print and lexical tuning effects are associated with behavioural measures of reading and children's orthographic and semantic learning of novel words. Children in grade 3 learned novel words through stories before being tested on spelling and meaning. Children then completed a lexical decision task, including real words, novel words, non-words, consonant strings, and false fonts. ERP results revealed bilateral print and lexical tuning effects for novel words and left-lateralized print and lexical tuning effects for real words. These effects showed an association with reading fluency and orthographic learning of novel words. These findings support self-teaching hypothesis and suggest that after a brief exposure, visual recognition of newly learned words occurs at 170 ms. These results bridge the gap between electrophysiological and behavioural accounts of reading suggesting that the N170 tuning effects to novel words may be considered as a potential biomarker of children's reading abilities.

[PS-2.21]

Resting state EEG related to reading skills in children with developmental dyslexia

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Reading disability (RD) is the most common neurodevelopmental disorder. However, there is substantial variability in response to intervention, and many RD children show limited gains. EEG studies suggest that neural oscillations may vary as a function of reading (dis)ability, but there have been no systematic longitudinal investigations of resting-state EEG in RD kids. In this exploratory study, we established partnerships with specialized schools to examine relationships between resting-state EEG and reading gains over time. Fifty RD children (22 female, ages 7;6 – 14;2 at enrollment) participated 2x/year for several years (mean timepoints= 4.2; SD= 1.5). We recorded resting-state EEG with participants' eyes open (2.5 minutes) and eyes closed (2.5 minutes each), and administered reading and phonological awareness assessments. Preliminary longitudinal analyses revealed that resting-state EEG measures were related to subsequent gains in reading. Specifically, word reading gains were related to lower relative gamma power, higher relative theta power, and higher theta/beta ratio over posterior sites. Phonological awareness gains were related to higher relative gamma power, lower relative theta power, and lower theta/beta ratio over posterior sites. Identifying such patterns in cortical oscillations that may predict reading over time is an important step toward optimizing interventions for children with RD.

[PS-2.22]

Phonological and visuo-attentional deficits in developmental dyslexia: A combined eye movement and ERP study

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Developmental dyslexia is a neurobiological disorder of debated etiology. While the phonological deficit theory is the most widely accepted explanation, some studies have suggested that a visuo-attentional deficit may also play a role. This study investigated the eye movements and event-related potentials (ERP) of university students with and without dyslexia while performing a phonological lexical decision task. The participants were presented with five categories of stimuli, each of which required different levels of sub-lexical or lexical processing. The study examined multiple reading-related measures, including the number and duration of fixations, the number and amplitude of saccades, and five ERP components (N170, P300, N320, N400, and LPC). Interestingly, participants with dyslexia compared to controls showed impaired performance only in phonological processes, specifically the grapheme-to-phoneme conversion (N320) and the retrieval of phonological information from memory (LPC). Moreover, dyslexics made fewer single fixations than controls, probably indicating that they have a limited visuo-attentional span. Taken together, these findings provide further evidence for the multifactorial nature of dyslexia, which includes deficits in both visual and phonological processing. However, to which extent phonological deficits could be related with specific pattern of eye-movements remains an open question that we are currently exploring through statistical analyses.

[PS-2.23]

Influence of enhanced perceptual features on development of neural specialization for Arabic print in early readers

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Reading in Arabic is challenging for many early learners. To improve Arabic reading fluency, a new textbook (IQRA) was designed to enhance the visual characteristics of Arabic, and thus, help children recognize the Arabic orthography (Wilson et al., 2020). 345 first year pupils in the UAE were tested to evaluate IQRA training effects. The students were able to accurately identify more letters compared to a matched control. However, it is unknown whether improvement is associated with accelerated development of the brain's reading network, which develops over a long trajectory. Thus, the goal of this study was to measure brain responses to Arabic print in early readers enrolled in IQRA instruction. EEG responses were collected from 49 first grade children in the UAE (N = 27 IQRA treatment, N = 22 control). We found that while control children exhibited stronger P1 responses to words in two left-hemisphere electrodes (O1 and P3), IQRA children exhibited a stronger N1 to words and a stronger specificity for print at M1. These findings suggest a modest effect of the IQRA curriculum on neural responses to print in young readers. Future work is needed to better characterize the reading network's development for Arabic.

[PS-2.24]

Thalamic features successfully differentiate readers with and without dyslexia

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There have been many theories aimed at providing a mechanistic explanation of the etiology of developmental dyslexia (DD) and its main consequences. The thalamus has been often reported in the sidelines of previous neuroimaging studies on DD, but its involvement has not been systematically investigated. In this work, we used a machine learning approach to examine whether thalamic nuclei volume and thalamocortical tract properties can accurately classify between readers with DD and control readers. Results yielded models with significant cross-validated accuracy scores highlighting the importance of left-lateralized sensory and pulvinar nuclei and thalamocortical projections. Most notably, the relevance of the left lateral geniculate nucleus along with the optic radiations, which is consistent with theoretical accounts pointing out to visual components in dyslexia; as well as of the left medial geniculate nucleus and the auditory radiations, which is also consistent with a common agreement among most theories regarding phonological deficits. In sum, the present work underlines that sensory features from the thalamus and its projections can be at the base of DD, paving the road for further examinations of this structure and unveiling its potential for a unifying account of dyslexia.

[PS-2.25]

The role of occipitotemporal cortex in speech processing as a function of typical and atypical literacy development

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The left ventral occipitotemporal cortex (VOT) is considered to host orthographic representations of words. Even though it was studied in visual word processing, there is evidence of multimodal engagement of the left VOT in spoken language processing. Such engagement is supposed to facilitate the integration of phonological and orthographic representations needed for effective reading and spelling acquisition. To investigate the development of the left VOT involvement in spoken language processing and its relation to reading and spelling ability, we tested 47 Polish children at the beginning of formal literacy acquisition, in the second grade and in the third grade of elementary school. At the third grade dyslexia or isolated spelling impairment was diagnosed in a subgroup of children (N=20). In an fMRI experiment, children had to decide whether two auditorly presented words start with the same sound, if they rhyme or if they are identical. During the presentation univariate and multivariate results will be presented on the quality of integration processes in the left VOT in typical and atypical literacy development.

[PS-2.26]

Voxel-based morphometry in children with dyslexia and healthy controls: a comparison of pipelines

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Developmental dyslexia is a reading disorder with a neurobiological origin. Despite a large body of research, there is no consensus on the cortical structures crucial for impaired reading in children with dyslexia (Jednorog et al., 2014). The aim of the present study was to clarify the structural gray matter correlates of phonological dyslexia in Russian-speaking children using SPM and FSL voxel-based morphometry pipelines (VBM).

Seventy-five children participated in the study: 40 typically developing children (TDC) and 35 children with dyslexia. Reading was assessed with SARS (Kornev, 2010) and phonological skills were evaluated with seven subtests of RuToPP (Dorofeeva et al., 2020). MRI scans of all participants were obtained. VBM analysis was performed in FSL and SPM softwares. Firstly, gray matter volume in TDC and children with dyslexia was compared. Then, we build General linear models with reading and phonological scores included as covariates in the mixed group of all children. The analysis revealed significant voxel clusters in the left insula and cerebellum (FSL) and in the right thalamus, putamen, insula, precentral and middle frontal gyri (SPM), showing low consistency. Thus, the found regions require further investigation and the results of FSL and SPM pipelines should be interpreted cautiously.

[PS-2.27]

Does white matter integrity mediate the relationship between SES and reading skills?

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Environmental factors, including Socio-Economic Status (SES), explain approximately 30% of the variability in reading skills (Andreola et al., 2020), however little is known about how these factors influence the reading-related neural circuitry. Extant work has found that SES and reading (related) skills are associated with white matter (WM) integrity in various tracts, including the bilateral Inferior and Superior Longitudinal Fasciculi (e.g. Noble & Giebler, 2020; Koirala et al., 2021). We extend this work by testing WM integrity (using Fractional Anisotropy and two novel metrics more specific to different neurite features [Neurite orientation and density indices]; Zhang et al., 2012) and phonological processing (PP) as mediators of the relationship between SES and reading, in a large, diverse sample of children from the Healthy Brain Network biobank (Alexander et al., 2017). We will use Structural Equation Modeling (SEM) with SES as a predictor and reading as the predicted variable, including PP and WM integrity as mediators. Multigroup SEM will allow us to determine if these pathways change over development. We hypothesize that WM and PP will mediate the effect of SES on reading and that SES will be a stronger predictor of WM and reading for younger children compared to older ones.

[PS-2.28]

Neural adaptation patterns of phonology and orthography processing in developmental dyslexia

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There are mixed findings regarding the neural basis of decreased literacy skills in dyslexia. Hence, our goal was to test neural adaptation patterns of phonological and orthographic selectivity. Two groups of children: control (CON n = 43) and with dyslexia (DYS n = 34) were tested in a Rapid Adaptation paradigm in fMRI. We repeatedly presented pairs of words that shared phonology but differed in orthography (condition 'homophone', e.g., kret-kred), shared both ('same', kret-kret) or differed in both ('other', kret-noga). This method enabled successful discrimination between phonological and orthographic processing respectively in the left temporoparietal cortex, TPC, and ventral occipitotemporal cortex, VOT (Glezer et al., 2016). In TPC there was group x condition interaction: DYS showed comparable activations across conditions indicating lack of distinction between words with different phonology, while CON presented a neural adaptation pattern (lower beta activations for 'same' than for 'other'). In VOT we observed a main effect of condition but no between-group differences suggesting preserved orthographic processing in both groups. These results indicate the lack of phonological selectivity in TPC in children with dyslexia. Disruptions in VOT functions beyond orthographic selectivity are still to be defined (e.g. Wang et al., 2022).

[PS-2.29]

A new perspective to account for the causal relationship between statistical learning and developmental dyslexia

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Statistical learning (SL), the human ability to extract regularities from sensory input, has been shown to be linked to reading impairments. However, the nature of the causal relationship between SL deficits and developmental dyslexia needs to be clarified (Schmalz et al., 2021; Singh & Conway, 2021). Based on the results of Vazeux et al. (2020), which recorded a better increase in phonemic awareness when prereaders learned letters-to-syllable associations than letter-to-phoneme associations, Guo et al. (2023) provided a new theoretical framework for the cognitive processes involved before learning the alphabetic code. Their hypothesis is that learning letters-to-syllable associations would trigger SL for the extraction of GPC regularities. If SL is involved in the extraction of GPC regularities, the amount of information about GPC regularities provided in letters-to-syllable associations would influence the efficiency of SL. This prediction was tested in a longitudinal experiment (where the paradigm was analogue to Vazeux et al., 2020), and the results confirmed that a rich supply containing more information about GPC regularities led to better progress in phonemic awareness than a poor supply containing less information about GPC regularities. We will develop how this paradigm can be used to explore the causal relationship between SL and dyslexia..

AUTHOR INDEX