IDEALAB

Candidates are highly recommended to write a proposal that fits into one of the following research lines and are recommended to contact the relevant supervisors when developing proposals. Other projects may be developed but the potential supervisors at the partner universities MUST be contacted prior to application.

- Individually tailored treatments in developmental dyslexia
- Pronoun processing in (primary progressive) aphasia
- Building articulatory routines in more than one language
- Language impairments in children with Benign Rolandic Epilepsy with Centrotemporal Spikes
- This is a wug and these are two _? On the role of morphological instruction in language Development.
- Principled relationships between dyslexia and word finding difficulties
- Effects of general hearing ability on phonological acquisition and speech perception in early childhood years
- Development of theory-driven assessment tools for aphasia
- Generative process models of eye movements in the visual world paradigm
- Scanpaths and reading impairments

Individually tailored treatments in developmental dyslexia

Developmental dyslexia is a heterogeneous disorder (e.g., Jones, Castles & Kohnen, 2010). Some children who struggle to learn to read have difficulties learning the letter identities (e.g., Brundon et al., 2006), other children struggle to learn how to map graphemes onto phonemes (e.g., Temple & Marshall, 1983), or learn the long term memory representations of written words (e.g., Friedmann & Lukov, 2008; Kohnen et al., 2018), or with processing letter position accurately (e.g., Friedmann & Rahamim, 2007; Kohnen et al., 2012). According to cognitive neuropsychological approaches to treatment, a remediation protocol should address the actual deficits that are found in the cognitive architecture of a child with poor reading (e.g., letter identities, grapheme-phoneme correspondences, long term memory lexical representations). However, there are very few studies that actually investigated whether using this tailored approach are more successful than more generic treatments or treatments which are not individually tailored (e.g., Gustafson et al., 2007; Rowse & Wilshire, 2007).

In this project, the following main question will be answered: Do individually tailored treatments lead to better reading outcomes in developmental dyslexia than more generic treatments?

Supervisors: Dr Saskia Kohnen (Macquarie University) & Dr Nicole Stadie (Potsdam University)

Pronoun processing in (primary progressive) aphasia

Aphasia is an acquired communication disorder that adversely impacts language skills, rendering daily communication impossible. This project seeks to unveil how people with aphasia struggle to process pronouns (e.g. she/him) by examining people with aphasia's moment-by-moment sentence-comprehension and its associated brain activity in both post-stroke aphasia and primary progressive aphasia (PPA, a form of aphasia resulting from brain degeneration). This will advance the understanding of pronoun processing in aphasia, evaluate theories of language dissolution in aphasia, and thereby enable clinicians to develop more effective protocols for its treatment. Potential topics include (but not limited to) investigating the deterioration of pronoun comprehension and production in sentences in people with post-stroke aphasia and primary progressive aphasia using eye-tracking and/or electrophysiological measures (i.e. ERPs).

Supervisors:
Prof. Lyndsey Nickels (MQ)
Prof. Roelien Bastiaanse (RuG)
Dr. Seçkin Arslan

Building articulatory routines in more than one language

This project looks at the acquisition of laterals in German-Arabic, AusEng-Arabic and UKEng-Arabic bilingual children using a combination of impressionistic, articulatory (using Ultrasound) and acoustic techniques. Laterals involve complex lingual articulations and are typically acquired late and are amongst the sounds that require clinical intervention. Laterals vary in the involvement of the tongue dorsum alongside the tongue tip as well as in the co-ordination with these two gestures, creating a continuum of gestural timing which manifests itself in what is impressionistically referred to as 'clear' (palatalised) or 'dark' (velarized/pharyngealised) /l/s. The realisation is of course gradient rather than binary and is governed both by linguistic (prosodic and morphological) conditioning as well as dialectal and cross-linguistic systematic variation. Given that the gestural organisation of a syllable with a lateral requires gestural co-ordination with surrounding sounds, children must learn these co-articulatory patterns from an early age, along with their linguistic conditioning. Little is known about how these co-articulatory routines develop if a child is learning two languages with different phonetic realisations of laterals as well as different morpho-phonological rules for the employment of tongue tip and tongue body gestures and their timing. Arabic and German typically have clear laterals in all word positions and contexts, Newcastle English generally has clear laterals in onset positions and dark laterals in codas (but with morphological conditioning as well), while Australian English has dark laterals throughout.

This project will investigate how bilingual or multilingual children come to acquire language-specific gestural timing and articulatory routines for laterals in each of their languages, and how their acquisition patterns may compare with monolingual children acquiring these languages. The findings will improve our understanding of the acquisition of gestural co-ordination across languages and multilingual contexts and will feed into our understanding of atypical acquisition of laterals.

Supervisory team:
Newcastle University: Dr Ghada Khattab (ghada.khattab@ncl.ac.uk)
Potsdam University: Dr Aude Noiray (anoiray@uni-potsdam.de)
Macquarie University: Prof Felicity Cox (felicity.cox@mq.edu.au)

Language impairments in children with Benign Rolandic Epilepsy with Centrotemporal Spikes

Promotor University of Groningen: Prof. dr. R. Bastiaanse Co-promotor University of Groningen (daily supervisor): dr. W. Tops
Promotor Macquarie University: N.A. Co-promotor Macquarie University: N.A.

Benign Childhood Epilepsy with Centrotemporal Spikes (BECTS) is the most common form of epilepsy among epilepsies of childhood which generally occurs between 3 and 13 years of age and spontaneously resolves by adolescence. A typical EEG in an individual with BECTS would show unilateral or bilateral spike wave discharges in central and temporal regions, mostly during sleep. BECTS is known for its benign nature with low seizure frequency and spontaneous remission.

However, in the course of over 40 years of research, general consensus has been reached that benign childhood epilepsy should no longer be considered 'benign' for a multitude of deficits have been found in the language, cognitive and behavioral abilities of affected children with sometimes lasting effects, particularly in verbal domain. Children with benign childhood epilepsy are mainly impaired in their receptive language skills due to problems with semantic processing. Next, also deficits in (verbal) working memory and social skills are reported. Despite the much-researched epilepsy disorder, the impact of certain epilepsy-related factors, such as age-at-onset and duration since epilepsy onset, the effects of centrotemporal spikes (CTS) dependent on its location (left, right, bilateral), as well as seizure frequency remain rather unknown.

This study attempts to investigate the influence of the epileptic syndrome as characterized by age-at-onset, epilepsy duration, CTS, spike-location, and seizure frequency on the language because a better understanding of the linguistic impairments in these children would aid in the development of new and improved intervention plans. In-depth linguistic analyses in children with BECTS are also scarce. This leads to the following research questions:

This is a wug and these are two _? On the role of morphological instruction in language Development.

This PhD project examines the influence of explicit morphological instruction on different dimensions of language development (i.e. reading fluency, reading accuracy, spelling accuracy, written vocabulary acquisition, and oral vocabulary acquisition):

The first part of the project examines whether or not explicit <u>written</u> morphological instruction (teaching associations between orthography and semantics of affixes) facilitates reading fluency, reading accuracy, spelling accuracy, written vocabulary acquisition, and oral vocabulary acquisition. Participants will take part in a novel word learning study in which they will learn associations between written complex words and pictures. Prior to training, half of the participants will receive explicit morphological instruction (learn the associations between orthography and meaning of the affixes). Following training, participants will participate in an eye-tracking experiment (to measure reading fluency), a spelling test (to measure spelling accuracy), a reading aloud experiment (to measure reading accuracy), a lexical decision task (to measure written vocabulary acquisition), and a picture naming task (to measure oral vocabulary acquisition). We will test both children and adults to see if the learning mechanisms differ across age groups.

The second part of the project examines whether or not explicit <u>oral</u> morphological instruction (teaching associations between phonology and semantics of affixes) facilitates reading fluency, reading accuracy, spelling accuracy, written vocabulary acquisition, and oral vocabulary acquisition. Participants will take part in a novel word learning study in which they will learn associations between spoken complex words and pictures. Prior to training, half of the participants will receive explicit morphological instruction (learn the associations between phonology and meaning of the affixes). Following training, participants will participate in an eye-tracking experiment (to measure reading fluency), a spelling test (to measure spelling accuracy), a reading aloud experiment (to measure reading accuracy), a lexical decision task (to measure written vocabulary acquisition), and a picture naming task (to measure oral vocabulary acquisition). We will test both children and adults to see if the learning mechanisms differ across age groups.

- Supervising Team:
- Macquarie University: Dr Elisabeth (Lisi) Beyersmann lisi.beyersmann@mq.edu.au
- Professor Anne Castles
- Potsdam University: Dr Audrey Bürki

Principled relationships between dyslexia and word finding difficulties

Approximately two children in a class of 30 have both dyslexia and developmental language disorder. Both of these neurodevelopmental disorders have potentially severe negative impacts on academic outcomes, mental health and job opportunities. To effectively treat these conditions and improve long-term outcomes, it is important to understand if the disorders can be addressed by the same treatment or not. Cognitive models make some clear predictions about the processing components that might cause these co-morbidities. Previous research has identified several associations between the oral and written domains, yet, links to theoretical models and practical outcomes (treatment) are missing.

This project will fill these gaps by investigating children who have both difficulties in word-finding and reading. Some children with developmental language disorder may struggle learning the meanings and/or phonology of words. Sometimes, a particular word may be sufficiently well specified to allow for comprehension but not reliable production of the word. This difficulty may impact on children's reading. For example, if they can't produce spoken words reliably (due to word-finding difficulties), they may struggle to read these same words accurately and quickly. Referring to cognitive models of processing will allow this research to advance the search for the proximal causal reasons for these co- morbidities.

<u>Supervisory team leader:</u> Dr Saskia Kohnen, Macquarie University: saskia.kohnen@mq.edu.au
Supervisory team: Prof Lyndsey Nickels1, Dr Christina McKean2, Prof Wendy Best3,
1Macquarie University, Sydney. UK. 2Newcastle University, UK. 2University College London (external institution)

**Effects of general hearing ability on phonological acquisition and speech perception in early childhood
years**

Some children suffer major, permanent hearing loss, with well-documented impact on their language processing and development. It is less well studied and more controversial to what degree language processing and development are affected by minor and temporary hearing losses. However, mild and temporary hearing losses occur frequently in early childhood, for example as side-effects of otitis media with effusion.

Minor hearing losses may temporarily affect children's ability to recognize speech sounds and words, or learn linguistic rules. These consequences may be amplified in noisy conditions, such as found in many classrooms. Potentially, the difficulties experienced under these frequently occurring sub-optimal listening conditions may be associated with perceptual advantages of phonological patterns that are typologically frequent across languages.

This project will investigate the relationship of hearing and general sound processing ability with speech perception in the infancy and pre-school years. For this purpose, experiments testing children's speech perception, processing, and learning will be combined with audiometric and sound processing assessments.

Supervising Team:

- [Dr. Tita Benders](#) (Macquarie University)

- [Dr. Natalie Boll-Avetisyan](#) (Potsdam University)

Development of theory-driven assessment tools for aphasia

The development of theory-driven diagnostic materials for aphasia has played an important role in neurolinguistic research and forms the basis for the work of clinical linguists. Often those assessments are both lengthy to carry out and difficult to score and analyze due to the number of linguistic variables taken into account. By developing new materials that can be administered on the iPad, we hope to make the assessment more enjoyable for the clients but foremost more accurate and time-efficient to carry out. Many tasks can be scored automatically, and thus results can be presented instantly. Furthermore, results of different tasks can be compared taking all relevant linguistic variables into account. This will lead to a thorough theory-based analysis of a client's linguistic profile. With assessments for verb and sentence processing in several languages underway, we welcome proposals focusing on other areas of assessment, adaptations to further languages or possibly treatment programs based on the assessments in order to broaden the scope of linguistic-based digital tools available for practitioners. The design of the tool (i.e. development of suitable materials), collecting data with it and developing a final version providing individual profiles compared to the normative data should form part of the project.

Supervising Institutions: University of Groningen: Dr. Dörte de Kok Macquarie University Sydney: Professor Lyndsey Nickels

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Generative process models of eye movements in the visual world paradigm

For several decades, the visual world paradigm has been successfully used to investigate the processes underlying moment-to-moment language processing. Surprisingly, there is no consensus as to how eye-tracking data from visual world experiments should be statistically analysed. There is a number of methods that are used in the literature but they all have known shortcomings. Some make potentially inadequate simplifying assumptions to make the problem technically tractable. Others, while technically more sound, simply do not answer the questions

that we care about. The goal of this project is to develop and evaluate Bayesian models of the generative process underlying eye movements in the visual world paradigm. These models will be compared to existing analytical methods and they will further be evaluated with respect to their ability to inform us about group- and individual-level differences in performance (e.g. differences in impaired and unimpaired processing). Visual world experiments will be conducted to obtain data sets for bench-marking purposes and to address real-world research questions.

(Groningen / Potsdam)

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Scanpaths and reading impairments

Eye-tracking research on reading and reading impairments commonly uses a set of canonical word-based measures such as the duration of the first fixation on a word. While these measures have been hugely successful in research on the micro structure of eye movements, they do obscure more holistic properties of how readers navigate a sentence or text. For instance, specific reading tasks and/or impairments may induce reading strategies tailored to cope with the demands of the task given cognitive constraints, but these strategies may not be captured by word-based measures. New analytic methods have been recently proposed to get a handle on the more global-level strategic aspects of reading behavior (e.g. von der Malsburg & Vasishth, Journal of Memory and Language, 2011). This project will investigate the efficacy of these methods for the investigation and the automatic detection and classification of reading impairments. For this purpose, eye-tracking experiments will be conducted with reading impaired and unimpaired participants, and the data will be analyzed with conventional and with scanpath methods.

(Gronigen/Macquarie)

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