Lost for words: investigating specific language impairments

Centred around her lifelong interest in language development, **Professor Mabel Rice**, of the University of Kansas, studies children who struggle to learn and develop their native language. Her investigations into the genetic and neurological elements of language acquisition have important implications for speech and language intervention methods and, ultimately, the quality of life of those for whom language is an everyday challenge.

Learning your native tongue is a skill that many develop without really thinking about it. But, for those with a Specific Language Impairment, learning this skill can take a lot longer. Luckily, Professor Mabel Rice's research is currently shedding light on this area of research, and her lifelong fascination with language acquisition has seen her dedicate her career to understanding how children learn and develop language.

In her early work, Professor Rice encountered children who struggled with simple tasks such as describing the colour or size of objects. It was these encounters that motivated Professor Rice to carry out further research into delayed language development. Ultimately, her research aims to broaden our understanding of why some children struggle to learn their native language, while for most children, the world over, this learning process happens automatically.

THE ART OF COMMUNICATION

Children who are late to acquire language without an obvious reason for the delay, such as hearing loss or other developmental delays, are said to have Specific Language Impairment (SLI). Children with SLI have difficulties picking up, processing and interpreting language, and their overall language level (i.e., vocabulary size and ability to generate complete sentences) remains below the expected level throughout adolescence and adulthood. Subsequently, those with SLI often experience further complications, such as reading impairment, as well as significant challenges in their social, academic, personal and professional lives. Evidence suggests that SLI is heritable, and Professor Rice studies the genetics and neural pathways of children with SLI and their families, in twins as well as single-born children.

EARLY IDENTIFICATION OF SLI

Professor Rice's lab at the University of Kansas takes a comprehensive and unique approach to their research, with an emphasis on the identification of a grammar marker, indicating the presence of SLI in preschool children. One important finding from her research has been that children with SLI particularly struggle within the domain of tense and agreement marking. This discovery led Professor Rice and her team to develop the Test of Early Grammatical Impairment (TEGI) and other experimental grammatical judgement tasks that can be used to identify young people with a history of SLI. In addition, the lab was also the first to discover that vocabulary deficits are more likely to persist later into adolescence in girls than boys. This finding has strong implications for how adolescent girls with SLI can be identified and supported.

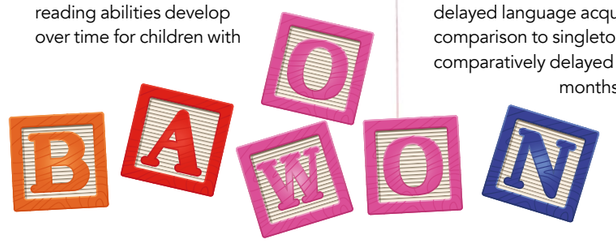
UNIQUE LONGITUDINAL DATA

Professor Rice is currently involved in a long-term collaborative project that studies the genetics and epigenetics (traits that are inherited, but not through DNA) of SLI. Four previous funding rounds have created a unique ongoing empirical archive of data comprised of 5000 children and their families. When these children reach adulthood, Professor Rice studies their children, providing a unique, multi-generational perspective on SLI. Using this data, the study has three principal aims: firstly, to document how language, speech and reading abilities develop over time for children with SLI in comparison to their unaffected peers; secondly, to conduct family-based candidate gene investigations to identify the gene networks involved in language impairment; and, lastly, to carry out brain imaging studies to understand the neuroanatomy of language processing in children with and without SLI.

For children with SLI, findings from this ongoing study show a consistent pattern of a delayed onset of language and language development on a parallel growth trajectory, but at lower performance levels to those without SLI. These lower levels persist through adolescence and are often accompanied by reading impairments. Family-wide investigations have found elevated rates of affectedness in family members. Related genetic studies suggest that it is a set of genes known to influence the development of the central nervous system that is responsible for language, speech and reading impairments. The continuation of this study will allow Professor Rice and her collaborators to expand on these findings, with the hope of ultimately identifying the components of the brain that can provide the missing link between DNA and the characteristics of how an individual learns and develops language.

STRONG PARTNERSHIPS

Professor Rice also directs a study of twins, in collaboration with colleagues in Perth, Western Australia, that investigates how SLI manifests in twins. These two parallel longitudinal studies allow for a unique opportunity to investigate the extent to which SLI can be attributed to genetic variation, known as heritability. With data from 2,000 twin children, the study has provided the first robust empirical evidence that demonstrates delayed language acquisition in twins, in comparison to singleton children. Twins have comparatively delayed language skills at 24 months, with the gap reducing at four and six years, suggesting that twins are able to catch up



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What disadvantages and challenges are faced by those living with limited language capacities?
Good native language skills bring many advantages. Even preschool children like to be friends with others who have good language skills: those who can successfully verbally negotiate with the teacher and other children for favourite toys or activities and can build friendships through verbal interactions. Children who cannot easily do this are less likely to be preferred playmates and less likely to be teachers' helpers. As children learn to read, they acquire many advantages academically, socially and, later, in the workplace or in higher education. About half the children with limited language capacity show difficulties in learning to read and may not reach age expectations, thereby limiting their educational or employment activities. Because language acquisition is so easy for most children, those with limited language capacities can be perceived as not trying hard enough, not very smart, or not motivated to fit into the social group. These assumptions can be, and often are, untrue, leaving persons with limited language capacity feeling misunderstood and at a marked disadvantage in changing peoples' erroneous assumptions. Recent research shows that most children with limited language capacity do not "outgrow" the problem; instead, they learn to blend in with peers, although they lack the quick use of linguistic alternatives to negotiate conversations, disputes, and advocacy for their needs. This "invisible" but crucial requirement for social, academic, and employment opportunities can have profound effects: a recent study followed up on five-year-old girls identified with a language disorder when they were 31 years of age. They were almost three times more likely to report child sexual abuse than control children (43% vs 16%). Language ability is a highly valued human attribute that everyone wishes to have, especially those children and adults with a history of childhood language disorders such as SLI.

Why is SLI often confused with Speech Sound Disorder (SSD) and why is it important to be able to differentiate between the two?
Children who receive speech/language therapy are most likely to have SSD. This is because SSD is obvious to other children and adults – children with SSD can be difficult to understand or have an unexpected way of saying sounds in words. Technically, SSD is a condition in which sound production is not as expected for age level. Examples at the five-year-level are "top" for "stop", "bawoon" for "balloon"; "wabbit" for "rabbit"; a lisp such as "theven" for "seven." Prognosis for a child with SSD to resolve the speech problem is very good, especially with therapy. Those with SLI, on the other hand, have a problem with the language system.

There are, roughly, three major dimensions of the language system that can be affected: the level of vocabulary size which affects how many words a child has available to express an idea or request; grammar which affects how to formulate sentences, such as "Where does he like to play basketball?" not "Where him like played basketball?"; and social uses of language, such as how to tell a joke or when to use a title such as "Mrs" versus a woman's first name. Language problems such as these usually do not affect intelligibility but they can leave an impression of immaturity, social awkwardness, or rude social interactions. Because they usually appear to be typical children, the language problems of children with SLI are frequently unidentified as the key element of their difference from other children. The prognosis for improvement or spontaneous "outgrowing" of SLI is much more guarded than for SSD, and SLI is more likely to persist into adulthood.

Your study on individuals with SLI in Kansas is running in parallel with a study on twins with SLI in Perth. What allows the results of these two geographically separate studies to be directly compared?
The population demographics of the metropolitan area of Perth, Australia are very similar to Kansas City, Missouri, USA, the area where the Kansas study is based. The same standardised, norm-referenced tests for language acquisition and identification of language impairments are valid in both areas, making it possible to make meaningful comparisons across the two studies. Further, longitudinal studies of young twins are difficult to carry out in the USA given the health care system, whereas when we started the twin study in Australia it was possible to recruit a relatively large sample of twins and follow them. In both areas families are likely to live in one region for long periods of time, a valuable demographic for longitudinal studies of children's language acquisition.

You are currently developing an app to aid your research. How does the app work?
The app is designed for mobile phone administration of simple grammar assessments based on the experimental measures developed in my lab. There is an assessment version in development, as well as a practice version. It will provide a method of grammar assessment that can be completed by anyone with a mobile phone, in any quiet place, and in a short time, with summary scores that are valid for detecting possible language impairments. It is intended to be a first step on the way to further treatment, much like the vision chart for eye assessments of children. The practice version will provide non-obtrusive ways to practice grammar tasks quietly and privately.

Do equivalent language issues exist across all languages?
At an abstract level, yes. At a specific level, languages differ in their sound, word, and sentence level requirements and these differences can influence which particular elements are easy or difficult for children with SLI. Are there any similar studies that investigate non-English language acquisition and development? Yes, although not nearly enough and not yet available across the long developmental arc as in the English studies. I know of very informative studies of Spanish, German, French, Norwegian, Swedish, Mandarin Chinese, Korean, Japanese, Italian, Greek and Dutch among others. There is a growing appreciation of how to carry out such studies and the need for better information about children with SLI and other forms of language disorders across languages and countries. There is also an emerging literature on bilingual or mulitilingual children with SLI that is very informative. As the world engages in more linguistic interactions across different languages it will be increasingly important to find ways to identify children with SLI, and parents with a history of SLI and unidentified language impairments as adults.


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from an initially delayed start. Furthermore, the study found SLI to have relatively high heritability in twins and, as found in previous studies, this heritability increases with age. This finding essentially suggests that, for SLI, an individual's underlying genetic makeup exerts increasingly more influence than the environment, as age increases.

IT'S ALL IN THE DETAIL
To investigate in more detail the influence of genetics on SLI, Professor Rice is currently collaborating with geneticists from multiple universities worldwide. These collaborations are exploring the genetics behind high-level cognitive abilities such as language and how delayed language development is transmitted genetically through families. Genetic studies in Professor Rice's lab have documented growth curves for children with and without SLI. The similarities and differences between these curves have led to the hypothesis that malfunctioning inherited cell-level timing mechanisms could be responsible for how SLI develops and manifests throughout childhood, adolescence and into adulthood.

COMMUNICATION IS KEY
One of the overriding objectives that persists throughout all of Professor Rice's research is the dissemination of research findings to those working practically with SLI children. Providing accessible information on SLI will help teachers and medical practitioners to appreciate which children are different, allowing them to better plan for their specific needs. The research outcomes will also aid clinical intervention methods not only in language-related impairments but also associated disabilities, such as autism and intellectual impairments. The ongoing work of Professor Rice and her team will make a great difference to children with language impairments whose differences are often misunderstood and under-provided for. Although Professor Rice and her team have already made great progress in this field, there is still some way to go before SLI can be fully understood. However, the future looks promising and, in the words of Professor Rice herself: "We're dedicated to doing it."

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Detail

RESEARCH OBJECTIVES
Professor Rice's research focuses on how the human language capacity develops throughout life, from young children into adulthood. Her research looks at children with difficulties acquiring a language with no apparent reason behind the delay. She is currently working on a collaborative project looking at the epigenetics and neural pathways of children with SLI.

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BIO
Professor Rice completed her BA and MA at the University of Northern Iowa. She undertook a PhD at the University of Kansas where she currently works as the Director of the Child Language Doctoral Program. She is also the Fred and Virginia Merrill Distinguished Professor of Advanced Studies and Director of the Merrill Advanced Studies Center.

CONTACT
Professor Mabel L Rice, PhD
Dole Human Development Center
Room 3031, University of Kansas
1000 Sunnyside Avenue
Lawrence, KS 66045
USA

E: mabel@ku.edu
T: +1 785 864 4570