

Early language development as related to the acquisition of reading

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This article reviews research on early linguistic precursors and enabling skills of reading acquisition among young children. Language development starts early in infancy when the child learns to categorize the speech sounds according to the pattern typical of the mother tongue. Equipped with these sound categories the child is ready to learn to segment words from the sound stream and to understand and to use words. The precise phonological representation of words will facilitate the important development of phonological awareness. Some longitudinal research and training studies indicate the causal direction of the relation between phonological awareness and reading. Preventive and remedial implications are pointed out. Preventive effects are related to vocabulary exposure in different social environments and to informal early literacy socialization. In particular, the benefits of reading aloud to children are discussed. The complexity of the causal relationships between different aspects of early language development, including genetic influences and later reading is emphasized.

Introduction

A skilled reader recognizes printed words rapidly and without effort. In fact, the words are as transparent as spoken words are to a listener. However, automatic word recognition is only one aspect of skilled reading. Comprehension of texts involves higher-order linguistic and cognitive skills such as sentence parsing, making inferences, dealing with text structure and activating relevant background knowledge. In fact, literacy activities in current society involve even more than just reading passages of conventional text but are also involved in the complex use of the enormously expanded memory bank provided by media, internet and printed documents and forms. Getting access to these sources is not only a question of decoding the printed words and using the normal listening comprehension skills developed in oral communication. Navigating in the sea of textual information

requires complex procedural memories and advanced cognitive strategies for locating items, for finding the right entries, using the right key-words, knowing the conventions of tabular packing of information, searching manuals, recipes and diagrams, following directions, remembering passwords, pin codes and efficient search procedures etc. These skills, certainly vulnerable to poor initial acquisition, loss due to disuse, accidents or ageing, deserve closer examination as the demands on literacy competence increase dramatically in post-modern society.

The increasing demands of literacy skills and the observation that a too high proportion of school children fail to reach a necessary skill level have aroused concern among responsible politicians and have attracted the attention of researchers in many disciplines over the last decades. An impressive number of studies have been carried out, in particular within developmental psychology, cognitive psychology, education, linguistics, human genetics and neuroscience. One issue of critical importance has been to understand the nature of reading acquisition, its early precursors in the development of a child, and a careful analysis of the underlying or enabling skills for success in learning to read. This knowledge has been regarded as the critical basis for successful preventive actions as well as for effective remediation. For some children, reading acquisition is indeed a particularly hard task and they run a serious risk of experiencing great troubles in their continuous schooling and their adult life in a symbol-based society.

The transition from a non-reading to a reading stage in the life of a child constitutes a remarkable mental revolution with profound consequences. Not only has a door been opened to a world beyond the immediate present, a world of fantasy, adventure, enjoyment and knowledge, but also the child has acquired a new epistemic position. The language, earlier used as an implicit instrument for communication, has now become the object for conscious reflection, and this new metalinguistic awareness has for the child opened up the more general metacognitive capacity to reflect on his/her own thoughts. Thus, becoming literate is far more than the trivial acquisition of a skill. However, as with all revolutions, reading acquisition has a long prehistory. Since reading is primarily a language-based skill, the ontogenetic roots of reading should be sought in the development of language.

Although it is obvious that reading is a visual activity, it is by now generally agreed that reading is basically a language-based skill. Written language represents spoken language. Symbols are assigned to linguistic units, and these symbols are presented in a conventional arrangement. Thus, reading is language by eye rather than by ear. A deeper understanding of children's oral language development might thus hold the key for understanding why some children fail to acquire reading skill. In this article I will bring up some aspects of early language development that will help to explain reading disability among older

children. But before I treat language per se, I want to bring up some general considerations of early human communication.

The earliest steps in communication and language development

As species humans are exquisitely social in nature. No other species are close to our sophisticated ability to communicate. A basic mechanism for understanding others' actions and emotions is the activation of the mirror neuron system.¹ These mechanisms allow us to understand directly the meaning of these actions and emotions without conceptual reasoning. The same neural systems are activated that are used when we execute an action. When we, for example, observe the disgust in a facial expression of someone else, we activate a network in a part of the brain called insula that is also active when we experience disgust ourselves. An interesting but still unanswered question is whether the capacity to understand the intentions underlying others' behaviour is also based on mirror neurons. In any case, the main point here is that the meaning of others' actions and emotions is experienced directly without a mediating step of conscious and cognitive interpretation. Thus, a very young infant is expected to have this social capacity at an early stage of development.

It seems as if a basic prerequisite for language learning is the ability to coordinate attention with someone else.² Shared attention means that you can see where the adult is looking and with your own eyes fixate on the same object. This is indeed a remarkable information processing achievement seen in young infants, already at the age of 6 months. Joint attention means that you see the same thing as I do, a first step towards the ability to understand what another person has in mind. Young infants who easily can follow their mother's gaze also have the greatest vocabulary by the age of 12 months.² Pointing with your hand or your index finger is another indication of attempts to coordinate attention, and children who use pointing early also tend to have a faster language development.

Infants form strong emotional ties to their caregivers. Since Bowlby formulated a comprehensive theory on the biological and social mechanisms of *attachment*,³ the issue has been extensively studied, and Bowlby's original ideas have enjoyed substantial empirical support.⁴ The establishment of a secure attachment during the first year of a child's life seems to be closely related to the sensitivity of the parents. The more secure the attachment is the more effective is the parent in helping the child to explore the world.⁵

Language in the crib

The scientific study of children's early language development is one of the great success stories in the behavioural sciences over the last decades. Language

development starts much earlier than people in general tend to assume. We now know that there is considerable activity relevant to language acquisition that takes place long before the child utters her/his first word. At birth, infants discern differences between all the phonetic units used in the world's languages. But already during the first year the infants come to recognize the perceptual properties of their native language. Long before they are capable of uttering their first words mental maps are developed for the speech sounds of their mother tongue.^{6,7}

Adult speakers of Japanese have notorious difficulties in making the /r-/l/ distinction.⁸ But a newborn Japanese child is capable of hearing the difference between /r/ and /l/. Eleven months later this ability is lost, not due to impaired hearing but as a result of the extensive exposure to the native language, where relevant linguistic contrasts are highlighted and non-used contrasts are de-emphasized. Similarly, the vowel system of Swedish has an early impact on Swedish babies who tend to perceive and categorize vowels differently from American babies.⁹ A puzzle remains, however. Infants lose their aptitude for hearing speech sounds in a foreign language at about 11–12 months, and yet children up to the age of around 8 can learn a second language without a trace of accent, while most older children and adults cannot.

A universal feature of all languages is that they are segmented into a very limited set of basic phonetic categories (the number of units tend to vary between 20 and 40). The unlimited number of utterances and the incredibly large number of words in a given language are created by rule-based combinations of these units or phonemes. And the infant faces the formidable developmental task of acquiring a vocabulary (at least passively) of some 50,000 words before the age of 16–17. If each word had to be treated as a unique and global configuration of sounds this task would be impossible. The remarkable economy of human languages is related to the fact that with a very small set of basic units and combinatorial rules an endless number of meaningful words and utterances can be generated. (For example: *sand, land, band* or *light, night, right, fight* differ only in the first segment.)

Non-human primates have a surprisingly rich repertoire of signals for communication. The acoustically produced 'words' for indicating various types of dangers, social encouragement, detection of suitable food etc, are treated as whole configurations, acoustic gestalts, non-segmented sounds. The estimated vocabulary of such words does not exceed 50 units. This limited vocabulary imposes a serious constraint on communication. Obviously, monkeys cannot go beyond the immediate present and the situational context. They cannot discuss earlier experiences, they have no ability to recall episodic memories, they cannot plan for the future together – in short, they are captured by 'here and now', their communication is on line. The remarkable characteristic of human

language, however, is the off-line capacity. The rich vocabulary and syntax makes it possible to transcend the immediate present and to create a common history and culture including purposeful collective planning for the future. This is certainly a sharp distinction between monkeys and men and evolutionary a giant step.¹⁰

Young human infants also seem to treat the first words in a monkey-like way where each word is a unique, global acoustic gestalt. However, as the vocabulary increases the memory load and the discrimination difficulties increase to a critical point. Thus, the phonemic segments of language might be emerging consequences of an increasing vocabulary. And most young children are well prepared to use the basic building blocks of speech at an implicit level. However, some children seem to have more problems than others to take that step.

Locke¹¹ studied the language development among infants where at least one parent suffered from developmental dyslexia. These children were assumed to have an elevated risk of also developing dyslexia later on due to the genetic mechanisms involved. In comparison to a group of non-risk infants the early pattern of babbling was not as rich and varied among the infants at risk, suggesting a less elaborated segmental system. Scarborough¹² also studied risk children and followed their development over a long period of time. One clear finding was that the vocabulary development was slower among children at risk for dyslexia. Elbro¹³ identified a large number of risk children. They had significantly lower precision of their phonological representations of words than a group of control children. Two studies of event-related potentials (ERPs) from the brain registered in infants have also shown relations to subsequent reading ability¹⁴ and differences between infants with and without a family history of dyslexia¹⁵

Apart from an unfavourable genetic disposition, other obstacles during the course of development may prevent the productive use of speech segments in vocabulary development. For example, repeated and untreated middle ear infections (otitis media) may impair hearing by some 20 dB, which may be enough to seriously affect the ability to make relevant phonological distinctions.¹⁶ Although some children may be genetically more vulnerable than others to develop otitis media, environmental factors do play a role. Passive smoking has been identified as a risk factor. Neglect, poor caring and poor medical treatment are often socially determined factors increasing the risk for untreated otitis and delayed language development. Breast-feeding, however, is considered to be a powerful protective factor strengthening the immune defence and reducing the seriousness of an ear infection. One could also speculate on the role of breast-feeding in the development of attachment. At least it might be a good indicator of emotional bonds of beneficial value for the further development of communicative skills. In any case, the infant caring conditions involve physical as well as psychological and social dimensions.

Vocabulary development

We have already pointed out that very young infants have an excellent ability to discriminate speech sounds. Yet it is not clear whether they use this ability when they start to learn the meanings of words by the end of the first year of life. At ten months of age the average infant understands about 40 words (range 11–154).¹⁷ At 16 months the average vocabulary is 169 words (range of 93–321). Their assumed failure to discriminate between similarly sounding words is attributed to underspecification of phonological representation. Thus, small children are assumed to have less detailed phonological representations than those of adults. The low density of children's vocabularies does not seem to require full detail. The novelty of a word might also imply underspecification. As words become more familiar, the phonological representations become more detailed. However, Friederici and Wessels¹⁸ have shown that 9-month-old infants can tell legal and illegal consonant sequences apart, listening longer to words and syllables with legal sequences. Recent studies with habituation tasks and preferential looking have indicated that young word learners at the age of 1;2 in fact have detailed phonological representations.¹⁹ The children were indeed sensitive to mispronunciations of familiar words, indicating rather precise representations. It is still unclear, however, whether some children have a particular weakness in this respect.

The vocabulary growth in a human child is indeed impressive. We have seen how exposure to the mother tongue sculpts the brain to create a perceptual system that highlights the contrasts of the specific language, while de-emphasizing speech sound differences that are not used. And this happens before the child learns how to use words. It seems as if the brain sets up a probability structure for native speech sounds. The early change in phonetic perception thus assists word learning. Language acquisition is indeed already at full swing by the time children begin to utter their first words. If language input produces changes in both speech perception and production already in infancy, we need to know more about how much and what kind of speech children hear during the first years.

Although most children learn new words in their native language with a remarkable speed there are wide individual differences. Hart and Risley²⁰ observed pronounced differences in vocabulary among three-year-old pre-school children in Kansas. Three-year-old children with well-educated parents on average had an active vocabulary of 1600 words whereas children from homes with poorly educated parents on welfare had only one third of this vocabulary. Hart and Risley decided to take a closer look at the linguistic environment of children. During regular home visits to families they carefully recorded parent–child communication from the age of 8 months to the age of 36 months. They counted the number of words exposed to the child, and based on the sample

observed they estimated the total number of words exposed to the child over the first three years of life. The individual differences were rather dramatic.

Children of parents with higher education (professionals) had been exposed to an average of more than 30 million words during the first three years of living, whereas children of parents on social welfare had an average of about 10 million words. Children of working class parents had an estimate somewhere in between (about 20 million words). These differences are certainly dramatic and probably explain much of the differences in vocabulary growth between children from these social strata. It seems as if a possible contribution from genetic factors in explaining inter-individual variation is effectively masked by social factors.

Not only does the sheer number or quantity of words to which the children are exposed differ between the groups, but the quality of speech directed to the children is also different. The children of professionals were to a far higher extent exposed to encouragement, praise, warm suggestions, expressions of trust and the like, whereas children of parents on welfare primarily listened to utterances intended to restrict their actions, disciplinary orders, blame etc. No doubt, the quality of speech input should have an impact on the development of the child's self-concept and future courage and willingness to learn in school.

The higher the socio-economic level, the more the parents listened to their children, prompted children to elaborate their utterances, told their children what was worth remembering, and taught them how to cope with problems. The correlation nature of this fascinating study certainly requires care in the interpretation of causality. We cannot know with certainty that the linguistic development of the children is determined by the quantity and quality of the verbal interactions. However, in combination with evidence from other studies there is a great deal of support for an interpretation in the suggested direction.

The importance of a rich vocabulary for reading comprehension is quite obvious. If more than 5% of the words in a text are unknown, the resulting comprehension will probably be very modest. When the child has learnt how to read, one of the major sources for vocabulary acquisition is written texts in newspapers, magazines, textbooks, manuals, novels etc. If your vocabulary is not sufficient for comprehension, you tend to avoid texts – texts that might have given you a chance to learn new words. This vicious circle is certainly not easy to break.

Early informal literacy socialization

Before reading instruction is given in the first school year, most children in our society enjoy the benefit of a great deal of informal literacy socialization at home and in pre-school settings. Without yet being able to read many children come to know the conventions of print, its directionality and its layout principles. Certain basic ideas of literacy are learned in picture-book reading episodes where

decontextualized and over-articulated language is used. Children learn that books concern fictional worlds, and they discover the fantastic symbolic power of language, a magic vehicle taking them beyond the immediate present to new worlds of fiction and adventure.

Attachment security is also related to early informal literacy socialization (emergent literacy) during the pre-school years.²¹ Securely attached children were more attentive and less easily distracted during literacy interactions. The more securely attached children spent more time reading together with their mothers than less securely attached children. The insecure children were inattentive during storybook reading and had greater difficulty in understanding the text. There is a bi-directional relationship between parent and child. Frequent reading interactions will increase parents' sensitivity to their children's developmental level. These high quality interactions will, in turn, increase children's participation and interest in literacy, leading to more frequent interactions.

It is generally assumed that children who are exposed to texts at an early age will have an easier route into reading. However, the facilitation effect is not clear. In a review of the research literature on the effect of reading aloud to children Scarborough and Dobrich²² estimated that less than 10% of the variance in reading ability could be explained by this factor. This is certainly not impressive, but research in this field is difficult and outcomes like long-term reading interests and comprehension have not been examined.

Although the research evidence is still embarrassingly meagre, some potential benefits of reading aloud to children can be pointed out.

Spoken and written forms of language differ in many ways. The linguistic information is usually packed differently. Written discourse involves syntactic devices very seldom used in oral conversation, such as embedded sentence structures, explicit cohesive ties, appositive constructions, literary forms and expressions developed during a long tradition but never heard in spoken language.²³ In written language, deictic terms such as 'there, here, now, this, him, she' must be dis-ambiguated by linguistic means, whereas in spoken language situational cues and gestures make these terms clear. Thus, through extensive listening to written discourse the child is given the opportunity to acquire a more advanced *syntactic ability* necessary for parsing complex sentences.

Texts usually contain a far richer *vocabulary* than oral discourse. By utilizing contextual cues provided by the local linguistic environment like sentences or paragraphs or the larger story context the child may, after several encounters with a word, be able to reveal its meaning potential. However, it is doubtful whether this implicit vocabulary acquisition is effective enough. Probably, more direct teaching or explanations are needed. Sensitive parents or other adults often engage in such direct instructions on line as they encounter unknown or low-frequent words.

Most importantly, reading aloud to children can have the powerful effect of developing a lasting *interest* for reading. The enjoyment of reading is revealed to them. They come to realize the symbolic power of written words bringing them to new, unknown worlds of adventure, excitement, and surprising events far beyond the immediate present. It is also a question of developing an *intellectual habit* to use written texts. These benefits seem to imply a powerful social learning process where the adults serve as important models or figures of identification demonstrating the joy of reading, the value of the skill.

In a large international study of reading among 9-year olds and 14-year olds in some 30 countries²⁴ the single most powerful factor that could explain the individual variation in reading achievement was the number of books at home. This factor was more predictive than teaching or anything else in the school system. The number of books at home seems to be a very significant indicator of cultural capital. In many homes with an abundance of books there is also an atmosphere of learning. The children are expected to learn to read and they are expected to develop the intellectual habit of reading.

Phonological awareness as related to reading acquisition

During talking a child is normally attending to the meaning of a message rather than its linguistic form. As the Duchess in Alice in Wonderland expressed it: 'Take care of the sense and the sounds will take care of themselves'. Thus, the phonological segments of speech are not spontaneously extracted and attended to in the everyday life of a pre-school child. The phonological system functions rather as an encapsulated module, which does not require conscious control. In the speech stream the phonemic units are co-articulated by complex gestures such that the physical realization of the phonemes varies considerably depending on the context. The phonemes on which the alphabetic system is based are thus elusive, abstract and not easily perceived or brought to the child's attention.

The crucial factor in becoming literate then involves a step from *implicit* to *explicit* control of the phonemic segments of language. The productive use of an alphabetic script requires an explicit awareness of the elusive phonemes, a conscious control of these units, such that they can be manipulated, substituted, and recombined. Some thirty years ago I discussed the precursors of this ability²⁵ and related the basic shift of attention from content to form to the more general decentring ability that emerges in the pre-operational stage of cognitive development as described by Piaget.

In a longitudinal study we demonstrated that there is a strong connection between early phonological awareness and later success in learning to read.²⁶ What develops later in time (reading) can hardly be the cause of something preceding it. Thus, the longitudinal design indicated the causal direction,

especially since the majority of the children at the first assessment were not able to read. This association between phonological awareness and reading acquisition is actually one of the most robust findings of development and cognitive psychology, repeated and replicated over and over again across languages and different tasks.

A commonly held view is that reading instruction is necessary for the development of phonemic awareness. However, in a training study we have demonstrated that phonemic awareness can be developed among Scandinavian non-reading pre-schoolers outside the context of formal reading instruction without the use of letters or other elements of early reading instruction. We²⁷ designed a programme, which required daily games and exercises in group settings over a full pre-school year. The programme included listening games, rhymes and ditties, playing with sentences and words, discovering the initial sounds of words and finally carrying out full segmentation of words into phonemes.

The effects of this program were very specific. There were modest or even no effects on general cognitive functions, on language comprehension, on vocabulary, rhyming and syllable segmentation, but rather dramatic effects on phonemic skills. Thus, it was concluded that phonemic awareness could be developed among pre-schoolers by training, without introducing letters or written text. A more crucial element seems to be the explicit guidance of children when they are trying to access, attend to and extract the elusive, abstract, and implicit segments of language.

Our children were followed up through four school years, and reading and spelling were assessed on several occasions. The trained group outperformed the control group on each of twelve points of measurement, indicating the beneficial effect of the pre-school programme. I also presented data from children in pre-school with a high risk of developing reading disability as revealed in a pre-test on phonological awareness and general language development.²⁸ Risk children who were involved in the training programme had fairly normal reading and spelling development, whereas the control children showed the expected poor literacy development. Thus, it seems to be possible to prevent the development of reading and spelling disabilities in school by a carefully designed pre-school programme that brings the children to a level of phonological awareness that is sufficiently high to meet the demands involved in the alphabetic system. The risk children who did not enjoy the benefit of such training seemed to face serious obstacles on their way to literacy.

A most important step in reading acquisition is thus becoming aware of the phonemic segments of language. The association of these segments with letters is a comparatively trivial task, cognitively speaking, and is within reach for most children.

Thus, although phonological awareness is a critical prerequisite for the acquisition of word recognition skill, it is not a sufficient condition.

Gene-environment interaction

The analysis presented so far may suggest that a rich informal literacy socialization, including language stimulation and the promotion of the development of phonological awareness, are powerful preventive actions. However, there is a risk that this perspective on child development may imply a view of the child as a rather passive recipient of benevolent adult actions. In fact, however, there are some children who do not seem to react as expected. They do not listen to stories, are not interested in rhymes or letters, they avoid books and obviously prefer non-linguistic games even despite rich opportunities and invitations to participate in verbal activities. These children seem to make active choices and selectively avoid activities that, for some reason, do not suit them.

We have to acknowledge the fact that children are different already from the beginning. They have different genetic dispositions tuning them to different experiences. Family studies as well as twin studies²⁹ have demonstrated a rather strong heritability for reading ability. Suspected loci of critical genes have been identified by molecular techniques. So far, at least five candidate positions have been identified indicating very complex genotypic interactions towards a phenotypic reading disability.

The dynamic complexity is further increased by the fact that children are not passively responding to the environment, but are engaged in active *niche picking* to find their optimal habitats. Or to state it slightly differently, genes drive experience. And if the environment is variable and rich in affordances there are ample opportunities for this gene-environment interaction to shape the development of a child. In fact, the initial genetic differences may be very small and yet enormous phenotypic differences may occur as a result of this powerful gene-environmental interaction involving the active niche-picking mechanism referred to.

The complex interaction between genes and environment during the course of development should make us cautious in drawing simplistic conclusions on issues of causality. Although it may seem quite clear by now that phonemic awareness plays a crucial role in reading development, other factors may also be involved and show its influence at different stages of development.

Genetic factors, early hearing impairment due to otitis media, neglectful caring, or lack of stimulation may all contribute to a delayed phonological development with poor specification of the phonological structure of words. This impairment will make the task of understanding the alphabetic principle hard,

since the basic elements, the phonemes, are not readily accessed. Thus, the phonological weakness primarily affects the very beginning stage of reading acquisition.

Careful, competent teaching and warm parental support may help the child to overcome the obstacles raised by a poorly developed phonological system. The child may reach a fairly adequate level of word decoding. Still, other obstacles may occur at later stages of reading development when comprehension is more at stake. Then, limitations in vocabulary and syntactic ability may prevent the child from becoming a good reader.

Thus, the first kind of complexity in the causality pattern is the fact that different basic linguistic limitations may have their impact at different stages of reading development.

Another source of complexity is related to the fact that various sub-components of the language system influence each other reciprocally. Thus, a poor phonological component, which can be traced back to early infancy, may prevent an adequate vocabulary development. As we have seen, when infants acquire word meanings by relating speech sounds to objects and events in the world, the language-specific mapping of phonology that has already occurred greatly assists this process.

A poor phonological system may also involve a poor phonological working memory. Baddeley, Gathercole and Papagno³⁰ have demonstrated the relationship between poor working memory and difficulties in learning new words. However, the causal direction is debatable. With reference to a cross-lagged correlation analysis, Gathercole and Baddeley³¹ argued that poor phonological working memory is the cause of slow vocabulary acquisition. Metsala³² on the other hand presented arguments for a reversed causality. The acquisition of new words should rather assist the development of a well-functioning working memory.

Crain and Shankweiler³³ argued that difficulties with phonology would affect both word decoding and reading comprehension. Thus, according to these authors syntactic ability is dependent on adequate phonology and in particular good working memory.

A child with a delayed or impaired language development, including poorly developed vocabulary and syntactic problems, will not necessarily encounter great difficulties in the very early stages of reading. If the phonological system is in reasonably good shape one might expect that the code breaking would run smoothly and that the word decoding would develop normally. On the other hand, when the texts become more demanding in terms of vocabulary and syntax one would expect difficulties to occur.

Another complication, which makes early prediction uncertain, is the fact that some children with language impairment spontaneously catch up with their peers.

Thus, there are wide individual differences in the natural rate of brain development.

The issue of modularity or partly independent linguistic sub-components in the development of language is controversial. Connectionist thinking would speak for strong dependence between the various aspects of language development.³⁴ On the other hand, we have seen many cases with dissociation of language functions, where, for example, the phonological system has been poorly developed in some individuals, and yet, they have a rich vocabulary and adequate syntax. The paradoxical fact that some prominent authors and journalists have suffered from dyslexic problems is difficult to disregard in this context.

The obstacles for good reading described in this article are, of course, not an exhaustive list. My focus has intentionally been restricted to linguistic factors assuming that such factors are proximal to the reading process. The complexity of reading certainly requires research along several dimensions and at a multitude of levels involving genes, brain structures, brain functions, sensory systems phonological modules, general language development, cognitive systems, early socialisation, motivation, self concept, instruction, culture and historical factors. The lively activities along these lines in research institutions around the world certainly give a promise of a brighter future for children with reading difficulties as well as deeper insights into human cognitive and linguistic functioning.

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