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The Processes of Learning to Read in Children: Conceptual and Theoretical Developments

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Abstract: ***We publish in this article a theoretical view on the development of the concept of reading, from the narrative historical perspective to the various definitions of reading according to the views of ancient Arab researchers such as Ibn Manzur in the book "Lisan al-Arab" and Khalil Ibn Ahmad al-Farahdi in the dictionary of "Al-Ain" and other contemporary researchers who They were interested in reading and its learning processes in the child, and they developed scientific cognitive models for the stages that the newly-educated child follows, and this is from the advanced stages of pre-scheduling to the first stages of the primary stage. The process of reading in its entirety includes two processes: recognizing the symbols written in the text, and understanding the reading or the text in its entirety, and for the second process, which considers the end of reading related to the first basic process. Accordingly, it is not possible to achieve the ultimate goal of reading without good control in linking the phoneme-grapheme compatibility smoothly and achieving two basic elements of the process of recognizing written words, namely the accuracy of reading and the effectiveness of reading, and reaching the desired goal of reading so that the latter achieves the self and cognitive benefit of the child***.

Keywords: Reading, accuracy, effectiveness, recognizing, models

1. Introduction

Earning to read is considered one of the major tasks of basic education and children who have difficulties in reading go into a descending trend that suffers from regression and low school results, which results in failure and failure of school accompanied by a negative perception of self-esteem in the psychological, social and occupational future. When a case of learning difficulties in reading is revealed or examined, a distinction must be made between decoding (reading accuracy and reading speed quickly) and understanding (a good understanding of the readable text). The problems of learning to decode (developmental dyslexia) and the problems of learning to understand texts (reading comprehension disorder) are two different problems of difficulty, which appear to be related mainly together so that they are classified within what is known as learning difficulties. The first can be directly related to early oral language disorders (in the early stages of the child's learning of the oral language) that continue to develop phonological skills, which later form a barrier that impedes the course of learning to read in a large and special way, while disorders of reading comprehension can be linked in particular to difficulties comprehensive oral language, especially the problem of understanding the meanings of words and problems in grammatical and pure skills. Reading requires deciphering written symbols to reach understanding. During the process of learning to read, children learn about the way the writing system symbolizes their spoken language, and the printed words can be decoded into spoken words to get the meaning (Verhoeven et Perfetti, 2017). Most of the studies that were based on dyslexia and the current reading process were based on English-speaking children, which are characterized by a difficult pronunciation to control as is the case in the Arabic language (transparent language). Across the languages of the world to find out the cause of reading difficulties, taking into account the linguistic characteristics of each nation. The primary common component in diagnosing reading difficulties remains the accuracy of reading above 1.5 standard deviation. We will introduce the most important concepts of reading and its difficulties. Understanding these learning requires knowledge of normal processes reading acquisition. In the past two decades, researchers were interested in studying the procedures put in place during normal reading skills. The proposed models provide thus a framework for understanding reading difficulties by allowing locating the dysfunctions responsible for these difficulties.

In general, theoretical models consider that the act of reading schematically appeals to the interaction of two essential components in the process of writing a low level processing component, word recognition writings, and a higher level processing component, understanding (access to meaning with syntactic, semantic and textual integration). Recognition of written words is a specific ability to read (Alegria & Morais, 1989). It is indeed impossible to access the meaning of a text without identifying at least part of the word it behaves. In this chapter, we will discuss the process of learning to read, its cognitive models, and the stages of its learning as a prelude to presenting and interpreting, reading difficulties, including dyslexia in general, as a global form of public health problems and basic education for children in all countries of the world without exception.

2. Reading

1) Various definitions of reading:

The history of reading goes back to the invention of writing during the 4th millennium BC. Although reading printed texts is today an important means of accessing information for the general population, this has not always been the case. With few exceptions, only a small percentage of the population of many countries was considered literate before the industrial revolution. Among the pre-modern societies with a generally high literacy rate are classical Athens and the Islamic Caliphate (Andrew, 2002). Scholars assume that reading aloud (light Clare in Latin) was the most common

practice in Antiquity, and that silent reading (light tacit or light sibi in Latin) was unusual (Carruthers, 2008). In The Confessions he wrote in the fourth century BC, Augustine of Hippo noted the unusual habit of Aurelius Ambrosius to read in silence (Carruthers, 2008; Jajdelska, 2007). In the Age of Enlightenment, elites encouraged passive reading rather than creative interpretation. Reading does not have concrete laws, but it allows readers to escape to produce their own products introspectively, favoring a deep exploration of the texts during the interpretation. Some thinkers of that time believed that construction (that is, the creation of writing and the production of a product) was a sign of initiative and active participation in society; in return, they considered consumption (that is to say, reading) as a simple absorption of what the manufacturers manufactured (De Certeau, 1984). Readers of that time were viewed as passive citizens because they did not make a product.

French historian Michel de Certeau argued that the elites of the Age of Enlightenment were responsible for this general belief. For Michel de Certeau, reading required venturing into the author's country, but taking away what the reader wanted precisely. This opinion maintained that writing was an art superior to reading within the hierarchical constraints of the time (De Certeau, 1984).

In eighteenth-century Europe, the then new practice of reading alone in bed was, for a time, considered dangerous and immoral. With reading becoming less of a common speaking practice and more of a private and silent practice, and with sleep moving more and more from common areas towards individual rooms, some expressed concern that reading in bed posed various dangers, such as fires caused by bedside candles. Some modern critics, however, speculate that these concerns were based on the fear that readers - and in particular women- could escape their family and community obligations and transcend moral boundaries through the fantasy worlds deprived of books (Nika, 2017). There is no fixed and fixed date for the beginning of learning to read and use from the beginning of humanity on the face of the earth to the present day, as researchers reached the topic of the history of the origination of reading. For an individual, who has been the principle of deciphering symbols and figures printed anywhere or something (rocks, trees, drawings and symbols, on leather, on wood panels and newspapers, to this day, even electronic media props, etc.) and understanding the content of his message to build new knowledge or use it Later in appropriate situations. It has been closely related to the heavenly books (Qur'an, Torah, Injil and Zabur) to spread and spread religion in the circles of their countries and societies over time. The verb of **reading** in the ancient was associated with religion and heavenly books, and here we refer to the first appearance of the command of the act of reading and this was with the first word revealed to the Prophet of Mercy Muhammad, peace and blessings be upon him, is "read" in the first of any of the first Surah Al-Alaq from the book of God Almighty, which he called the Qur'an And the Criterion is a short sentence in its pronunciation, broad in its concept, the Almighty saying:*{ Read in the name of your Lord who created }* [Al-Alaq 96: 1] The verb "reading" has been mentioned in many verses and surahs in the Book of God Almighty and this is more than 1400 years ago. Accordingly, the religion of Islam commands and urges reading and learning it as it is shown in the following verses: *{so if you are in doubt*, [O Muhammad], *about that which we have revealed to you then ask those who have been reading the Scripture before you. The truth has certainly come to you from your Lord, so never be among the doubters.}* [Yunus 10: 94], Likewise in [Surah Al Furqan: 32, Sheba: 31, and "Al-Talaq" Divorce: 26, and Al-Zukhruf: 31], [Al-Jin 72: 1]. Many Arab grammatical scholars have also defined the word reading, and we mention from them the dictionary of Al-Ain to Khalil bin Ahmed Al-Farahidi - died: 170 AH/940 AD, the dictionary of the Arabic tongue - Ibn Manzur al-Afriqi - died: 711 AH /1311 AD and other ancient Arab linguists and we mention some language definitions, for example: • Read the book and the like.1- Follow his words, given or not, he likes to read poetry / narrations, he used to read daily newspapers: He read the book, read, read, and Quran: he followed his words and pronounced them. He read following his words and did not utter them. And it was called (newly) in silent reading and he read the verse from the Qur'an: He uttered her words from sight or from memorizing because he is a reader. Plural: readers. And he, peace is upon him, read it: He informed him.

He read it and read the Qur'an: put it together and put it together until today, researchers and intellectuals did not agree on a unified concept for reading a single, but there are several different and diverse concepts, and this is due to the diversity of fields of specialization for each researcher on the one hand, as well as the difficulty of the concept and the breadth of its temporal and spatial limits and its semantic dimensions that differ according to the context and subject of treatment, and we mention among them: "Reading" is the process of looking at a series of written symbols and obtaining meaning from them. When we read, we use our eyes to receive written symbols (letters, punctuation marks, and spaces) and use our brain to turn them into words, phrases, and paragraphs that get us together. The reading can be silent (in our minds) or loudly (until others hear it).

Reading is a receptive skill – with which we receive information. But the complex reading process also requires the skill of speaking, so that we can pronounce the words we read. In this sense, reading is also a fruitful skill in that we receive and transmit information (even if only with ourselves). **Reading** is the third of the four language skills: Listening, speaking, reading, writing in our language, reading is usually the third language skill we learn. The verb of reading express an individual's ability to link between the linear series units of text and the special linguistic units of the natural language (sound or phoneme, syllables and words, grammatical units), in addition to awareness of the content of the written text (1) Consciousness consists in understanding the meaning of the text in its own context. Therefore, the purpose of reading is to gain an understanding of the written text. **Reading** is a complex activity that cannot be defined by one type of cognitive process. In fact, this involves the coordinated implementation of various processes of general skills (such as attention, memory, and general knowledge) and skills

for handling written information. In general, theoretical models consider that a schematic reading verb calls for interaction between two basic components of writing processing: 1 / a low-level processing component, which is recognition of written words, 2 / a high-level processing component, which is understanding (i.e. reaching meaning with integration) Grammar, semantic and deliberative text). Recognition of written words is a special ability to read (Alegria & Morais, 1989). It is really impossible to reach the meaning of the text without specifying at least part of the words it contains. José Morais (1994) defines reading as a set of consecutive cognitive processes that are concerned with the processing of symbols drawn, written, or printed in order to gain an understanding of the message they contain. He adds that the ability to read is a cognitive activity that converts representations (inputs) to other representations (outputs). The researcher pointed out in his book "The Art of Reading" in «L'art de lire» in 1994, "When we talk about reading, we often confuse the concepts related to it" reading ability, reading goal, reading activity, reading skills. Reading skills: means the output, which is the degree of success of the reading activity (Morais, 1994).

Reading Activity: It is the set of events that occur in the mind and in the cognitive system that the brain supports and is accompanied by sensory and motor organs. Reading goals: is to understand the written text or achieve a beautiful impression or behavior. The ability to read: It is that part of the total mental resources that we move during reading and is devoted to reading activity, in other words it is not involved in other activities. The variety of definitions prompts Hudson et al. (2009) to consider fluency in reading as a complex and multifactorial construction where certain notions are frequently associated such as precision, automation, prosody, comprehension (Kuhn & al., 2010) and speed of reading (Wolf & Katzir-Cohen, 2009).

2) Concepts related to fluency

Word reading accuracy is the ability to recognize or decode words correctly. Reading speed covers both the speed of identification of single words and the speed of movement in a text (Torgesen and Hudson, 2006). Effective reading speed, associates reading speed, number of words read per minute, with accuracy of comprehension (Jackson and Mc Clelland, 1979). Reading is a multi-faceted process that includes word recognition, understanding, fluency and motivation. Learn how readers combine these aspects to create meaning from typing or writing. In order to do this, we must present the various explanations of the reading process, so that we can understand them well and determine which types of their disorders are.

3) Identify the written words

Gombert and his colleagues (2000) also emphasized that writing, unlike the oral language that is automatically acquired, graded and read, especially the acquisition of knowledge of words written in languages with spelling, has explored abundant and there are several theories and models that have been concluded to explain this phenomenon in this part, we have presented only three models. Frith Model (1985) Seymour Model (1997) Gombert Model (Gombert, 2000; 2003; 2004). The choice of the Frith model (1985) is due to the fact that it has been subjected to several criticisms and considered prominent this model mainly many hypotheses that remain until now have a significant impact. The Seymour (1997) model was chosen because it responds somewhat to criticism of the Frith model. Finally, the Gombert model was chosen because it uses an additional concept of distinguishing between explicit and implicit gradation of reading, It is clean that for the economy, we have not developed hypotheses and models for knowing the written words of a good reader, but some of these hypotheses were presented with achievement before presenting the models for the gradient, as some of these models were inspired by the assumptions of good reading. It is clear that we finished this section with a brief introduction of models evaluating the knowledge of written words.

4) Evolution Models of Learning Reading

This section is devoted to the evolution and description of the main models learning to read and their concept of dyslexia.

4.1 Frith Model (1985)

Around the 1980s, the first developmental models emerged. Overall, according to these models, the reading system is developed by a series stages (or stages) that allow the adoption of different strategies or treatment procedures. The purpose of these models is to describe the passage of learning from the apprentice reader to the expert reader. One of these models, the most famous, is that of Frith (1985). His model learning to read comprises three successive and interdependent stages: the logographic stage, alphabetical stage and orthographic stage, as reported in Table. **The logographic strategy** is characterized by a mode of word identification based on the recognition of a visual pattern, the subject of which has memorized the meaning. We call it a graphic "logo" with reference to the "logo" whose meaning is based on their graphic representation. This stage occurs well before learning the word decoding. The phonological factors and the order of the letters are then completely ignored. **The alphabetical strategy** is characterized for its part by a process of identification based on the use of grapheme phoneme correspondences. The meaning of the written word is obtained from the sequence of phonemes that we have assembled. However, this strategy does not allow the decoding of irregular words and recognition of morphemes. Finally, the **orthographic (spelling) strategy** is characterized by the identification of words on the basis of the orthographic unit, without compulsory mediation phonological. At this stage, letter groupings are recognized visually and combined to form words with the support of verbal semantics thus speeding up the reading process. The child thus builds the strategies of adult reading and becomes a fast reader. Another peculiarity of the model developed by Frith in 1985 is that reading and spelling can develop in phase shift and influence each other compared to each other. Reading and writing serve in turn to stimulate development of a strategy. Reading is considered to be the stimulator of logographic strategy, which is then transferred to the field of writing. Subsequently, writing serves as a stimulator for the development of the alphabetical strategy, which is transferred to the field of reading. Finally, reading again serves as a stimulator for

development of the spelling strategy, which is ultimately transferred to the domain of writing. According to the author, reading and writing is cognitive activities not only very close but also in mutual interrelation. Progress and disturbances of each influencing the learning of the other. Frith's model was criticized by the scientific community because it does not account for the anomalies which can be observed, both in reading and in dictation, in dyslexics.

Table 1: Model of the stages of learning to read and write linked together from Frith (1985)

Stages	Reading	Writing
1 a	Logographic	(Symbolic)
1 b	Logographic	Logographic
2a	Logographic	Alphabetic
2b	Alphabetic	Alphabetic
3a	Orthographic	Alphabetic
3b	Orthographic	Orthographic

Note: The numbers "1, 2, 3" and lowercase letters "a" and "b" indicate the stages of the development of reading and writing processes at the same time it becomes automatic and fluent between the following levels: the symbol is your own logo graphic and the alphabet, up to Orthographic which is later known as the harmonics between graphic phonemic.

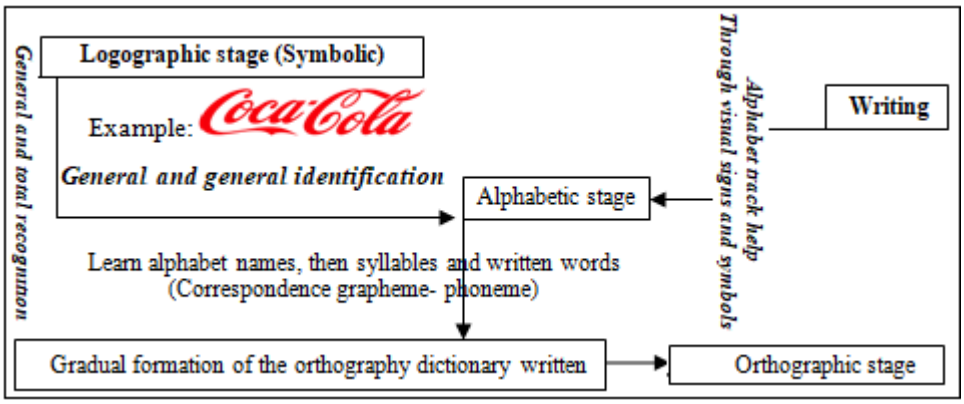

Figure 1: A graphic representation of the first model of the learning to read and write stages for Frith Mentioned in (Ladjal, 2015)

The following chart summarizes and illustrates how to move between the three different stages shown in the Frith model. This figure clearly summarizes how to move between the three stages of learning to read in a newly learned child that is between Frith (1985), which is considered as one of the first models of learning to read, which moves from the logistical stage, then the alphabetical stage, to the orthographic stage of spelling that depends on the storage of words and the formation of the written linguistic dictionary. For the child, it should be noted that this interim model was the cause of several criticisms, especially regarding the successive trait and not the set of stages, and the certain passage through the logistical stage (Casalis, 1995; Rieben, Foyel & Perfetti, 1997; Spreger-Charolles & Casalis, 1995) these criticisms Some writers and researchers have led the likes of Seymour to present a more effective model which we will present later.

4.2 Dual Track Models

Reading learning paradigms have witnessed several developed by researchers that resulted in converging models in the proposition that defined the dual-track model, and we mention the Seymour, Besner, Coltheart model and other researchers who were dedicated to providing an accurate definition of dyslexia and their later types that depend on dual models.

4.2.1 The Double Foundation Model of Seymour (1997):

This model defends the coexistence of logographic and alphabetical procedures during the construction of the orthographic lexicon. The objectives of this model are: to better account for individual differences in the acquisition of reading — writing to present the idea of interactivity between the processes; and to show that the development of phonological awareness under the effect of teaching takes place from reduced units to large units (Seymour, 1997). For this, this orthographic development model proposes to go beyond the developmental perspective in stages which presents the alphabetical phase as critical in the learning of the written language by highlighting other components which could explain learning disabilities. These are 5 in number and can be designed as “processors or modules”, logographic, alphabetical, linguistic awareness, orthographic and morphographic processors (see figure 2). The first two modules have a foundational role insofar as they contribute significantly to the development of spelling development and not only during the early stages, and store them. This term cannot be assimilated to logographic recognition via strictly visual indices (as in the models of Frith, 1985 and Morton, 1989) but refers to visuo-orthographic processes taking into account phonological indices. Thus, the logographic process, according to Seymour, consists in storing lexical or infra-lexical units, the orthographic information being able to remain incomplete (letters or groups of letters not specified). This processor is essential because it is through it that the word copies, from which the orthographic information must be extracted, are internalized. Finally, it does not require phonemic awareness (no interactive relationship is observed with linguistic awareness). A deficit in this process could cause difficulty in memorizing a vocabulary and in the long term: a distortion

in the development of the orthographic system which will manifest itself in the form of a pattern of "surface dyslexia" in reading and a deficient orthographic. The function of the logographic processor is to recognize words or parts of words directly the alphabetic processor is based on knowledge of letters and their "sound" equivalents. Seymour (1997) specifies that "the acquisition of letters can be conceived as a second form of logographic learning", if we consider that letters remain arbitrary signs to learn and store. However, they have to the logographic processor, which maintains an interactive relationship with the phonological component of linguistic awareness, in the sense that the establishment of the alphabetic process involves the isolation of the phonemic structures of speech. This is consistent with much evidence that the emergence of the ability to manipulate phonemes coincides with the formal introduction of the alphabet (Alegria et al., 1982).

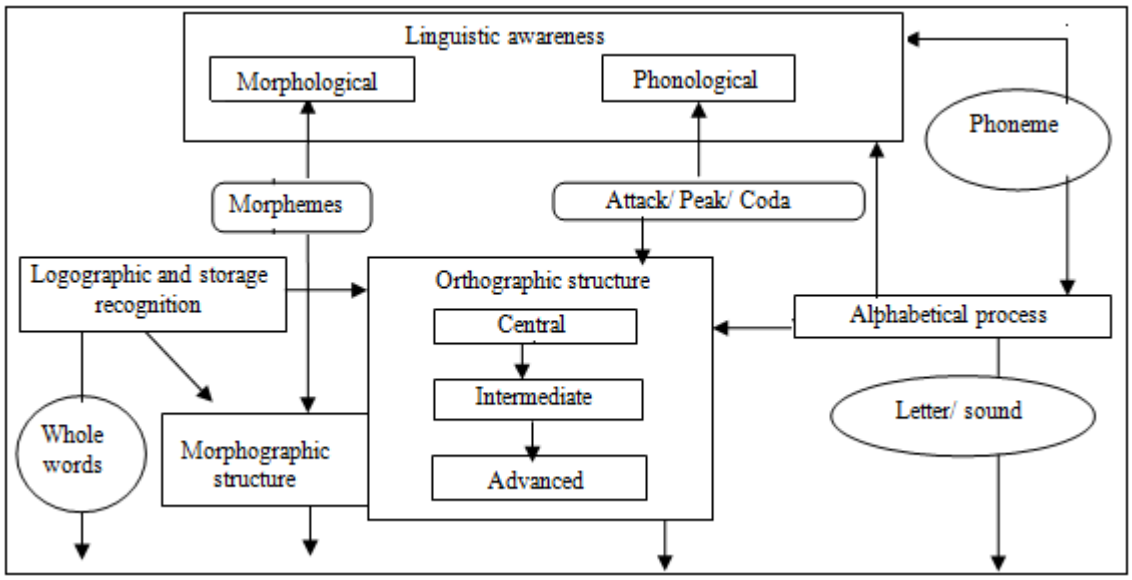

Figure 2: Double foundation model of orthographic development, adapted according to Seymour (1997).

These two processors are founders of orthographic development insofar as they are essential for the development of orthographic representations and their specifications. Linguistic awareness develops under the effect of learning the written language during orthographic segments are related to phonological segments whose size varies, partly, according to the level of development achieved and, on the other hand, depending on environmental pressure. Two types of linguistic awareness can then be distinguished (Duncan et al., 1994; Seymour and Evans, 1999): (1) An implicit and natural linguistic awareness which proceeds from the lowest level of the hierarchy, from whole syllables going through attacks and rhymes up to the phonemic level; (2) An explicit linguistic awareness implemented under the effect of the instruction which develops in the opposite direction, from the phonemic level to the lowest levels of the hierarchy. Finally, this model postulates another form of linguistic awareness in reference to the morphological structure of words, which is necessary for more advanced levels of development during those who have the ability to spell complex words, composed of combinations syllables, prefixes and suffixes is required (Seymour & Evans, 1999).

The orthographic processor is the focal point of the model. Its function is to code general knowledge of the system (orthographic information) with specific features of words. The developmental hypothesis assumes that the process first involves simple structures towards complex structures (complete and specific sequences of letters forming words). Thus, the lexical units stored by the logographic processor can be specified by the orthographic processor. According to Seymour (1997), the process of "representational description" by Karmiloff-Smith (1992) accounts for this development. The development of the orthographic structure proceeds during the development by steps or stages: a distinction will be made between the central stage, the intermediate stage and the advanced stage. The origin of the orthographic structure is the central stage. The hypothesis is that there emerges basic knowledge on graphemes-phonemes resulting from the formation of the alphabetic process. A reorganization of all the correspondence (i.e. the list of letters and their predominant sound) would be carried out. This would be based on the three-dimensional structure of the initial consonant (CI), vowel (V) and final consonant (CF) or attack / pic / coda type syllable as well as on the realization of a parallel orthographic representation. The basis and specification of orthographic representations would therefore result from the use of the 3D phonological level of the syllable linked to their graphemic realization (Karmiloff-Smith, 1992).

Finally, a processor processes the morphological structure of the words, the processes carried out by this module being dependent on those carried out by the orthographic processor. This model of orthographic development is developed as a central idea that the achievement of reading and writing encountered in play the formation of a "structure" which encodes the abstract properties of the written language and that this development depends on the contributions logographic and alphabetical foundations as well as reciprocal interactions with linguistic awareness. According to this model, children could develop a certain orthographic sensitivity to frequent series of letters in

written language despite their difficulty in mastering the processing of phonological coding.

4.2.2 Dual Route Models

What characterizes dual-path models is the assumption that the act of reading is based on two procedures corresponding to two reading channels. The two reading channels use specific components. Thus, information on the orthographic and phonological form of words memorized in lexicons is specific to the lexical way, whereas a system of transcoding of orthographic units into their phonological correspondents (conversion grapheme-phoneme) is specific to the sub-lexical way. Each channel specializes in processing of one type of item: the lexical way in word processing, the sub-lexical way (or analytical) in the treatment of pseudo-words and new words. The dual route hypothesis of Reading was published in the 70s and 80s, making this theoretical framework one of the oldest. The first computational version of the dual-lane model is the DRC (Dual Route Cascaded model), proposed by Coltheart et al. in 2001. The DRC model Figure (3) assumes a cascade transmission of activations so that the activation spreads between adjacent levels via bidirectional connections, excitatory and inhibitory. Only the connections between the line and letter levels are unidirectional. They are bidirectional but only exciting between the lexicons orthographic and phonological.

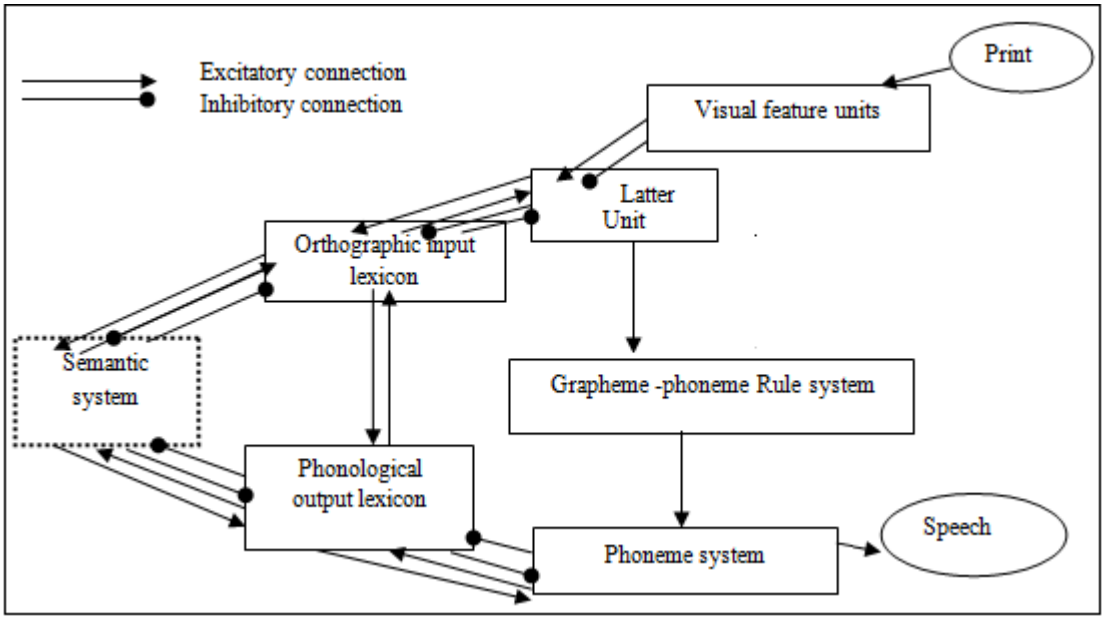

Figure 3: *Schematic representation of the DRC model (Coltheart e al., 2001))*

The presentation of a written sequence results in the activation of traits which compose the letters which, themselves, activate the letter units, according to the principles of IA model. The information then spreads to the components of the lexical and sub-lexical pathways. For the lexical way, the activation is propagated in parallel from the units "letters" to the units "words" of orthographic lexicon with return activation of the "letter" level. Orthographic units activate the units of the phonological lexicon which, in turn, activate the corresponding phonemes within the phonemic system. For the sub-lexical way, each letter or group of letters is associated with the phoneme which corresponds to it most frequently in the language thanks to the rules of grapheme-phoneme conversion. The processing is strictly serial, operating from left to right at within the sequence. Phonemic activation is transmitted to the units of the phonemic system. The units of this system therefore potentially receive activations from both the lexical pathways and sub-lexical. The phonological response in response to the written entry corresponds to the exit from the phonemic system. It largely depends on the course of treatment within the two reading channels. The complete diagram of the model shown in Figure (3) also provides the existence of a semantic path, but this has not been implemented.

The model accounts for the effects of lexicality (words are read faster than words pseudo-words) and frequency. The regularity effects are explained by the competition between the tracks lexical and sub-lexical:

— When words are of high frequency, faster processing of the lexical path leads to activate the units of the phonemic system before their activation via the analytical system. The answer is therefore only a function of lexical processing both for regular words than irregular.

— On the other hand, low frequency words are found less quickly via the lexical procedure, which delays the activation of units within the phonemic system. In this case, the activations phonemes that result from the grapheme-phoneme conversion can be transmitted to units of the phonemic system simultaneously with the activation of these units by the lexical way. This model simulates several classic effects of reading aloud: (1) the frequency effect (Forster and Chambers, 1973), (2) the regularity effect and the interaction between these two effects (Seidenberg et al. 1984), (3) the effect of pseudo- homophony, (4) the effect of neighborhood size, (5) the effect of repetitions and many others experimental effects. However, the model seems to be having difficulties for simulate the effects of neighborhood frequency and word superiority. In addition, the DRC

applies to English, German, French and Italian but surely isn't suitable for very different writing systems like Chinese, Japanese, Korean and Hebrew. He does not share the hypothesis of a universal phonological coding in silent reading and restricts this coding to alphabetic systems with vowels. A strong point of this model is that it successfully accounts for two types of dyslexia: phonological dyslexia and surface dyslexia, consequences of a non-lexical and lexical pathway disorder respectively. Although the performance of this model is very good and its simplicity and clarity make it particularly attractive, it was recently criticized by Perry, Ziegler and Zorzi (Perry et al. 2007) who proposed a connectionist model incorporating part of the DRC and capable of simulating even more performance. It will be presented in the following section devoted to these connectionist models.

4.2.3 The CDP + model

The CDP + model (Perry et al., 2007) adopts the central hypothesis of double-channel models by postulating the existence of two reading channels involving clean components. The objective is to respond to the limits of the DRC model by simulating the effects of consistency and providing the network with self-learning capabilities. The novelty of the CDP + model lies essentially in its implementation of the track sub-lexical (Figure 4). A level of graphemic representation (graphemic buffer) is added which codes the different grapheme according to their syllabic position. A TLA network (assembly network two layers, two-layer assembly network) encodes the grapheme-phoneme relationships. It is structured by exposure to words from grapho-syllabic information from the graphemic buffer; the connections with the corresponding phonemes are all the stronger than the correspondence occurs in more frequent words. The processing is associative and serial within this network.

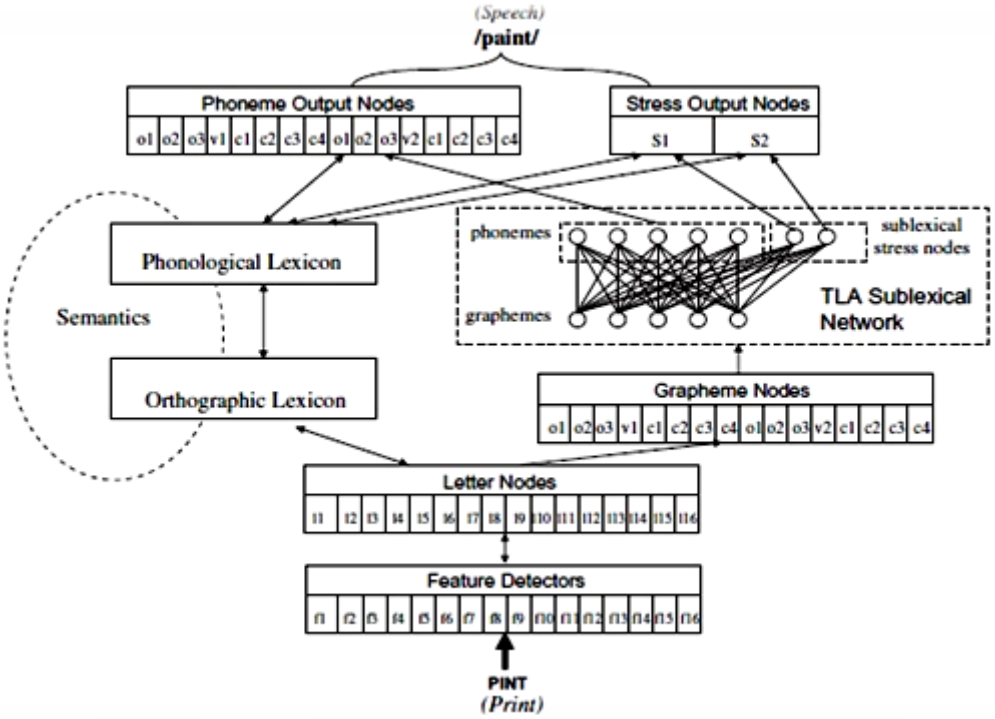

Figure 4: Schematic representation of the CDP + model (Perry et al., 2007).

The activations from the lexical and sub-lexical pathways are then combined by summation to within the output phonological component. The sequence produced corresponds to all the most activated phonemes on each position. We note that CDP + simulates the effects of consistency and item-by-item performance of the model correlate with those of human subjects more strongly than for previous models (DRC and triangle). The effects of length more marked on the pseudo-words than on the words are reproduced, as well as the positional effects of the irregularity in the word. An extension of the model to the words and English disyllabic pseudo-words, the CDP ++ model; have been proposed recently (Perry et al., 2010). This new model notably includes a tonal accent assignment component, which receives excitatory connections of the phonological outputs of the TLA network and maintains connections bidirectional with the units of the phonological lexicon. CDP ++ was also used for simulate the reading performance of multi-syllabic items in French (Perry et al., 2010).

4.2.4 The multi-trace model (Ans and al. 1998):

Like dual-route models, the multi-trace model postulates that 2 types of procedures, one global and the other analytical, are necessary to be able to pronounce all the sequences of letters. However, it cannot be considered as a new version of the two-road model for three main reasons. First, the procedures global and analytical involve similar computational principles: the analytical path does not include a system of conversion rules grapheme / phoneme but the correspondence between spelling and phonology emerges from learning whole words and the syllables of those words. On the other hand, the 2 mechanisms do not operate in parallel, the overall procedure always intervenes first and the analytical procedure is set up only when the previous one failed. Finally, the 2 procedures do not are a priori dedicated to a type of stimuli (words or pseudo words)

and do not differ only in the type of visual attention they involve. Only the items recognized as familiar by the system are treated globally. The unfamiliar letter sequences cannot be processed from this way and are therefore treated analytically. This network is made up of 4 layers of units: two orthographic layers with a similar architecture, an output phonological layer and a layer intermediary of episodic memory. Coding of the orthographic entry depends on the reading channel used and therefore on the focal point of the visuo-attentional window. In global mode, the visual-attention window includes the word. The orthographic units coding for each of the letters of the word as well as those encoding the initial and final spaces are therefore activated and generate the simultaneous activation of the phonological form. In analytical mode, on the other hand, the visual-attention windows include only a small part of the letter sequence, the rest of the letters being coded as contextual. The syllables are successively presented to the input orthographic layer and their phonological correspondence becomes available. The presentation of a word or a syllable of this word to system generates a trace in episodic memory. Learning consists in strengthening the connection weights between this unit and active units in the two orthographic layers and the phonological layer. This model works well for simulating normal reading and the two types of dyslexia. Its main advantage is to allow the reading polysyllabic words and pseudo-words unlike pretenses that were limited to monosyllabic words. Another plus of this model is that it takes into account visuo-attentional processes like an integral part of the reading procedure.

Through what was discussed in the literature on reading and mentioned the most important models and their development according to the view of their owners, which may differ according to the linguistic cultural environment of one society to another. For example, the DRC Model for Coltheart (2001) has achieved positive responses in understanding the reading process and in particular providing a clear and comprehensive vision on dyslexia and its types, and it also helps researchers to develop treatment programs appropriate for each type of reading difficulties, and this is never dispensed with other models. Each model reflects a percentage of the reality of reading learning and its difficulties. The causes of dyslexia and thus give it an accurate and uniform definition in the world or even every linguistically different society that has linguistic specificities.

We have touched on a part of the concepts of the reading process and the ways it is learned by the child and other elements remain that we have not touched upon and this is according to our cognitive perception only, and we cannot understand dyslexia without being able to the most important theoretical concepts about how to learn to read and its cognitive processes and the underlying skills such as attention and memory, especially work memory and various Their compounds and phonological awareness and other important related compounds.

Reading and its cortical areas:

The first description of the center of speech is due to Bouillaud who in 1825 locates “the legislative organ of speech” in the anterior lobes of the brain. This opinion was strongly criticized by anti-localizationists like Flourens. To the at the same time a surgeon of Napoleon, Doctor Dax (1836) maintains that the language disorders are related to previous lesions of the left brain. Broca (1865) locates the center of articulated language at the level of the foot of the 3rd convolution frontal and Trousseau gives the name of aphasia to language disorders speak clearly. Soon after a German physician, Wernicke (1874) described another type of aphasia following lesions of the 1st temporal convolution. The patient does not understand what he is told (verbal deafness), nor what he reads (Alexia) in 1892, the neurologist Joseph-Jules Déjerine reported the case of a patient who presented unable to read, but could still write from dictation, without being able to read this that he had written. This disorder being well isolated and specific, he called it “blindness verbal “, which is now called "Alexia pure "or "Alexia without graphic". The patient died a few years later and during his autopsy, Déjerine discovered old lesions in the left occipital (visual) lobe and the bundle of associated nerve fibers (callused lesion) He deduced that there was a center specific reading located in the left cerebral cortex, which had been disconnected, visual areas: “the visual center of letters”. He located this center in the angular gyrus (inferior parietal lobe and first temporal convolutions). A Following these observations, Geschwind (1965) developed a global diagram of the areas cortices involved in the pronunciation of read words. This diagram included the primary visual areas, the angular gyrus, Wernicke's area located in the lobe temporal (and considered as an area of integration of visual messages and hearing), then from there, by a bundle of nerve fibers (arched bundle) the projections were performed in the Broca area and finally in the motor areas allowing phonation. Dejerine, then Geschwind therefore had a serial vision of reading, according to which the nerve centers processed information step by step and successively. The visual information gained the visual center of the letters, then the center of the auditory images of words, the region of Broca where the words took — meaning and articulated shape — to finally reach the motor area allowing their pronunciation (Figure 5).

Functional MRI, another method, can be used to locate activated regions during reading. Participants mentally read presented words at a random pace. Among the activated network, the region of the visual form of words systematically appears at the approach of the left lateral occipito-temporal sulcus, on the edge of the fusiform convolution. According to Ishai et al. (2000), and Puce et al. (1996), reading, that is to say the recognition of written words, activates an occipito-temporal area always located between responses to faces and responses to objects. But MRI and PET are exploration methods that introduce a delay between blood flow and reception, and therefore imprecision. See figure 6 (Dehaene, 2007).

Electroencephalography (EEG) and magneto encephalography (MEG) allow more precise measurements to be obtained outside the cranium. According to Allison et al. (1999), face recognition is treated preferentially in the right occipito-temporal region, and words in the left. Regardless of their position on the retina, the words we read converge on the occipito-temporal region of the left hemisphere (spatial invariance). In this experiment,

participants read words presented to the left or right of the gaze fixation point. We know that words shown on the left side of the screen are initially processed by the right hemisphere, and vice versa. Around 150-170 ms after the word appears, a first wave appears on the side opposite the word and is associated with the activation of a visual region located behind the brain called the V4 area. Around 180-200 ms, a second wave appears, still on the left side. MRI confirms the convergence of activation towards the ventral occipito-temporal region of the left hemisphere (the corpus callosum, a thick network of nerve connections). Written words can be recognized unconsciously or subliminally. In this experiment a word is presented for 29 ms and sandwiched between other shapes making it completely invisible (priming effect). Yet this unconscious word speeds up participants' responses when it then appears consciously. Brain imaging shows that the left occipito-temporal region is responsible for this priming effect: its activity decreases when the same word is repeated, even when its typography is changed (Dehaene et al., 2001). We know that neurons are sensitive to repetition: their rate of discharge decreases rapidly when the same image is repeated several times, while it rises to a high level when one new image is presented. The lowest level that of letter processing is observed in the rear part of the occipito-temporal region, in both hemispheres.

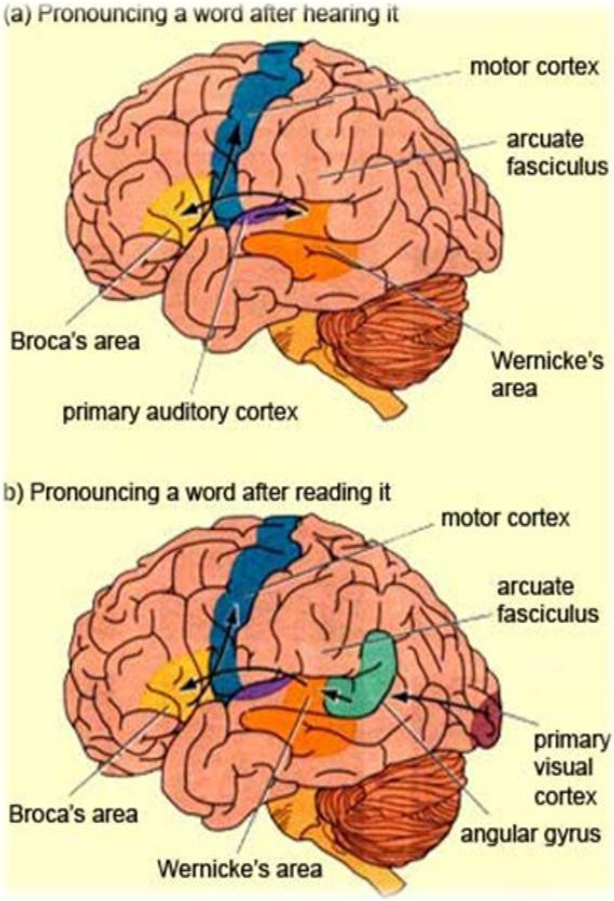

Figure 5: Schematic representation of the connection of brain regions during reading (cited in Rhawn, G. J. , 2000)

At this level, only isolated letters are coded. A more advanced level of perceptual invariance is achieved in the immediately anterior region of the left hemisphere, one cm further forward. This region identifies the resemblance between words like TREFLE and reflection. However, only the left occipito-temporal region recognizes the invariance between g and G. Its counterpart in the right hemisphere recognizes the resemblance between the identical typographical words SOUK and souk, but not between ERG and erg (due to the spelling different between capitals and lower case). The French find words that have a meaning more quickly than the series of letters or the series of numbers. There is a cultural permeation of the cortex when learning to read. But it is the same region that is activated regardless of the written language (Latin alphabet, Chinese or Japanese characters, etc.). Thanks to the magneto encephalography, we could see that, depending on whether you hear or read a word, the pathways of entry into the cortex differ, but the activity then converges on the same areas of language. During reading, activation begins in the occipital pole, at around 100 ms, then at around 170 ms it extends to the left occipito-temporal region, the presumed site of the analysis of the visual form of the word. Then there is an explosion of activity in multiple temporal and frontal regions shared with the hearing of words (Marinkovic et al, 2003).

Psychologists postulate two ways of reading: - regular words and neologisms are recognized by a way of translating letters into sounds (grapheme-phoneme conversion); - frequent or irregular words are identified in a mental lexicon which gives access to the identity and in the sense of words. Recent experiments show that the two reading paths postulated by psychologists correspond to two distinct networks of cerebral areas (that of sound and that of sense). It is the upper temporal region that is involved in the conversion of letters into sounds. Brain imaging (MRI) distinguishes visual regions (in the left hemisphere) activated by seeing a letter, and auditory regions activated by listening to sound (in the right hemisphere). But a whole part of the superior temporal cortex is multimodal, that is, it activates as much in writing as it is orally (in the right hemisphere). An upper region of the temporal lobe, known as the planum temporale, responds to compatibility between letters and sounds: listening to a sound compatible with the letter (o and 'o') increases the activity of this region, while conflict between letter and sound (a and 'o') results in reduced activity. Thanks to MEG, we know that this conversion of letters into sounds begins as early as 225 ms after the appearance of the letter on the retina, and compatibility with sound is recognized after approximately 400 ms.

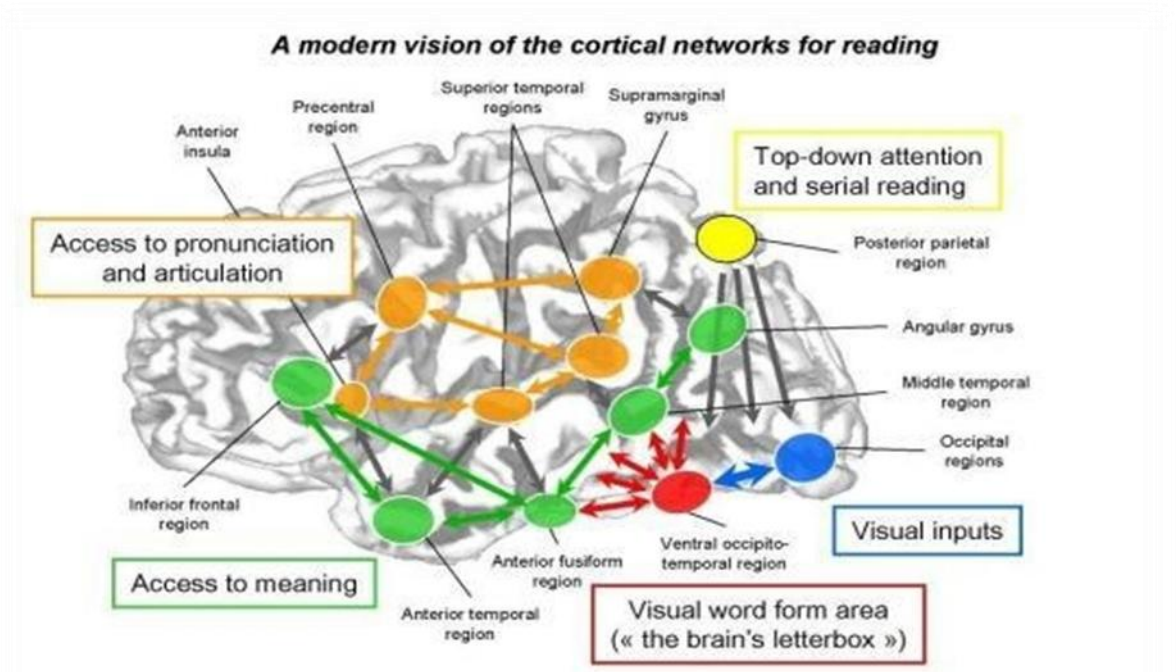

Figure 6 : The classical neurological model of reading (top) is now replaced by a parallel and "bushy" model (bottom).The left occipito-temporal "letterbox" identifies the visual form of letter strings. It then distributes this invariant visual information to numerous regions, spread over the left hemisphere, that encode word meaning, sound pattern, and articulation. All the regions in green and orange are not specific to reading: they primarily contribute to spoken language processing. Learning to read thus consists of developing an efficient interconnection between visual areas and language areas. All connections are bidirectional. Their detailed organization is not yet fully known – in fact, cortical connectivity is probably much richer than suggested in this diagram.

The planum temporale is probably one of the most important areas of the brain for processing spoken language. It is an asymmetric region: its surface is larger in the left hemisphere than in the right hemisphere. In babies, the planum temporale is activated by speech in the left hemisphere from the first months of life. This region "learns" to pay attention to relevant sounds and to neglect those that will not be useful in the language. The lower parietal region which is located just above the area temporal presumably forms, along with part of Broca's area (the frontal region), a circuit which activates when we mentally speak the words. This circuit is part of an internal articulator loop, which we use when we repeat sounds to ourselves in memory, to remember a phone number or to decipher, syllable by syllable, a complicated word, for example the scientific name of aspirin. , 'acetyl salicylic acid'. The brain regions activated during the analysis of the meaning of words (the back of the middle temporal convolution, the anterior ventral aspect of the temporal lobe and the triangular part of the lower frontal region) also come into play when we think about the conceptual relationships between the spoken words or even between images (e.g. semantic association between the image of a palm tree and a pyramid, which are part of the same lexical field [and not semantic, as SD puts it], that of the desert. One of the peculiarities of these brain sense areas is that they are active even before the participant has been asked to do mental work. The temporo-parietal region, in particular, is already activated in the resting state, and becomes "deactivated" below its initial level, when pseudo-words devoid of meaning. The left temporal region is less active, in response to synonyms (e.g. 'sofa' and 'couch', in an experience where one of the words is presented as subliminal priming and the other visible.) only to unrelated word pairs (like 'honey' and 'couch').

3. Conclusion

Reading is a complex neurocognitive process that requires biological maturity and ensuring neural interactions between several areas in the learner's brain."Words are recognized as universal forms, and we often talk about image processing rather than alphabet processing." Then we move to the second stage, which is the alphabetical stage, at this stage it calls for phonemic awareness, and the regular voice correspondence is increasingly established, that is, between oral, written, written and spoken. The last stage is In the spelling stage, where the child uses the linguistic dictionary of words like complete, comprehensive units, and during these three stages, interspersed with interactive and kinetic processes until reaching the comprehension of the recite. Therefore, reading requires coherent activation of several mental areas. Activation begins at the occipital pole, about 100 milliseconds, and then extends about 170 milliseconds to the left occipital region. Then: an explosion of activity in multiple regions Temporal and frontal common with hearing words.

Finally, all the scientific efforts made by researchers in the field of reading are considered interdependent, integrated, and developmental actions to achieve fast and effective reading for the newly-educated child in school, and research is still ongoing to enhance knowledge about the topic of reading, its difficulties and ways to address it.

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