CRITICAL REVIEW OF READING MODELS AND THEORIES IN FIRST AND SECOND LANGUAGES

Dr. Zaidah bt. Zainal
m-zaidah@utm.my
Department of Modern Language

Abstract

Reading models have been much discussed by researchers and language practitioners to explain the cognitive processes which occur in a reader's mind. Because reading is a silent and internal process, much is left unknown. In this paper, the writer attempts to critically discuss the different views of reading processes, from the perspectives of first language (L1) and second language (L2). These views are modelled into two classes, the process and componential models, and further divided into three types, the bottom-up, top-down and interactive models. Further discussion of L2 reading is also provided in the light of whether L2 reading is a language or reading problem. To provide further insights into the cognitive processes of a reader, two types of hypotheses commonly used to explain the complexities involved in L2 reading are reviewed, the language interdependence hypothesis and the language threshold hypothesis.

INTRODUCTION

In the past, L1 reading was modelled as a linear process, a one-way flow of ideas and knowledge conveyed by a writer to a reader (see Gough, 1972), involving the reader in focusing on and building up meaning from the messages in the text. More recently, the perception of the reading process has undergone some changes. The construction of meaning is perceived as an active process on the part of the reader involving dependence not only on the reader's linguistic knowledge but also on the background knowledge stored in his/her memory. In such a representation, the issue arises as to the degree of influence that background knowledge has on the comprehension of texts (Rumelhart, 1990).

Many reading models have been developed to explain the process of reading comprehension in first language readers. Two classes of models are identified, namely *process models* and the *componential models* (Urquhart and Weir, 1998). The *process models*, also referred to as sequential models (Paran, 1994) 'include descriptions of how words are recognised, how long they are kept in working memory, when syntactic processing begins, and so on.' (Urquhart and Weir, 1998: 39). In other words, the focus of these models is on how the process happens in real time. The *componential models*, in contrast, focus on the different components involved in text processing rather than the descriptions of the process itself. Both these classes of models have received criticisms. The *process models*, which attempt to explain the detailed stages of reading, are often criticised for their incomplete design while the *componential models* are often seen as being too simplistic. In the following paragraphs, further discussion of these two classes of models is given. First, the *process models,* such as the bottom-up, top-down and interactive models, are described with specific reference to L1 reading. This is followed by the *componential models,* such as Coady's (1979) and Bernhardt's (1991b), which are commonly employed in L2 research.

In L1 reading, three types of reading models have been developed: the bottom-up (Gough, 1972; Rayner and Pollatsek, 1989), the top-down (Goodman, 1975, 1988; Smith, 1971) and the interactive models (Rumelhart, 1990; Stanovich, 1980). These models of L1 text processing view comprehension as either text-driven or reader-driven (Urquhart and Weir, 1998). The former view, chiefly represented by the bottom-up model, suggests that the meaning of the text is contained only in the text itself. The reader is merely receiving information from the printed text, decoding the symbols (letters), words, phrases and sentences serially. The latter view, represented by the top-down and interactive models, however, suggests that the reader plays an important part in constructing meaning to the written text. In the top-down models, for example, a reader constantly predicts the meaning of the text. The reader is perceived as reaching a level of automaticity in recognising the words and sentences and able to predict the meaning of the text immediately after this recognition takes place (Goodman, 1975). Reading comprehension, as characterised by Goodman is a problem solving activity, 'a psycholinguistic guessing game' (Goodman, 1975). In the interactive process of reading, a reader goes back and forth from bottom-up processing to top-down processing in order to interpret the texts efficiently. In addition to that, it also includes another important factor, the reader's background knowledge (Eskey, 1988). This factor interacts with the information from the text and consequently plays a major role in interpreting text.

To begin with, we will describe the bottom-up models developed by Gough (1972), LaBerge and Samuels (1974) and Rayner and Pollatsek (1989). The purpose of this exploration is to show their appropriateness to the characterisation of L1 reading in particular. We will then proceed with the discussion of theories and issues in L2 reading. For clarity purposes, the term L1 refers to a reader's first language (or mother tongue) while the term L2 refers to his/her second language.

Bottom-up Processing Models

The bottom-up or data-driven processing model of reading suggests that reading begins with a reader processing the visual information exhibited by a written text. The reader, then, recognises the words, sentences and paragraphs from the visual images of graphemes. In L1 reading, bottom-up data processing can be seen in the work of Gough (1972) and LaBerge and Samuels (1974). These models are classed as Process models. Of the two, Gough's model is considered 'the most comprehensive bottom-up model of reading (and the one that has been the most influential)' (Rayner and Pollatsek, 1989: 465). It has often been criticised, however, for representing reading aloud rather than silent reading (Urquhart and Weir, 1998). Reading aloud may not be so for skilled adult readers as it is not a natural way of processing a text.

Gough's (1972) model, (Appendix - Figure A), starts with the process of fixation on the visual input which enters the visual system in the *iconic memory.* Strings of letters are then recognised in a serial manner by a *scanner* using *pattern recognition devices* in the long-term memory. The letters are read and held in the *character register.* The process of decoding the data by the *decoder* into phonemic representations occurs. The phonemic representations serve as input to the *librarian* and are kept temporarily in the *phonemic tape.* The process of matching the phonemic representations against the *lexicon* occurs and the data are then kept temporarily in the *primary memory* until a sentence is recognised. The sentence is then processed by the *Merlin* where *syntactic and semantic devices* are applied before it is moved to

TPWSGWTAU (the place where sentences go when they are understood). The sentence is processed by the *editor* and the *phonological rules* are applied. The sentence then moves to the *script* and finally to the *vocal system*.

This model has been criticised, however, by Rayner and Pollatsek (1989) in particular for its lack of explanation regarding the processing of higher-order information. It is unclear how *Merlin* processes the sentence and how the meaning of a text is derived from the string of letters, sentences and propositions. For this, Gough depended on the magical work of *Merlin* and *TPWSGWTAU* (Rayner and Pollatsek, 1989). Furthermore, the step-by-step bottom-up process makes reading seems laborious, ascribing a passive role to the reader since the reader's schemata do not appear to have any role in the comprehension process. The reader is depicted as having little freedom in varying the linear sequence of the reading operation (Rayner and Polatsek, 1989). Clapham (1996), who believes that the decoding process is largely affected by the higher level processing, also points out that Gough's model is inadequate in explaining the reading process. Comparing the following sentences (p.14):

(1) The children are eating apples.
(2) The juicy ones are eating apples.

Clapham notes that higher level processes are necessary to clarify ambiguities which occur during lower level processing. Linear processing of the letters, words and sentences above may not be able to detect the difference in word class and meaning of 'eating' in sentences (1) and (2). Higher level processes are therefore invoked in order to interpret these sentences.

Another bottom-up model commonly cited by researchers is LaBerge and Samuels' (1974) model, which is also a *process model*. It contains three memory systems: the *visual memory system*, the *phonological memory system* and the *semantic memory system*. These memory systems hold three different representations of data input. The reading process is linear, beginning from the *visual memory system* to the *phonological memory system* and lastly to the *semantic memory system*. The *visual memory system* contains detectors which register and recognise the input of string of letters and words and eventually map the input into spelling pattern codes. The input of data is then processed by the *phonological memory system* which registers the phonological representations of the letters and words. The last process is completed in the *semantic memory system* which recognises the semantic representation of the words and sentences that are read.

This model of reading, also known as the Automaticity Model, involves two basic processes: decoding and comprehension. Attention is said to be central to this model with the amount of attention given by readers to any of the memory systems depending on his/her reading ability. Skilled readers are said to pay more attention to the comprehension processes as the decoding processes are already automatised, while less skilled readers pay equal attention to both the decoding and comprehension processes. This model, like Gough's (1972) model, also receives criticism for its inability to explain the effect of syntax on the *semantic memory system* (Rumelhart, 1990). According to Rumelhart (1990:582) 'whereas it is not too difficult to see how, say, the LaBerge-Samuels model could account for the effects of orthographic structure on letter perception, it is somewhat more difficult to see how the effects of syntax and semantics can be mediated within such a model'. Another criticism of this model is in terms of its failure to explain the importance of 'meaning' in reading.

Bernhardt (1991a:7), for instance, notes that as perception and attention are two central focuses of this model, meaning becomes peripheral and 'what is understood is not terribly important'. Furthermore, like Gough's (1972) model, this model does not provide any allowance for the modification of lower level processes by the higher level ones as it depicts reading as linear and unidirectional (Hassan,1999). To overcome this problem, the model was revised to include feedback loops and episodic memory (Samuels and Eisenberg, 1981) which by their presence have modified this into 'an interactive model as it allows for processing at later stages to influence earlier ones' (Hassan, 1999).

The interactive notion of reading began to intrigue not only LaBerge and Samuels, as noted by Samuels and Eisenberg (1981), but also other advocates of bottom-up models such as Rayner and Pollatsek (1989). Rayner and Pollatsek's (1989: 472) model (Appendix - Figure B) attempts to show an interaction between bottom-up and top-down processes despite the fact that the authors maintain that their model 'is primarily a bottom-up model'. The main principle of this model is that there are two routes, a direct and indirect route. The reading process begins with *eye fixation* behaviour, followed by an initial word encoding process. The *initial encoding processes* are divided into two parallel processes: *foveal word processing*, which is concerned with registering the letters and words and *parafoveal processing*, which recognises up to 15 character spaces of the data input to the right of the fixation and is therefore concerned with 'where to look next' (Rayner and Pollatsek, 1989: 472).

The next stage, lexical access, takes place through two routes, as mentioned earlier. The indirect access route comes into play when there is a problem in recognition of the data. Rules are applied to create auditory codes and the process is cyclical (from *saccade* to *eye fixation* again) until the first stage of encoding of letters and words is achieved. The direct route, on the other hand, is when lexical access is successful and the lexical item is mapped against the *lexicon* in the *LTM* (long term memory). The process continues linearly to the *inner speech* system of the *working memory* where records of information are held for comprehension processes. As the lexical access of a word is completed, the process starts over again with the attention shifting to the next word (word n+1) to the right of the fixation.

Although this model is very detail, Rayner and Pollatsek (1989) note that it still fails to account for higher-order processes, that is, how a reader constructs meaning is still not clear. According to these researchers,

> *the situation is pretty murky after we leave the lexicon. Processing is probably quite interactive (although syntactic processing is very likely prior to most of the semantic construction) and reasonably on-line (although most of the semantic processing probably lags behind the eye by at least one fixation). Unfortunately, it is premature to draw any more definite conclusions than that about how semantic processing works or what it constructs. (pp. 477).*

To summarise, the bottom-up models discussed here maintain that reading starts from lower level processing to higher level processing. The limitations of these process models mainly centre on the inflexibility of the representation, which, on the whole, is serial and linear, with the result that the reader's creativity and ability to move from lower level processing to higher level processing and vice versa are not depicted. In spite of these criticisms, these bottom-up models cannot be ignored

because they provide justifications for the reading processes of poor or beginning readers who depend substantially on lower-level processing (Hassan, 1999).

Top-down Processing Models

In contrast to the above-mentioned representations of reading as a bottom-up process, top-down models (such as Goodman's, 1975 and Smith's 1971) represent readers as constantly hypothesising about the conceptual meaning of a text. These two models of reading are also classified as *process models* (Urquhart and Weir, 1998).

Goodman first developed and later revised a top-down model (although not identified as such initially) on the basis of his experience with young L1 readers. The revised model (1988) was derived from what is referred to as oral miscue analysis, an analysis comparing 'observed with expected responses as subjects read a story or other written text orally' (p.13). It is a concept-driven model, which samples reading as a process of testing hypotheses and making prediction, rather than a data-driven model (Clapham, 1996). According to this model, a reader moves from one sequence of a cycle to another and makes hypotheses about the conceptual meaning of the text. The efficient reader, Goodman notes, focuses on the meaning of the text and 'minimises dependence on visual detail' (Goodman, 1988:13).

This model represents reading as a process of four cycles consisting of *optical, perception, syntactic* and *meaning construction* cycles. The model proposes that the cycles overlap with each other as the reader constantly tries to predict the meaning of the text. Five processes are employed in the cycles: *Recognition-initiation, Prediction, Confirmation, Correction and Termination.*

In the *recognition-initiation* stage, the reader recognises the visual graphic input of the written text. Then, he/she anticipates and predicts the meaning of the data input. After *prediction*, the reader tries to check his/her predictions by confirming or disconfirming original predictions using follow-up information, whether or not the information is as expected. If the prediction cannot be confirmed, the reader will then make *corrections*. Lastly, in the *termination process*, the reader terminates the reading process after he/she has completed the task or perhaps has no more motivation to continue with the reading activity.

This model has been criticised by Rayner and Pollatsek (1989) for its lack of precision and inability to show how higher-order processes, such as making inferences and prediction, occur. Rayner and Pollatsek (1989:464) further note the following weaknesses of this model:

- Insufficient explanation given regarding the logical sequence of nonvisual information to perceptual image
- Its inability to discriminate between important and less important information
- Its inability to parse and interpret sentences
- Its inability to explain how meaning is assimilated with prior meaning.

Another top-down model, which shares the same orientation as Goodman's (1975), is that of Smith (1971). This stresses the importance of making predictions during reading and also describes reading as a psycholinguistic process. It is based on four principles namely 1) reading is purposeful, 2) reading is selective, 3) reading is based on comprehension and 4) reading is anticipatory (Kobeil, 1999: 28). Readers are said to have specific purposes in mind when they read: they are selective in their

reading to fulfil their purposes and employ their background knowledge to confirm or disconfirm the information they read. By drawing on their background knowledge, the readers anticipate the content.

Samuels and Kamil (1988), however, question whether Smith's representation in fact constitutes a model. According to them, 'it is not so much a model of reading as it is a description of the linguistic and cognitive processes that any decent model of reading will need to take into account' (pp.24). Also, like other top-down models it suffers from the problem of overemphasising higher-level processes (Eskey, 1988). The meaning of a text seems to be derived from contextual clues and the background knowledge of a reader since little emphasis is given to the lower-level processes of decoding. In addition, because of the lack of emphasis on lower-level processes, this model, as in the case of Goodman's, seems more suitable for proficient readers (Hassan, 1999). The limitations of both the bottom-up and top-down models of reading have led to developments in modelling reading as an interactive process.

Interactive Processing Models

The third category of reading models is referred to as interactive (Rumelhart, 1990 and Stanovich, 1980) since they combine the characteristics of both top-down and bottom-up models. Rayner and Pollatsek (1989: 467) explain that, 'in interactive models, readers are usually assumed to be drawing upon both top-down and bottom-up information before eventually settling upon an interpretation of the text'. It is also noted that the notion of 'interaction' includes the interaction between readers' prior knowledge and the information in the text (Eskey, 1988, Eskey and Grabe,1988, and Grabe, 1991).

One of the commonly cited interactive models is the one developed by Rumelhart (1990) which was used to explain L1 text processing (Appendix – Figure C). The strength of Rumelhart's model lies in its allowance for interaction between lower-level processes (such as orthographic knowledge) with higher-order processes (such as semantic knowledge) (Samuels and Kamil, 1988). Readers are seen to play an active role in the process of reading because they constantly hypothesise about the meaning of the text. They are able to use their *orthographic, syntactic, semantic* and *lexical knowledge* in order to perform a reading task (Kobeil, 1999). Although Urquhart and Weir (1998) classify this model as a *process model*, it also seems to contain some elements of a *componential model*. This can be seen in the later stages of the model where all the four types of knowledge mentioned above interact with each other.

Rumelhart's interactive model of reading synthesises four different types of knowledge, simultaneously: *syntactical knowledge, semantic knowledge, orthographic knowledge and lexical knowledge.* This model begins with *graphemic information* being registered by the *visual information store* (*VIS*). The *feature extraction device* extracts information from *VIS*, in addition to serving as sensory input to a *pattern synthesizer*. All the different types of knowledge, then, interact with each other in the *pattern synthesizer* in order to produce the 'most probable interpretation' (Rumelhart, 1990: 588). The interactive model is viable because it allows a reader's background knowledge, such as cultural knowledge, to interact with other types of knowledge possessed by the reader, such as syntactic or semantic knowledge.

This model has also been opened to criticisms. Rayner and Pollatsek (1989) do not consider this a comprehensive model of reading because it does not identify the

degree of importance of the different types of knowledge and how comprehension is reached beyond the sentence level. According to these researchers, Rumelhart's model provides a framework for the further development of reading models. It is merely an alternative framework to the serial models of bottom-up and top-down models.

Another interactive model of reading commonly cited not only by L1 researchers but also those concerned with L2 reading is Stanovich's (1980) model. This model takes Rumelhart's (1990) interactive model a step further by incorporating the notion of lower-level processes compensating higher-level processes and vice-versa. It is also referred to as a compensatory-interactive model because it caters for both skilled and unskilled reading. The underlying assumption of this model is that deficiencies at one level of the process can be compensated for at other levels. According to Samuels and Kamil (1988: 32), 'if there is a deficiency at an early print-analysis stage, higher-order knowledge will attempt to compensate'. For example, unskilled readers who face the problem of identifying the meaning of some difficult words in a text, but have knowledge about the topic of the text, can compensate for their weakness through their background knowledge. On the other hand, skilled readers who do not have the required content knowledge can compensate for their deficiency by way of their decoding skills. However, the weakness of Stanovich's model is that every reader is potentially efficient since his/her strength can compensate for his/her deficiency in reading. From a research perspective, although this model can explain results, it does not have predictive power (Urquhart and Weir, 1998; Rayner and Pollatsek,1989).

Researchers in both L1 (Yoon and Goetz, 1994) and L2 (Bernhardt, 1991a) tend to prefer interactive models of reading to the top-down and bottom-up models. While Rumelhart's (1990) model depicts readers as active processors, Stanovich's (1980) model shows how skilled and unskilled readers compensate for their weaknesses with processes which they are good at. In sum, the notion of interaction in reading has shed light on a whole new perspective of reading, that is, reading as an active process on the part of a reader to comprehend a text (Bernhardt, 1991a). Bernhardt (1991a) views the changing trends from linear models to interactive models as a paradigm shift not only in L1 models but also in L2 models. Because comprehension rather than decoding is the central purpose of reading, flexibility by readers in utilising the different levels of processes helps them to arrive at comprehension.

Having described the three types of process models, we now turn to the description of componential models which are adopted in L2 reading research. It is clear that L2 reading is more complex than L1 reading in that L2 readers have normally acquired L1 skills and fluency in such a way that the L1 skills will influence the L2 reading skills. Two hypotheses (the linguistic threshold hypothesis and linguistic interdependence hypothesis) are proposed to explain the complexities involved in L2 reading. These two hypotheses centre on the issue of whether reading in L2 is influenced by a reader's L1 reading skills or his or her L2 proficiency. Discussion of these two hypotheses will also be included in order to highlight the complexities of L2 reading.

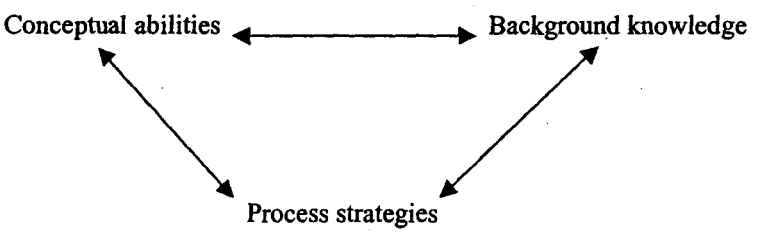
Reading Models and Theories in a Second Language

Here, we will describe models and theories developed to explain L2 (second language) reading. As mentioned in section 2.1, Componential models focus on the different types of components involved in reading rather than the process of reading (Urquhart and Weir, 1998). The Componential models can be categorised into two types: two-component and three-component models. The two-component model such as Hoover and Tunmer's (1993) contains *word recognition* and *linguistic comprehension* components. Referring to their model as 'the simple view', Hoover and Tunmer (1993) claim that both components are of equal importance. However, since this model was developed using young L1 readers, it is difficult to generalise its applicability to L2 readers (Urquhart and Weir, 1998).

The three-component model such as Coady's (1979) consists of *conceptual abilities*, *process strategies* and *background knowledge* components, while Bernhardt's (1986) and (1991a) comprises *language*, *literacy* and *world knowledge*. In applying these models to L2 reading, the principal issues include whether L2 reading is a developmental problem and whether knowledge of one aspect of the L2 (such as syntax) can compensate for another aspect (such as semantic).

Coady's model (1979) incorporates three components of the process namely *conceptual abilities, background knowledge* and *process strategies* (Figure 1). His model emphasises the importance of a background knowledge component which 'has been the most neglected factor in EFL/ESL reading' (Carrell and Eisterhold, 1988). Coady's model suggests that EFL/ESL readers' *background knowledge* interacts with their *conceptual knowledge* (i.e. their intellectual capacity) and their *process strategies*, which include *grapheme-phoneme, grapheme-morphophoneme, syllable-morpheme, syntax, lexical meaning* and *contextual meaning* (Carrell and Eisterhold, 1988; Paran, 1996). As L2 readers progress to higher-level *process strategies* of contextual meaning, they become less dependent on the lower-level *process strategies* of grapheme-phoneme and vice-versa. However, this model has been criticised for its simplistic representation of the complex cognitive activities of reading, for instance, one may ask at which point does the reading activity start and end.

Figure 1 - Coady's model (1979)



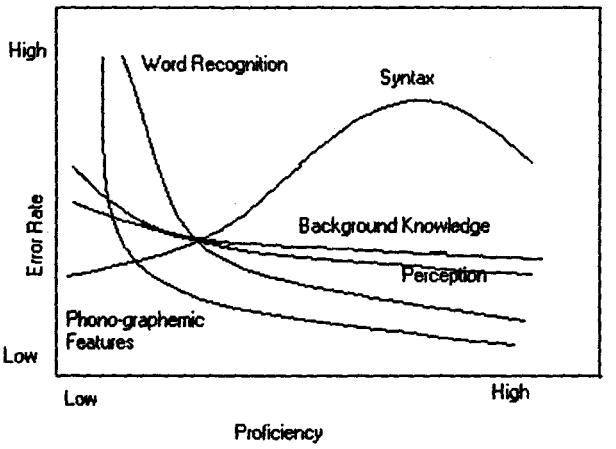
Two data-generated componential models were developed by Bernhardt: the constructivist model (1986) and the multifactor model (1991). The 1986 constructivist model, which was developed from Coady's (1979) model, has two types of components: *text-based* (phonemic/graphemic features, word recognition, and syntactic feature recognition) and *extra-text-based* (intratextual perceptions, prior knowledge and metacognition). Paran (1996:6) points to the criticism that 'not only

are there a large number of variables interacting here, but there seems to be no principled way of disentangling them'.

A more popular model (Bernhardt, 1991a) consists of three components: *language, literacy* and *world knowledge*. The *language* component refers to the text's traits such as word meaning, syntax and morphology (1991b). The *literacy* component refers to operational knowledge such as 'knowing how to approach text, why one approaches it, and what to do with it when a text is approached.' (Bernhardt, 1991b: 35). The *world knowledge* component refers to the background knowledge of a reader. Paran (1996) points to the strength of Bernhardt's 1991 model:

1. It is built on the basis of empirical research using readers of different languages rather than solely on theoretical considerations. It is, thus, viable for research into the reading of L2 subjects.
2. It shows that interaction exists between language, literacy and background knowledge factors, rather than a serial replacement of one factor by another, which can be seen in bottom-up and top-down processing models.
3. It includes a background knowledge factor as an important component in processing texts.
4. It stresses that reading abilities in a second language develop and progress in time.

Figure 2: The Theoretical Distribution of Reading Factors in L2 (Bernhardt, 1991a)



The 1991 model, derived from an examination of 300 readers of French, German and Spanish, is developed on the basis of error rate over instructional hours in the second language. In order to account for the three variables involved in this model, namely *linguistic, world knowledge* and *literacy*, Bernhardt considers the relationship between 'proficiency' and 'error rate' (Figure 2.5). These may be summarised as follows:

- Improvements in *word recognition* and *phono-graphemic features* are related to longer instruction time. A decline in error rate is observed in these features as proficiency increases.

- The syntactic curve illustrates a 'radically different' (Bernhardt, 1991b: 40) pattern. Error rate for syntax increases relative to the increase in instructional hours at early stages but decreases at later stages of development.
- The *perception* and *background knowledge* curves are 'relatively flat' (Bernhardt, 1991b: 40) indicating that no drastic change is observed over the development period. This shows that the two components are reader-inherent and not necessarily connected to instructional time and proficiency level.

We note, however, one major weakness with this model. This model was tested with subjects who were familiar with the English orthographic system but not with subjects whose L1 orthographic traditions were different, such as Chinese, Arabic, Hebrew and Greek. Grabe (1991:387) notes that 'orthographic differences between a student's L1 and English have often been cited as a likely cause of additional difficulties'. Thus, in terms of word recognition and phono-graphemic features, this model cannot be generalised to subjects whose L1 orthographic systems are not English.

In summary, these L2 models of reading seem to focus only on the interaction of the different components possessed by a reader. They do not, however, suggest the level of influence a person's L1 knowledge has on his or her L2 reading. The issue of whether L2 reading is a reading problem or a language problem has been raised (Alderson, 1984, 2000) in order to explain the complexity of reading in L2. Two contrasting hypotheses regarding L2 reading, therefore, emerge: the linguistic threshold hypothesis and linguistic interdependence hypothesis. In general, these two hypotheses consider the role played by a person's L1 reading ability in his or her L2 reading. Although these two hypotheses seem to provide explanations critical to L2 reading behaviour, their underlying assumptions are opposed to each other.

Linguistic Threshold Hypothesis

The linguistic threshold hypothesis in L2, first known as the short circuit hypothesis (Clarke, 1988), suggests that 'limited control over the language "short circuits" the good reader's system causing him/her to revert to poor reader strategies when confronted with a difficult or confusing task in the second language' (p.120). This hypothesis implies three things:

- That an L2 reader needs to have a certain level of second language linguistic ability in order for him/her to read in a second language (Clarke, 1988).
- That an L2 reader has a linguistic threshold level below which they cannot use their L1 reading skills to comprehend text in a target language (Clapham, 1996).
- That L1 reading ability may not be transferable from one language to another (Bernhardt and Kamil, 1995, Clarke, 1988).

A number of studies have been conducted to examine the level of influence L1 skills have over L2 reading (see Clarke, 1988; Horiba, 1990 and 1996). Clarke (1988) conducted two studies on poor and good Spanish L1 readers using cloze test in English and Spanish and oral reading performance using miscue analysis. Results of both studies indicate that although a good reader depends on semantic cues more than syntactic cues when reading in L1, this behaviour changes when they read in L2. Their use of semantic cues reduced noticeably and they tended to rely on syntactic

cues more than semantic cues when reading in L2, reverting to strategies similar to the ones employed by poor L1 readers. In conclusion, these two studies provide evidence that L1 reading ability may not be transferred to reading in a target language. Bernhardt and Kamil (1995:17) posited that 'within this hypothesis is the belief that language is the key factor in reading/literacy activities. In other words, in order to read a language, one has to "know" the language'. Hassan (1999) criticises these studies due to the use of cloze test as a measure of the subjects' L1 and L2 reading abilities. Like other studies on reading which employ cloze test, Clarke's (1988) studies also suffer the problem of what exactly has been tested: comprehension or proficiency.

Two studies by Horiba (1990, 1996) also reveal that reading short circuits when readers lack in L2 proficiency. Horiba's (1996) study, for instance, was conducted with L1-Japanese and L1-English subjects. In addition, two groups of English subjects, who were enrolled in Japanese courses, L2-intermediate and L2-advanced, also participated in this study. Subjects were required to read two short stories which Horiba noted as 'culturally neutral': *Baby* and *Thief.* The L1 and L2 readers of Japanese processed texts in Japanese while the L1-English readers processed the texts in English (translated versions). Each set contained two versions, one high-coherent (with original structure) and the other low-coherent (consisting of a manipulated structure). For each text, subjects were asked to think-aloud while reading and then recall the story.

Results from the think-aloud protocols show that the Japanese intermediate group tends to employ lower level processing strategies, such as analysis of words and sentences. This seems to indicate that the intermediate subjects may be having difficulties in understanding meaning at word or sentence level, preventing them from inferring the meaning not explicitly mentioned in the texts. Horiba (1996 : 459) posits that:

> *For L2-intermediate readers who have little competence in a language, disruptions in processing at lower levels occur so frequently that ideas and events are not fully extracted from the sentences, and connections are not made between ideas and events. As a result, their mental representations of the text are fragmented and underdeveloped.*

The advanced group, on the other hand, tends to employ higher level processing strategies, such as *backward* and *predictive inferences* but not *elaborative inferences* and *use of background knowledge.* The L1 readers tend to focus on using *elaborative inferences* and *background knowledge* but rarely lower level processing such as word and sentence level strategies. Horiba also concludes that the advanced and L1 readers, unlike the intermediate readers, use *inferencing* strategies with low-coherent texts. These results suggest that the intermediate and advanced L2 readers exhibit different processing behaviours. Furthermore, the strategies employed by L1 and L2 readers also seem to be distinct, suggesting that L1 reading skills may not be transferable to L2 reading skills. Overall, Horiba seems to suggest that difficulties in L2 reading may be due to language problems rather than reading problems which therefore supports the linguistic threshold hypothesis.

One criticism of this study, however, is the choice of text (Japanese short stories). When comparing L1-Japanese and L1-English readers, Horiba notes that the L1-Japanese groups employed their background knowledge more frequently than L1-

English, a fact which is hardly surprising since the texts were Japanese (rather than English) short stories. Even though Horiba claimed that the texts contained neutral topics, she noted that the Japanese readers' protocols were derived 'from direct experience with the situation than in the case of L1-English readers who did not have such highly relevant general background knowledge' (p. 459). Therefore, it can be argued that the Japanese readers are advantaged by the choice of text topics.

In summary, the studies mentioned above give strong evidence of the linguistic threshold hypothesis that readers have to acquire a certain level of L2 proficiency before they are able to employ higher level processing strategies to help them understand a text. In other words, L2 reading abilities rely more on L2 proficiency than L1 reading ability. For instance, in Horiba's (1996) study, the L2-intermediate subjects' lack of proficiency seems to hinder them from inferring from the events in the low-coherent texts, although they may already have acquired these higher-level processing strategies in their L1 reading.

In contrast to this, the linguistic interdependence hypothesis, which will be explained in the following section, suggests that readers rely on the same reading skills when reading both in L1 and L2.

Linguistic Interdependence Hypothesis

The linguistic interdependence hypothesis (Cummins, 1991a), also referred as the common underlying proficiency hypothesis (Bernhardt and Kamil, 1995), has the underlying assumption that 'reading performance in a second language is largely shared with reading ability in a first language' (Bernhardt and Kamil,1995:17). This implies that:

- Reading ability in L1 is transferable to another language.
- L1 and L2 reading abilities are interdependent and are the same at some fundamental core.
- Once L1 reading ability has been acquired, 'the same operation is not "reacquired" in L2' (Bernhardt and Kamil, 1995: 17).

An advocate of linguistic interdependence hypothesis is Cummins (1991a). As noted earlier in section 1.3.4, Cummins examined the reading abilities of Japanese and Vietnamese subjects in their L1 and L2. Using two dimensions of proficiency, attribute-based and input-based aspect of proficiency, results suggest moderate correlations between subjects' L1 and L2 abilities, leading Cummins to conclude that L1 and L2 reading abilities are interdependent and are similar at some fundamental core. According to Cummins (1991a: 84):

> *In general, moderately strong crosslingual relationships are observed for attribute-based aspects of L1 and L2 proficiency as a result of the fact that underlying attributes of the individual manifest themselves in the individual's performance in both languages.*

Geva and Ryan (1993) examined the reading development of bilingual Hebrew-English subjects using cognitive, memory and linguistic-processing predictors as variables. In the 1993 study, for instance, a number of test batteries were employed to measure intelligence (Ottis-Lennon Test of Mental Ability), linguistic

knowledge in L1 (Clause Completion Test), reading comprehension in L1 and L2 and working memory in L1 and L2 (Word-Span Test). Results suggest that the subjects' reasoning ability correlates both with measures of their memory (in L1 and L2) and of their linguistic performance (in L1 and L2). In addition, a significant correlation was found between the L2-clause-completion task and L1-reading comprehension task. Furthermore, strong correlations are also seen in the memory-span tests in Hebrew and English. Overall, these results suggest that underlying cognition and memory span play an important role in performing L2 linguistic and comprehension tasks. Geva and Ryan (1993: 37) conclude that 'the observed relationships between L1 and L2 can be attributed, at least partially to underlying individual differences in ability, conceptualized in terms of constructs such as intelligence and memory span.' Although these researchers interpret the findings as supporting the linguistic interdependence hypothesis, they are aware that the 'common underlying proficiency' involves more than memory span, linguistic knowledge and intelligence (Cummins, 1991a). Therefore, any interpretations of these findings have to be treated with caution.

Block's (1986, 1992) studies of reading strategies of L1 and L2 readers seem to support this hypothesis. In Block's (1986) study, for instance, conducted with native and ESL students, subjects were required to read two passages taken from an introductory psychology course. They were asked to think-aloud while reading, recall the texts after reading and sit for a multiple-choice test. The findings of this study suggest that there is no difference in the strategies used by L1 and L2 readers. Block concludes that 'language background did not seem to account for the different patterns. The native speakers of Chinese in this study did not appear to employ strategies different from the native speakers of Spanish. Moreover, ESL readers did not appear to use strategies or patterns of strategies that were different from those of native speakers of English.' (p. 485). In other words, readers appear to employ the same strategies when reading in L1 and in a target language. Block notes that the L2 readers seem to bring with them the knowledge of the reading process when reading in L2, leading her to conclude that 'some aspects of reading ability are readily transferred from one language to another.' (Block, 1986: 485).

Is L2 Reading a Language or a Reading Problem?

The issue of L1 and L2 in reading is very complex. In the studies cited above, subjects were familiar with both reading in L1 and L2. Therefore, the studies tend to focus on the level of transfer which occurs from one language to another. However, there may also occur a situation where a reader cannot read in their L1 due to the fact that the language has no or very little written form. In this case, it may not be possible to transfer the L1 reading skills to L2 reading.

In view of the conflicting evidence from the studies cited above in support of either the linguistic threshold hypothesis (Clarke, 1988; Horiba, 1990 and 1996) or linguistic interdependence hypothesis (Cummins, 1991a, Block, 1986 and 1992), the question of whether L2 reading is a language or a reading problem is still unresolved. Several studies have attempted to further pursue this issue (see Carrell, 1991, Bernhardt and Kamil, 1995, Bossers, 1991, Lee and Schallert, 1997), and from these studies there seems to be a consensus that both hypotheses are applicable.

Carrell (1991), like Alderson (1984), raises the question of whether second language reading is dependent on L1 reading ability or L2 language proficiency. She

conducted a study with native speakers of Spanish and English who were required to read two passages (Spanish and English versions) on a general topic and answer multiple-choice questions. These questions were designed in such a way that subjects had to make inferences about the content. The subjects' language proficiency was determined by their instructional levels. Employing multiple regression test, results show that 'both first language reading ability and second language proficiency have significant effects on second language reading ability' (Carrell, 1991: 167). Specifically, for the Spanish subjects, their L1 reading ability has a greater influence on their L2 language reading than their L2 proficiency. For the English subjects, on the other hand, their L2 proficiency has a greater influence on L2 reading than their L1 reading ability. Carrell (1991: 168) concludes that:

> *Since each of the two groups of subjects showed significant effects of both first language reading ability as well as second language proficiency, both of these factors appear to be important to address in second language reading pedagogy.*

Nevertheless, she acknowledges that the language status of Spanish (as a foreign language) and English (as a second language) may explain the differentiation, and therefore, the findings have to be treated with caution. Furthermore, the Spanish and English subjects' proficiency levels may not be comparable (Bossers, 1991). For instance, while the L1-Spanish group was from instructional ESL levels 3, 4 and 6, the L1-English group was from instructional levels 2, 3 and 4 (Spanish as a foreign language).

Bossers (1991) also examined the relation between L1 reading, L2 reading and L2 knowledge with Turkish subjects learning Dutch as a second language. The subjects' L2 proficiency ranged from intermediate to advanced level. A Dutch-as-a-second-language test battery was used to measure subjects' L2 level. Subjects were required to read four texts (two for each language) and answer multiple-choice questions. The overall results from the multiple regression tests show that 'although both predictors (L1 reading and L2 knowledge) significantly account for unique variance in L2 reading, the importance of L2 knowledge for L2 reading far outweighs that of L1 reading.' (Bossers, 1991: 55). However, when a separate regression test was conducted, Bossers discovered that the L2 knowledge played an important role at a lower proficiency level. The situation was different at an advanced proficiency level where the L1 reading became a prominent factor in L2 reading.

Bernhardt and Kamil's (1995) study of readers whose L1 is English and L2 is Spanish also seems to provide support for both hypotheses. This study indicates that both L1 reading ability and L2 language proficiency play an important part in L2 reading. Therefore, they suggest the importance of consolidating the linguistic interdependence hypothesis and linguistic threshold hypothesis as follows: 'all of the evidence presented above (in their study) clearly establishes the importance and relative contribution of two factors: language knowledge and reading knowledge' (Bernhardt and Kamil, 1995:32).

CONCLUSION

In conclusion, L1 reading models have evolved from linear processing to interactive processing, and have been applied also to L2 reading. As noted earlier, the bottom-up

models suggest that reading starts from lower level to higher level processing. The serial and linear representations of these models have made them less attractive in comparison to the top-down and interactive models. Readers are depicted as being inflexible in processing a text. The top-down models, on the other hand, suffers from the problems of overemphasising higher-level processes while neglecting lower level processes. In comparison to these two types of models, the interactive models have proved appealing to many L2 reading researchers, such as Bernhardt (1991a and b), Grabe (1988) and Eskey (1988), among others. Although the interactive models such as Rumelhardt's (1990) and Stanovich's (1980) are much preferred by researchers, they also receive criticisms in terms of their inadequacy in explaining how comprehension happens beyond sentence level. Further development of these existing models needs to be explored in terms of multiplicity of the background knowledge possessed by a reader. The existing models and theories seem to consider only limited number of background knowledge components in the reading processes in such a way that they are unable to explain some interesting phenomena in reading. Both top-down and interactive models suggest that readers use their background knowledge to comprehend written texts. A critical issue in the discussion of background knowledge is the mechanism by which readers retrieve this knowledge. As Clapham (1996:16) notes 'fundamental to all these models, therefore, must be some systems of storing and retrieving past knowledge.' It is therefore recommended that future development of reading models should take into consideration the different facets of background knowledge and their roles in text processing. In addition to these models, two hypotheses in L2 reading, the linguistic threshold hypothesis and linguistic interdependence hypothesis, are highlighted. These hypotheses are believed to explain results from many L2 reading studies, although studies have so far produced inconclusive and mixed results.

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Appendix

Figure A- Gough's Model of Reading (Gough, 1972)

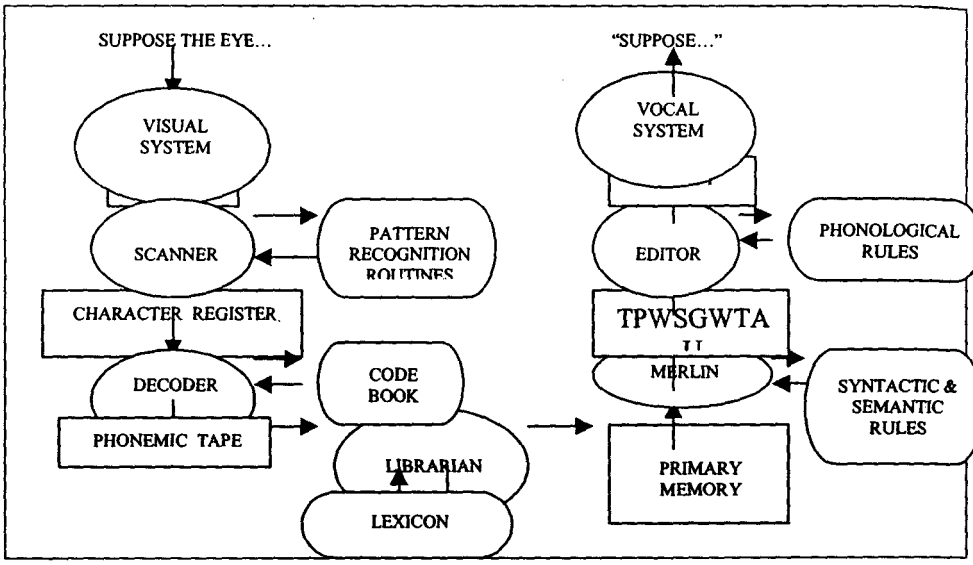

Figure B – Rayner & Pollatsek's model of reading

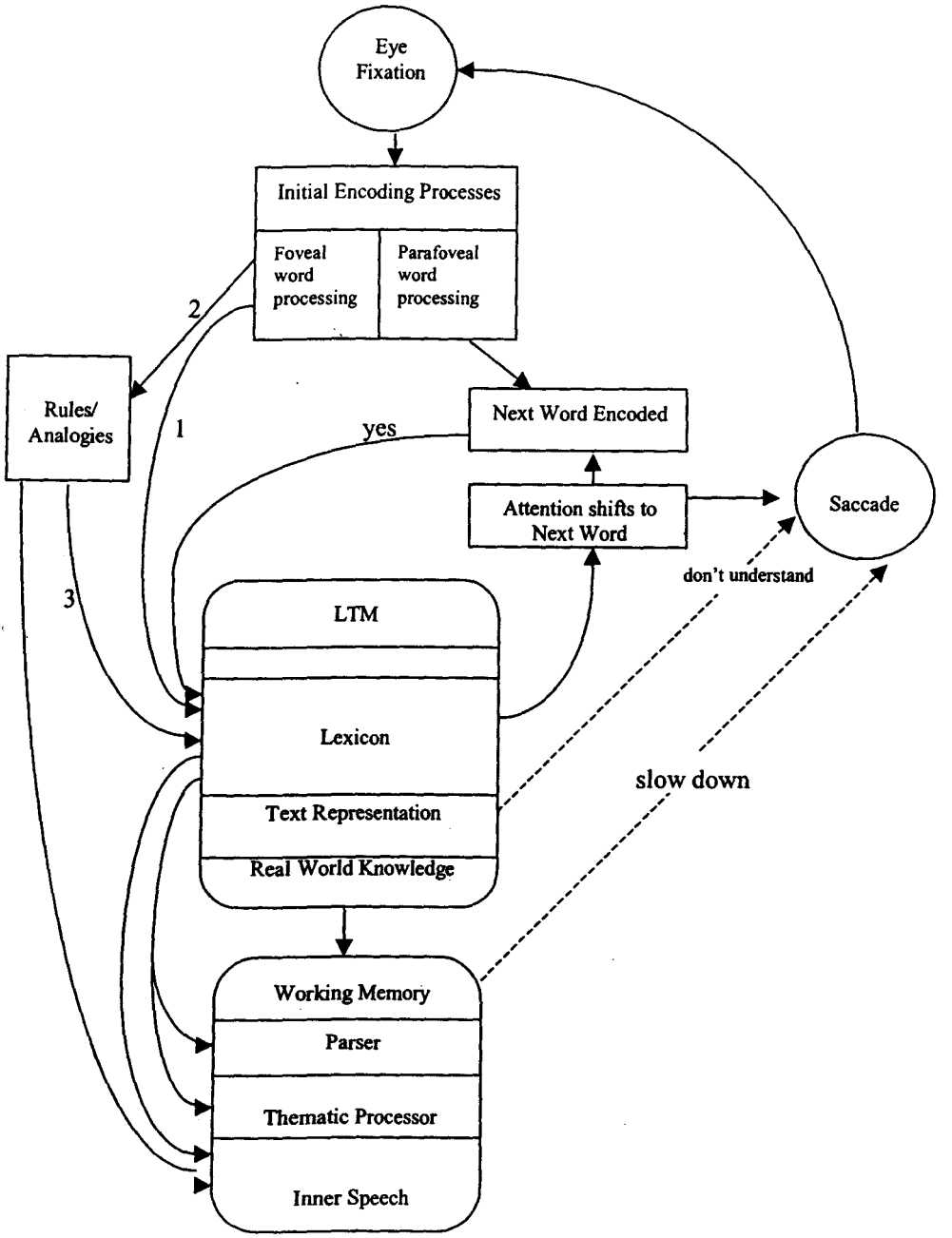

Figure C – Rumelhardt's interactive model of reading (Rumelhardt, 1990)