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How Do Readers Approach Traditional Texts and Hypertexts? A Review on Reading Comprehension Models

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Abstract:

This review aims to provide a more comprehensive understanding of different spectrums of comprehension processes that account for various reading situations. More specifically, this review sheds light on how readers approach and comprehend traditional texts and hypertexts by examining the reading comprehension models in both reading environments. To this end, three prominent comprehension models were reviewed with reference to reading traditional texts: the bottom-up model, the top-down model, and the interactive model. On the other hand, four prominent comprehension models were reviewed with reference to reading hypertexts: Kintsch's and Van Dijk's model, the construction–integration (C–I) model, the text and graphics model, and the navigation, integration and evaluation model.

Keywords: Reading Comprehension; Comprehension Models; traditional texts; Hypertexts

1. Introduction

Reading is not a luxury that one can do without; in fact, its importance goes far behind individuals to extend the whole of society. For instance, Bradshaw and Nichols (2004) published a report highlighting multiple reading benefits. At the professional level, good readers are likely to have more financially rewarding occupations, whereas less advanced readers have fewer opportunities for career growth. At the academic level, there is a strong correlation between reading frequency and academic achievement.

Given the importance of reading, how do readers approach a text? What does it take for them to achieve comprehension? In fact, readers often develop different understandings and can process the same text differently. To account for the similarities and differences in readers' comprehension, researchers in the field developed and presented three reading models of reading: bottom-up, top-down, and interactive. The following review examines these models to elucidate how readers approach and make meaning of the texts they read. However, how about reading in the hypertext environment? Do people read on-screen the same way you do in print? Classical reading -in which readers flick through printed pages and are physically involved with the reading material- is now turning into screen-based reading, where readers use the mouse, touchpad, or screens to click and scroll up and down the text. People today spend more time using their computers, laptops, tablets, and other diverse technological devices than before. This technological proliferation brought about increasing dependence on electronic texts, especially among young readers (Coiro, 2003). In this regard, Taky-eddine and Madaoui (2022), who explored Moroccan Students' attitudes toward onscreen reading, revealed that the shift toward onscreen reading is remarkably increasing among students and that their attitudes toward it are positive.

This phenomenal shift from paper-based texts to hypertexts begs the questions to how readers approach hypertexts and what it takes them to achieve comprehension. Since hypertexts provide enormous amounts of information structured into a sizeable semantic system (Rada, 1989), finding the required information in the hypertext is the most common cognitive operation that challenges hypertext reading comprehension. In other words, hypertext readers find themselves compelled to locate specific information in an extensive amount of textual nodes (Guthrie & Kirsch, 1987).

In the hypertext environment, readers are free to click on any link they choose to navigate and reach the intended nodes (chunk information) to accomplish their reading objectives. Thus, links are deemed electronic pathways that readers use to navigate their ways through the hypertext and jump from one node (unit content) to another. Therefore, examining readers' cognitive processes while reading in the hypertext environment is crucial for understanding how readers approach and construct meaning from hypertexts. With this purpose in mind, this review examines the prominent comprehension models proposed by researchers in the field.

2. Reading comprehension models in traditional texts

2.1 The Bottom-up Model

According to this model, also known as the perceptually-driven or data-driven model, reading is a "linear process by which readers decode a text word by word, linking the words into phrases and then sentences" (Gray & Rogers, cited in Kucer 1987). Therefore, according to this definition, reading is a systematic procedure that begins with identifying letters, combines letters into words, phrases, and sentences until the meaning is established. In Gough's words (1972), this model emphasized a single direction of part-

to-the-whole sequential text processing. That is, readers start translating letters into speech sounds, combining speech sounds to form separate words, then combining words to achieve comprehension of the writer's message (Gough, 1972). In other words, this model was based on the belief that reading comprehension is a process of gradually examining and adding small chunks of text to each other in a linear manner until the chunks become meaningful.

However, this belief has raised criticism at two different primary levels. The first criticism indicates that the bottom-up model emphasized processing low-level information letters, words, and sentences rather than focusing on the ultimate goal of reading which is comprehension. As a result, critics, such as Adams (1990), Nunan (1992), and Nuttall (1996) argued that the bottom-up reading process slows reading and causes short-term memory overload, which negatively affects comprehension and remembrance of the text content. Besides, the bottom-up model has been strongly criticized for neglecting both the context (readers' cultural and social factors) and readers' background knowledge (Rumelhart, 1977).

Moreover, the bottom-up model has failed to account for the implied meaning in texts. In this regard, Nuttall (1996) stated that four meanings can be derived from a single sentence: conceptual "a word can have on its own," propositional "a sentence can have on its own," contextual "a sentence can have only when in a context," and pragmatic "a sentence has only as part of the interaction between writer and reader." Nevertheless, despite its limitations, the bottom-up reading model remains essential for understanding the reading comprehension process and continues to provide significant contributions to the field of reading research.

2.2 The Top-down Model

The second type of reading processing is the top-down model, also known as the conceptually-driven processing approach. According to this model, reading is considered a high-level, active, and cyclical process of sampling, predicting, testing, and confirming (Goodman, 1967). In this regard, Goodman (1967) reported that reading is a psycholinguistic guessing game, meaning that readers do not thoroughly identify letters, words, and sentences. Instead, readers sample the graphic cues in the text and go through a decision-making process that enables them to accept, reject, or refine the information they obtain from these cues. In other words, readers take samples from the text they read and make predictions on its content based on their background knowledge, and then they either confirm their predictions or correct them. In this vein, Stanovich (2000) stated that reading is a process through which readers are actively engaged in hypothesis-testing as they make meaning of the text they read.

Interestingly, readers sample the textual content and make hypotheses that they either confirm, correct, or reject as they process the text. For this reason, the top-down model regards readers' prior knowledge as a vital element in the comprehension process. That is, unlike the bottom-up model that regards reading as a process of passively decoding linguistic input, the top-down model focuses more on the background knowledge readers bring to the text. Accordingly, the meaning of the text is not determined by the text itself, but rather by the background knowledge readers bring to it. To support their view, advocates of the top-down model stated that different readers could interpret the same text differently based on their personal background knowledge.

Nevertheless, critics provided evidence that contradicts the top-down view of reading comprehension. For instance, research on eye movement affirms that reading is not a selective process of words that engages readers in sampling the text's visual features to confirm their hypotheses. Instead, readers process and fixate on individual words in the text even when they are familiar to readers (Morrison, 1984; Rayner, 1979). Nevertheless, the duration of readers' eye fixations on words depends on a number of variables. These variables include word difficulty, word frequency (how frequently the word is used), age of acquisition (the age at which the word was learned), word predictability (how anticipated a word is, given the text context), word length (how many words can be formed by changing one letter in the word), among many other variables (Hyönä, 2011; Rayner, 1998, 2009).

Notwithstanding, despite the criticism, the top-down model's contribution to reading research has been remarkably beneficial for teaching and learning practices. For instance, in teaching reading, teachers are highly encouraged to activate their students' background knowledge by inviting them to predict what the text is about, guess the meaning of words and sentences from their context, and skim the text for the gist.

2.3 The Interactive Model

Conceptualizing reading processing as either top-down or bottom-up has raised strong criticism against both reading models, eventually leading to the emergence of a balanced model called the interactive model. This model views reading as a simultaneous interaction between bottom-up and top-down processes (Rumelhart, 1977). Accordingly, reading was deemed both a perceptual (data-driven) and a cognitive (reader-driven) process. That is, readers do not only employ their perceptual capacity but also their cognitive one (Stanovich, 1980). Therefore, for readers to successfully achieve comprehension of the texts they read, they should not only rely on the text itself but also their background knowledge.

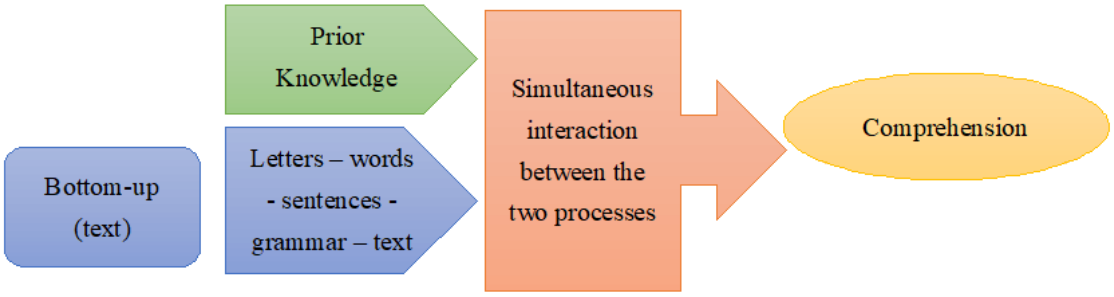

Figure 1.1 Reading Comprehension According to the Interactive Model

Figure 1.1 above reveals how the interactive model works for fluent readers. Thus, this model stresses the interaction between various knowledge sources (feature, orthographic, lexical, syntactic, and semantic knowledge) and readers' background knowledge. In this regard, Stanovich's interactive-compensatory model of reading comprehension proposes that readers can rely heavily on any source of knowledge when other sources are weak.

3. Reading Comprehension Models in Hypertexts

3.1 Kintsch's and Van Dijk's Reading Comprehension Model

One of the first models to explain the cognitive processes occuring when reading hypertexts was proposed by Van Dijk and Kintsch (1983). Kintsch's and Van Dijk's Reading Comprehension Model is a prominent model that includes eight cognitive processes that characterize reading in the hypertext environment illustrated in Figure 1.2 below.

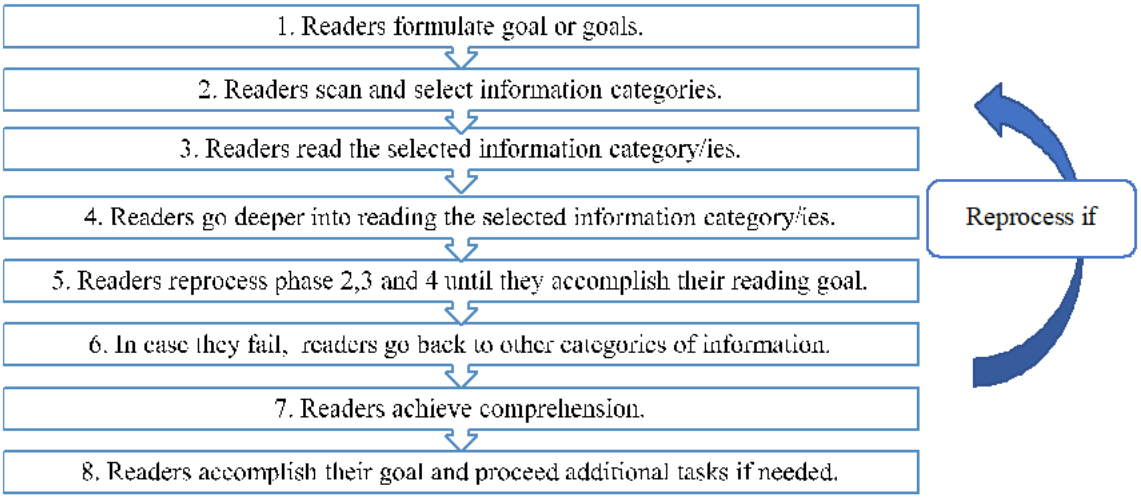

Figure 1.2 Comprehension Model of Hypertext Reading (Knitsch & Van Dijk, 1983).

Since reading comprehension is a goal-oriented process, readers of hypertexts formulate intrinsically or extrinsically motivated goals for their reading. Formulating a goal or goals is paramount for locating information in the hypertext environment, especially since the hypertext environment is characterized by information density.

Scanning and selecting adequate information categories (links/information nodes) is the second cognitive process that identifies hypertext reading. After formulating their reading goal or sub-goals, readers can either scan categories of information available in the hypertext or directly read the information presented before them while ignoring going through overall categories. Because hypertexts offer multiple categories of information, readers are more likely to find themselves compelled to scan available categories before selecting the proper ones relevant to their reading goals. After selecting proper categories, readers start constructing meaning from the selected categories (links/information nodes) and extracting details that will help them accomplish their reading goals. Then, readers go deeper into their selected reading path and click on appropriate links to obtain more information, thus meeting additional reading goals. After that, readers can reprocess the second, third, and fourth phases until they meet their reading goals.

Furthermore, because not all categories of information (text segments) in the hypertext may be necessarily appropriate to readers' reading goals, readers may fail to select appropriate categories of information and hence may fail to accomplish their reading goals. In this case, readers go back to rescan through the hypertext and choose other categories of information (segments of texts) that they think would help them accomplish their reading goal or any other additional reading goals. Next, once the required information is extracted, readers integrate the new information with that in their background knowledge to accomplish comprehension. Last but not least, once comprehension is attained, readers are prepared to answer their reading tasks if required. However, it is essential to

note that the above-mentioned reading processes of hypertext reading comprehension can occur simultaneously or sequentially (Van Dijk & Kintsch, 1983).

Similarly, Guthrie (1988) suggested a parallel model that involves five processes. To start with, readers start with formulating a goal or goals. Then, readers search categories to select the one appropriate to the reading goal. Next, readers extract the required information from the selected category. Afterward, readers integrate the newly extracted information with their previously existing knowledge. Finally yet importantly, if readers fail to achieve their goal, they recycle through previous elements until their goal is successfully accomplished.

3.2 Construction–Integration (C–I) Model

Hypertext reading comprehension can also be understood from the perspective of the construction–integration (C–I) model (Kintsch & van Dijk, 1978). This model differentiated between two cognitive representations formed by readers: the textbase and the situation model. The textbase is the textual representation of the information through which the text content is presented, whereas the situation model is the cognitive representation that results from integrating prior knowledge with new information from the text.

In the hypertext-reading environment, links are likely to affect the construction-integration (CI) model of reading comprehension (Kintsch & van Dijk, 1978). According to Scharinger et al. (2015), links disturb the reading process by shifting readers' task from reading to making decision on link selection in "the construction phase". As for the integration phase, readers are required to follow a link to carry on the reading process and integrate the subsequent node with the already read nodes into a situation model.

Also, the construction–integration (C–I) model stresses two main elements that are essential to comprehension: coherence and prior knowledge (Salmerón et al., 2005). Coherence indicates how readers can comprehend the connection between the text's ideas, whereas prior knowledge refers to readers' acquired knowledge or background knowledge.

Since hypertext information is likely to be structured nonlinearly, it was thus concluded that hypertext readers face problems building coherence while navigating through a "discontinuous text." In this regard, a study by Schnotz (1988) indicated that readers of a continuous text remembered more content and drew more conclusions than readers who read a discontinuous text. Likewise, other researchers (e.g., DeStefano & Lefevre, 2007; Potelle & Rouet, 2003; Scheiter & Gerjets, 2007) concluded that the more a hypertext is linear, continuous, or hierarchical in its structure, the more likely that readers' comprehension of it is ameliorated. Notwithstanding, empirical findings (e.g., Gerdes, 1997; Lawless & Brown, 1997) have shown that coherence-building problems related to hypertext reading can diminish if readers have a certain extent of mental models and prior knowledge that help them fill in text gaps and assimilate new information into their existing structures of knowledge.

3.3 Text and Graphics Comprehension Model

The integrative comprehension model for text and graphics was developed by Schnotz and Bannert (2003) to differentiate between descriptive and depictive representations. Since hypertexts provide varied combinations and forms of information (e.g., texts, videos, pictures, audios), Schnotz and Bannert proposed this model to differentiate between descriptive and depictive representations and stress the integration of both verbal and pictorial electronic representations of information. While descriptive representation consists of symbols describing an object, such as spoken or written texts, depictive representation consists of symbols describing pictures.

At the depictive level, readers first build a visual mental representation of the picture. Afterward, readers build both mental and propositional representations of the information displayed in the picture. Mental representations are hypothetical internal symbols representing external reality, whereas propositional representations are mental relationships between objects presented by symbols and not by mental images (Morgan, 2014). On the other hand, at the descriptive level, readers start by building a mental representation of the surface code and then develop a propositional representation of the content. Eventually, they build a mental model of the topic introduced in the text.

Overall, the text and picture comprehension model introduced by Schnotz and Bannert (2003) presented a theoretical explanation of the construction of mental representations via joining verbal and pictorial information. Therefore, to meet their reading needs in a hypertextual environment characterized by images and texts, readers select and process both verbal and pictorial information to construct mental representations of the text content (Schnotz & Bannert, 2003).

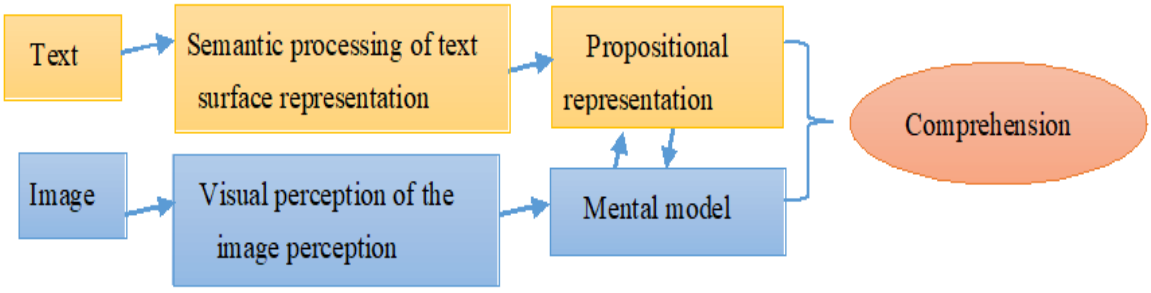

Figure 1.3 The integrated Model of Text and Picture Comprehension (Schnotz & Bannert, 2003).

Figure 1.3, which illustrates the model by Schnotz and Bannert (2003), attempted to explain cognitive processes taking place when reading from a more detailed perspective based on the dual coding of images and words. Nevertheless, despite its significance in

explaining cognitive processes in the hypertext environment from the dual coding of images and words, low-level processes such as word recognition and its subcomponents remain identical regardless of whether readers read traditional texts or hypertexts.

3.4 Navigation, Integration, and Evaluation Model

In general terms, the hypertext environment provides readers with more freedom and flexibility that allow them to read texts in the order they choose and have immediate access to information "in the sequence, volume, and format that best suit their needs at the time" (Grice, 1989, p. 22). Therefore, it became crucial for readers to know how to navigate, integrate, and evaluate the required information from multiple locations in hypertexts. To put it differently, for successful reading comprehension to occur in the hypertext environment, readers must develop specific contemporary competencies and strategies.

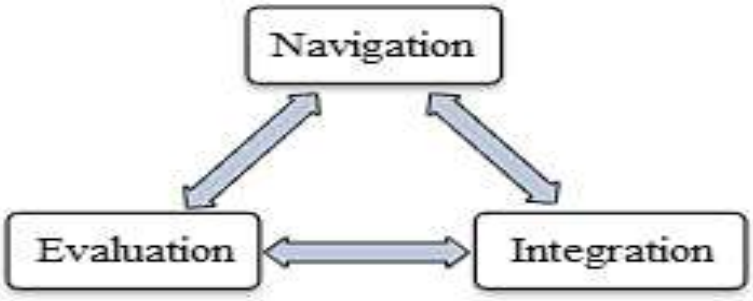

Figure 1.4 Three Main Competencies of Comprehension Processes in Hypertexts (Salmerón et al., 2018).

As shown in Figure 1.4 above, Salmerón et al., (2018) proposed a model that incorporates three main competencies or reading skills that readers should have to succeed in their hypertext reading comprehension experience. These skills include (a) navigation, (b) integration, and (c) evaluation. Regarding navigation, readers must carefully pick hyperlinks to search and scan for goal-oriented information. That is, readers have to know how to: navigate their reading path (by selecting appropriate hyperlinks), scan and find pertinent information, organize and synthesize enormous and diverse amounts of information, and distinguish which elements of information need more focus and which ones can be neglected (Coiro, 2003).

With respect to integration, readers must be able to integrate information from numerous types of hypertext structures and sources on the WWW to process information thoroughly. Besides, Integration also demands that readers connect information across hypertexts with their background knowledge to achieve comprehension. As for evaluation, readers have to evaluate information with respect to quality, significance, and credibility, especially since information on the internet can be biased or inaccurate if taken from unreliable sources.

4. Conclusion

To conclude, a total of seven reading models (also called theories, approaches, or processes) are discussed in this review to explain how readers approach and comprehend traditional texts and hypertexts. With regard to reading traditional texts, the bottom-up model was the conventional approach that suggested that readers construct meaning only from decoding text letters, words, and sentences. Conversely, the top-down model overemphasized the role of readers' background knowledge and experiences in their comprehension and interpretation of the text. On the other hand, the interactive model stressed that readers' comprehension level of texts is determined by how well they actively combine both the bottom-up and top-down reading processes. Therefore, balanced contributions of the text readers read along with the background knowledge they bring to it are essential to comprehension. Each of these models offers unique insights into how readers comprehend text and has implications for instruction and assessment in literacy education.

On the other hand, this review also sheds light on four prominent models that researchers have proposed to understand the complex process of reading comprehension in the hypertext reading environment. Due to its nonlinear structure that necessitates navigation through interconnected nodes of information, hypertext reading introduces additional complexities compared to traditional linear reading. Therefore, this review examined these models to provide frameworks for understanding the cognitive processes involved in hypertext reading and offer insights into how readers comprehend and navigate through interconnected information in the hypertext environment. These current models of comprehension cover different spectrums of comprehension processes of different types of hypertexts.

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