READING COMPREHENSION AS A MULTILEVEL COGNITIVE PROCESS: THEORETICAL PERSPECTIVES AND DEVELOPMENTS

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Abstract. These articles also examines key methodological developments, ranging from recall-based and think-aloud methods to real-time techniques including eye-tracking, electroencephalography (EEG), and functional magnetic resonance imaging (fMRI). The article argues that reading comprehension is best understood as a dynamic, multilevel neurocognitive process and underscores the value of integrating theoretical and methodological perspectives to inform evidence-based reading research and instruction.

Keywords: Reading comprehension; cognitive processes; psycholinguistics; Construction–Integration model; eye-tracking; EEG; neurocognitive approaches

Reading comprehension is widely recognized as a complex, multi-layered cognitive process involving linguistic decoding, meaning construction, inference generation, and knowledge integration. Because comprehension cannot be reduced to a single skill or mechanism, researchers have developed diverse methodological approaches to investigate how readers process, understand, and remember texts. These approaches span psychology, psycholinguistics, education, and computational linguistics. McCarthy, Kopp, Allen, and McNamara (2020) argue that the field requires multiple converging methodologies because no single method can capture the full complexity of reading comprehension in either L1 or L2 contexts.

Reading comprehension is a complex cognitive activity of humans, and the mechanisms of its formation and functioning have been studied across different periods through various scientific methods in psychology, psycholinguistics, and pedagogy. The multi-layered cognitive, linguistic, and social characteristics of the reading process have led to the development of a multi-method approach to its investigation (Grabe, 2009).

In psychology, the study of the reading process initially began with the examination of memory and perception mechanisms. Ebbinghaus's (1885/1964) classical experiments on memory empirically demonstrated the principles of retention, repetition, and forgetting during text reading. Research in this period focused on assessing reading comprehension through content recall, with memory performance serving as the primary criterion of reader activity.

In the early twentieth century, Thorndike (1917) conceptualized reading as a "complex form of thinking" and developed the first reading tests based on questions designed to determine the level of understanding of the internal logical relationships within a text. The methods of this period included identifying the structural elements of a text, determining the main idea, and reconstructing parts of the text.

During the period when behaviorism was dominant (mainly the 1930s–1950s), the processes of reading and reading comprehension were studied not in terms of internal mental activities, but solely on the basis of external, observable behaviors. According to behaviorist scholars, scientific research should rely only on outcomes that can be measured and observed. Therefore, what mattered was not what the

learner was thinking or how the text was being understood, but how the learner responded and how quickly the text was read.

In this period, reading comprehension was mainly assessed through three indicators:

1. Reading speed (how fast a learner can read a text),
2. Number of correct answers (how many questions were answered correctly),
3. Relationship with vocabulary knowledge (the assumption that the more words a learner knows, the better they understand the text).

For example, Carver (1990) notes that evaluating reading efficiency on the basis of speed and accuracy was widely practiced.

During this time, standardized reading tests were developed. These tests were administered under identical conditions for all learners, making it possible to objectively compare their results. As a result, reading comprehension became easier to assess quantitatively (through scores, percentages, and rankings), and testing began to be widely used in educational systems.

However, the main limitation of the behaviorist approach was that it failed to explain the internal psychological and cognitive mechanisms of reading, such as meaning construction, inference making, activation of prior knowledge, and mental processing of the text. The focus was not on why a learner understood or failed to understand a text, but only on what kind of responses were produced. Consequently, in later periods, cognitive and psycholinguistic approaches emerged to provide a deeper and more comprehensive explanation of reading comprehension.

From the period when cognitive psychology began to emerge and develop (mainly the 1960s–1980s), the approach to reading and reading comprehension changed fundamentally. Researchers no longer limited themselves to learners' external responses, but instead sought to empirically investigate the mental processes that occur in the mind during reading. Reading came to be interpreted as a complex cognitive activity in which information reception, processing, storage, and meaning construction are closely interconnected.

During this period, scholars focused primarily on how learners "work with" a text. This included how readers recognize words, identify logical relationships between sentences, distinguish main and secondary information in a text, and activate prior knowledge (background knowledge) in order to connect it with new information. Reading comprehension was no longer viewed as passive reception, but rather as an active process of meaning construction.

As a result, this stage saw the development and widespread use of specialized methods capable of revealing learners' internal cognitive processes. One of the most important methods was think-aloud protocols, in which learners verbalize their thoughts while reading a text. For example, they explain what they understand, where they encounter difficulties, and what predictions or inferences they make. Pressley and Afflerbach (1995) demonstrated that this method allows researchers to directly identify learners' comprehension strategies.

Another widely used method was free recall, that is, the free retelling of a text. In this approach, learners are not required to memorize the text verbatim; instead, they are asked to recount the content in their own words after reading. This makes it

possible to determine what information learners consider important, how they construct a logical structure, and how effectively they integrate information from the text.

In addition, eye-movement analysis methods became increasingly common. These techniques measure, using specialized technology, where readers' eyes fixate longer on certain words or sentences and where they make backward movements (regressions) during reading. Rayner's (1998) studies show that eye movements provide valuable information about learners' comprehension difficulties and cognitive load.

Overall, the methods applied during the cognitive psychology period made it possible to explain reading comprehension from the perspective of internal, invisible mental processes. As a result, researchers gained clearer insights into which strategies learners use to understand texts, as well as where and why comprehension difficulties arise. This approach later served as a solid theoretical and methodological foundation for psycholinguistic and educational research.

Kintsch and van Dijk (1978) explain reading comprehension not as simple "reading and memorizing," but as a process of constructing meaning in the mind. Their Construction–Integration model proposes that when a reader processes a text, two main cognitive stages operate.

1) Construction stage

At this stage, the reader breaks the sentences of the text into small units of meaning, known as propositions.

A proposition is the core semantic unit of a sentence. For example: *"The student read a book"* → (student) + (read) + (book).

During this stage, the reader extracts a large amount of information from the text. Some of this information is important, while some may be irrelevant. In other words, the mind collects "raw" or unfiltered information.

2) Integration stage

Next, the reader connects the extracted meaning units, selects the relevant ones, suppresses the irrelevant ones, and integrates them into a coherent overall meaning of the text.

During this process, the reader:

- identifies cause–effect relationships between sentences,
- seeks answers to questions such as "What does this lead to?",
- attempts to understand implicit or hidden meanings in the text,
- incorporates prior knowledge.

As a result, a mental model of the text is formed in the reader's mind (Kintsch, 1988).

A mental model refers to the internal representation of the text—that is, constructing a clear, coherent, and logically organized understanding of the text's meaning in the mind.

In contemporary psychology, reading comprehension is no longer interpreted solely as a cognitive or psycholinguistic process, but rather as a complex neurocognitive system**.** That is, researchers now explore not only the question "How does a reader understand a text?" but also **"**Where, when, and how does this process

take place in the brain?" For this reason, research on reading comprehension from a neurobiological perspective has intensified significantly in recent years.

First of all, eye-tracking technology makes it possible to clearly observe how attention is distributed during reading and which words or sentences require greater cognitive effort. For example, when a reader encounters difficult or unfamiliar words, fixation duration increases and regressions (backward eye movements) become more frequent. These patterns directly indicate that the reader is experiencing comprehension difficulties.

At the same time, EEG (electroencephalography) allows researchers to measure electrical brain activity during reading at the millisecond level. EEG studies have identified specific neural responses associated with semantic processing, word recognition, syntactic violations, and semantic incongruities. For instance, the N400 component reflects semantic mismatch, while the P600 component is associated with difficulties in syntactic processing.

In addition, fMRI (functional magnetic resonance imaging) is used to identify which brain regions are activated during reading. fMRI research shows that reading comprehension involves coordinated activity across multiple areas, including left-hemisphere language-related regions (such as Broca's and Wernicke's areas), as well as the prefrontal cortex and temporal and parietal regions. As noted by Pavlidou and Williams (2021), semantic encoding and attentional control during reading are carried out through distributed yet highly coordinated neural networks in the brain.

In modern neuropsychological research, working memory is regarded as a central component of reading comprehension. Working memory enables readers to temporarily retain earlier sentences in a text, integrate them with new information, and construct an overall meaning. Studies by Cain and Oakhill (2014) demonstrate that readers with limited working memory capacity tend to experience greater difficulties in reading comprehension.

Furthermore, the neural foundations of phonological processing (encoding and processing the sound structure of words) and semantic integration (combining meanings across words and sentences) are being examined in depth. These processes occur in parallel across different brain regions, and their coordinated functioning is essential for successful comprehension. If one of these systems functions inefficiently, reading becomes slower or remains superficial.

Theoretical and Practical Significance

These neurobiological approaches make it possible to conceptualize reading comprehension not merely as a matter of test performance or strategy use, but as a complex system organized in the brain**.** As a result:

- individual differences in reading (e.g., slow readers or individuals with dyslexia) can be explained more precisely;
- the sources of comprehension difficulties can be identified at the neural, rather than purely cognitive, level;
- instructional methods can be adapted to learners' neurocognitive capacities.

In conclusion, contemporary psychology views reading comprehension as a multilevel neurocognitive process**.** Through technologies such as eye-tracking, EEG, and fMRI, the neural organization of reading has become increasingly transparent,

providing a strong scientific foundation for the future development and improvement of evidence-based reading instruction methodologies.

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