

This book proposes to restore that balance — to help educators make *the invisible act of seeing* a conscious part of learning.

FROM RESEARCH TO PRACTICE

This work began as a doctoral study on *the contribution of visual memory to the construction of meaning*. Its early chapters explored how the eye processes text, how memory stores visual traces, and how comprehension arises from their interaction.

Over time, these findings evolved beyond academic boundaries. They became questions of pedagogy, psychology, and philosophy:

- How do we teach students not only to read, but to *see* what they read?
- How can teachers use space, color, and rhythm to support comprehension?
- What does it mean to “see” an idea, a character, or a logical relation?

The answers to these questions are not purely theoretical — they emerge from classroom experience, from trial and reflection, from the subtle observation of learners and teachers in action.

A VISION FOR EDUCATION

- This book is not a technical manual.
- It is a *call to look differently* at the act of learning.
- In an age saturated with images, paradoxically, we are losing the ability to *see with the mind*.
- We scroll, we scan, but we rarely fix our gaze long enough for memory to shape understanding.
- To teach reading today is to teach **attention, perception, and inner vision**.
- It is to help learners rediscover the creative power of their eyes — to transform lines into ideas, words into worlds.
- When we reconnect seeing and knowing, education becomes once again a human art: the art of guiding others to look deeply, remember wisely, and understand fully.

“Understanding begins where the gaze becomes thought.”

May this book help teachers, students, and readers everywhere to see — and in seeing, to understand.

WHAT MEMORY LETS US SEE



1 What Memory Lets Us See

1.1 Introduction

Understanding how we read does not begin simply with the printed text or the eye's landing on a page—it begins with how the visual system and memory collaborate to capture, structure and sustain what we see. At the heart of this process lies visual memory, the capacity to retain visually-presented information for immediate or extended use, which underpins the complex activity of reading comprehension, defined as the reader's ability to construct meaning, integrate with prior knowledge and monitor cognitive processes (Kendeou, van den Broek, & Rapp, 2005). In this chapter we treat reading comprehension through the lens of cognitive-semiotic and didactic theory: we argue that visual memory mediates the transition from perceptual input to meaning construction and that pedagogical interventions must attend to that mediation. We begin by delineating core memory systems and then progress to their roles in reading, finally mapping didactic implications for teaching and curriculum design.

The first foundational construct is iconic memory, the ultra-brief storage of visual input (often a fraction of a second). Iconic memory serves as the sensory trace that feeds into working memory, the system with limited capacity able to hold approximately 4 ± 1 chunks of information (Cowan, 2001) and to manipulate them (Baddeley, 2012). Working memory comprises distinct subsystems such as the visuospatial sketchpad (visual/spatial features) and the phonological loop (verbal information; Baddeley & Hitch, 1974). Importantly for reading, these subsystems interconnect: the visuospatial sketchpad

allows retention of letter shapes, line positions, and spatial layout, while the phonological loop supports internal verbalisation. The interplay of these subsystems—under the governance of an episodic buffer (Baddeley, 2000)—provides the cognitive workspace in which visual information is converted into coded representations. A comprehensive visual memory model must therefore recognise both the brief sensory traces and the more sustained manipulations in working memory (Sridhar & Hegde, 2023).

Following the sensory and short-term phases, we encounter long-term visual memory, encompassing both visual imagery (the mental reconstruction of visual scenes) and stored visual knowledge (schemata of letter scripts, word-forms, orthographic patterns). It is helpful to distinguish this from visual imagery: while imagery involves volitional reconstruction, visual memory in its passive sense refers to the retention of visually-encoded representations even after the stimulus disappears (Intraub, 1992). The notion of visual span, defined as the number of characters or elements a reader can recognise in a single eye fixation (typically around 7 ± 2 for skilled readers; Rayner, 1998), illustrates how visual memory constrains the perceptual window for reading. The efficient reader orchestrates a series of fixations and saccades (eye movements), each of which engages visual memory to maintain continuity of textual input (Rabe et al., 2023). Thus, memory provides the continuity of vision necessary for text processing.

Reading comprehension does not proceed merely by decoding words—it is a meaning-construction activity in which the reader forms a coherent mental model of the text, activates prior knowledge, monitors

comprehension, and makes inferences (Kendeou et al., 2005). From a semiotic-didactic perspective, reading is the transformation of signs (orthographic, visual) into meaningful concepts and then into schematised knowledge. In this sense, visual memory contributes to reading comprehension by supporting three interdependent processes: (a) the perceptual capture of written signs, (b) the maintenance of those signs in cognitive workspace long enough for lexical access and deeper processing, and (c) the retrieval and integration of previously learned visual-verbal associations (orthography–phonology–semantics). Empirical evidence confirms that individual differences in working memory capacity correlate with variance in reading-comprehension performance (López-Resa et al., 2023). Furthermore, emerging research shows that visual search skill—the ability to efficiently locate relevant visual information in a field—predicts reading comprehension indirectly through decoding accuracy (Liu et 2025). These findings underscore that reading comprehension is grounded not solely in linguistic skills but also in visual-cognitive abilities.

To integrate these insights in a constructivist pedagogy, we evoke the concept of schema formation. A schema is a mental structure that organises prior knowledge and guides incoming information processing (Rumelhart, 1980). From a visual-didactic viewpoint, learners bring into reading tasks both verbal and visual schemata—orthographic patterns, morphological templates, action schemas for navigating text layout, and visual imagery associated with domain knowledge. When readers encounter new text, they map incoming visual representations into existing schemata; this mapping process is productive only if the visual memory workspace allows adequate

retention time and accessibility of the input. Cognitive-load theory (Sweller, 2011) further reinforces the argument: when the visuospatial sketchpad or phonological loop become overloaded (for example, by complex page layouts or distracting visuals), the capacity for schema-mapping and meaning construction decreases. Therefore, for effective didactic design, visual presentation of texts must be optimised to reduce extraneous load and to support visual-memory retention of relevant cues.

A complementary theoretical strand is the well-known Dual Coding Theory (Paivio, 1971), which posits that information encoded both visually and verbally enjoys richer retrieval and integration. In reading, dual coding suggests that co-presenting visuals (images, diagrams) and text promotes comprehension by providing two representational codes that share semantic linkage. Importantly, visual memory serves as the storage locus of the visual code; the verbal code resides partly in the phonological loop and long-term verbal memory. Thus, effective reading instruction can exploit dual-coding by guiding learners to generate mental images of text content, or by intentionally pairing visuals with verbal narratives. In a didactic setting, for instance, prompting learners to visualise described processes or to sketch key scenes engages visual memory, thereby supporting comprehension and retention (Mayer, 2009). Crucially, this interplay between visual memory and verbal processing supports deeper processing rather than surface description.

In practice, reading comprehension is a dynamically unfolding process of fixation–saccade–recognition–integration. During each fixation

(typically around 200–250 milliseconds), the foveal and parafoveal visual information enters the visual system, engages the visuospatial sketchpad, and triggers lexical access (Rayner, 1998). The retention of that information across saccades depends on visual memory traces and attentional control. Simultaneously, the reader’s working memory must juggle multiple streams: word decoding, syntactic-semantic mapping, and integration into text-models—all while monitoring comprehension and potential regressions. This cognitive-visual choreography underscores the centrality of visual memory in reading. Failure at any stage—e.g., insufficient retention of parafoveal preview, reduced visual span, or inadequate schema linkage—can lead to breakdowns in comprehension (Kendeou et al., 2005). From a practical standpoint, teaching interventions can scaffold this by modelling eye-movement strategies (such as previewing text), encouraging metacognitive awareness of fixations and regressions, and selecting visually accessible materials (e.g., appropriately spaced text, high contrast, reduced background clutter).

The implications for didactics are manifold. First, classroom materials should be designed with clear visual-memory support: typography and layout should maximise legibility, spacing should reduce visual crowding, and diagrams or images should align with textual content rather than distract. Educators may consider visual-memory rehearsal techniques, such as encouraging students to briefly preview a paragraph, close their eyes and attempt a mental image of the text layout and main ideas, thus engaging the visuospatial sketchpad and strengthening retrieval links (Pickering & Joubert, 2023). Second, in reading strategy instruction, guiding students explicitly to form mental

images of what they read fosters active interaction between visual memory and meaning construction. Third, assessment of reading comprehension should consider not only verbal but visuospatial factors—namely, how quickly a learner can extract meaning from visual layouts, charts or diagrams, and retain that information while integrating it into the text model.

From a neuro-didactic standpoint, the brain networks supporting visual memory and reading are increasingly well-mapped: fronto-parietal networks underlie working memory operations, while occipito-temporal regions support orthographic and visual-pattern recognition (Sridhar & Hegde, 2023). Individual differences in these networks' efficiency account for variability in reading comprehension outcomes—a fact that points to the importance of early screening for visuospatial memory or visual search deficits (Liu et al 2025). Didactically, this suggests that intervention should not wait until comprehension fails: early tasks that strengthen visuospatial attention, visual-search fluency, and orthographic pattern memory may produce foundational benefits for reading development.

1.2 The Human Architecture of Memory

1.2.1 What Is Memory?

Memory is the brain's capacity to encode, store, and retrieve experiences, transforming fleeting perception into lasting knowledge (Baddeley, 2012). Encoding converts sensory input—what we see, hear, or feel—into neural representations; storage maintains those representations over time; and retrieval re-activates them when we recognize, recall, or apply what we have learned (Squire & Kandel,

2009). Far from being an abstract mechanism, memory is the living foundation of personal continuity. When a student recognizes a familiar face in a hallway, recalls the structure of a poem studied last week, or visualizes the layout of yesterday's classroom diagram, each act engages memory's threefold operation. These everyday events illustrate how the brain weaves experience into stable patterns of recognition that make new learning possible. Cognitive neuroscience shows that even the simplest act of remembering—a face, a place, or a paragraph—depends on the coordinated activity of distributed networks linking the hippocampus, neocortex, and sensory association areas (Eichenbaum, 2017). Thus, memory is not a single storehouse but a dynamic system that reconstructs experience each time it is recalled.

From a didactic standpoint, defining memory in this concrete way grounds pedagogy in lived cognition rather than abstraction. Teachers constantly rely on memory's operations: when a learner identifies a word seen before, applies a rule from a previous lesson, or relates a new idea to prior knowledge, the educational act succeeds because encoding, storage, and retrieval work together. The ability to connect present perception with past learning is what transforms exposure into understanding (Bransford et al., 2000). Hence, to teach effectively is to guide the learner's memory processes—helping students to notice, organise, and later reconstruct what they have perceived.

1.2.2 Why Memory Matters for Understanding

Without memory, comprehension collapses. Every act of understanding—whether interpreting a sentence, solving an equation, or inferring a character's motive—depends on recalling and integrating