



Language, Literacy, and Learning

THEORY AND APPLICATION

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Foreword

When Meredith told me she was writing this book, I rejoiced. Language development in young children is a miraculous human feat. Only learning to read rivals it. There is a critical need to clearly describe these complex processes and how they are fundamentally linked. Meredith does just that in this volume. She succinctly and thoroughly synthesizes decades of research and practice on the language basis of reading. What makes the volume unique is her marriage of academic and

clinical knowledge and the breadth and depth of topics. Meredith covers the history of reading and writing through the neurobiology through evidence-based practice of both reading and writing and both expression and comprehension. I've had the pleasure of working with Meredith for nearly a decade and her stellar intellect and passion come through the pages. This volume will become a staple of graduate education and clinical practice across many disciplines.

—Tiffany P. Hogan, PhD, CCC-SLP
Director of the SAiL Literacy
Lab; Professor
MGH Institute of Health
Professions

Preface

A word for instructors who are considering using this volume in the classroom—this is my eighth year as an instructor of college students. Every fall for the past eight years I have taught either the graduate-level course with the same title as this volume or a related, graduate-level course regarding language and literacy in school-aged children. Thus, it is safe to say that the information presented in this volume as well as the ancillary materials provided for students and instructors have been extensively tested by real students in real classrooms! That said, I am well aware that I am still in the very beginning stages of learning how to teach, and so I am grateful to my students for continually challenging me to be a better instructor. I am especially thankful to them for providing me with inspiration during every interaction. For example, it was a graduate student in my class who coined the phrase “thinking in letters” to describe the phenomenon of orthographic interference (see Chapter 3 of this volume), and I think that this is a perfect expression!

A word for clinicians, and for students who are on the path to becoming clinicians, who are considering using this volume as a resource—I hope that you will find the opening chapters to be as valuable as the later chapters. Specifically, Chapter 1 through Chapter 3 describe the foundations of literacy: how, where, and why reading and writing originated; the evolution of the perspectives of researchers and speech-language pathologists regarding reading and writing differences; how reading and writing are instantiated

within the brain; and the theories and models that inform the ways in which we conceptualize these extraordinary achievements. As you read on, you will discover information that more directly addresses how to “do” clinical work. Undoubtedly, while serving the children and adults on our caseloads is our ultimate goal, I think that understanding the foundational theories and models presented in the early chapters can only help us to achieve that goal. Therefore, as the volume’s subtitle implies, I have attempted to present both theory and practice throughout the text, remaining optimistic that understanding both will be beneficial to our growth as clinicians.

A word about cultural and accessibility implications—it is impossible to overstate the importance of exploring diversity in all of its forms, including neurodiversity, cultural and linguistic diversity, disability identity, diversity in socioeconomic and sociopolitical understanding, expressions of gender and sexuality, diversity in religious beliefs, and experiences of intersectionality. To draw your attention to these issues, I have flagged the paragraphs within each chapter that address cultural and accessibility implications. You will notice these paragraphs because they appear next to a globe icon. In addition, I have flagged the paragraphs that contain specific activities for clinicians, teachers, parents/guardians, and siblings to use when supporting learners’ reading and writing skills. You will notice these paragraphs because they appear next to a paintbrush icon.

A word regarding pronouns—as I was writing the initial drafts of this volume it felt very awkward and unwieldy to use three pronouns (feminine, masculine, and nonbinary) in every instance where a pronoun was required. For example, I tried to begin a sentence with, “If a young child enjoys reading, she/he/they are likely to . . . ” I felt that this would ultimately disrupt the flow of the text and prove to be distracting to the reader. Therefore, for each chapter, I chose to select one of these three pronouns and stick with it for the entire chapter. You

will notice that, for example, Chapter 1 includes exclusively masculine pronouns, Chapter 2 includes exclusively feminine pronouns, and Chapter 3 includes exclusively nonbinary pronouns.

Finally, I thank you for taking the time to join me on this journey of learning and exploration. I hope that this volume proves to be enjoyable and memorable to you, that you discover one nugget of information that particularly sparks your interest, and that my words support, challenge, or broaden your original perspectives. Happy reading (and writing)!

—Meredith

1

From Decorated Rocks to Dyslexia Research: The Evolution of Reading and Writing

“The constellations were ‘the writing of the heavens.’”

—Henri-Jean Martin, 1924–2007, authority on the history of writing

Learning Objectives Based On Anderson et al.’s (2001) Revision of Bloom’s (1956) Taxonomy

After reading this chapter, the learner will be able to

- **Understand:** *Compare* concepts about world cultures to ideas about the development of world writing systems. *Summarize* the reasons as to why an ideal writing system is one that represents features of both whole words and individual sounds.
- **Apply:** *Produce* a list of aspects of early science that are still relevant today and other aspects of early science that are relatively obsolete. *Implement* your clinical judgment and respect your client’s preferences regarding the use of person-first language or identity-first language.
- **Analyze:** *Point out* explanations of scholars as to how and why writing developed. *Organize* world writing systems into those that are mostly logographic, those that are mostly syllabic, and those that are mostly alphabetic.

- **Evaluate:** *Judge* the evidence for the conclusion that writing initially evolved from counting. *Summarize* the history of speech-language pathologists' and psychologists' understanding of reading differences.

In the first section of this volume, I will describe the theoretical aspects underlying literacy and the history of this extraordinary achievement. In Chapter 1, I will travel from the times of ancient civilizations through current practices around the world in search of information concerning *grammatology*—the study of the history of writing systems. Throughout this journey, I will explore perspectives regarding the cultural aspects of reading and writing. I will also analyze various writing systems associated with early and modern world languages. I will conclude this chapter with a detailed account of views spanning the past one-and-nearly-one-half centuries about the bases of reading differences in children and adults.

It would be impossible to unpack completely these complex and multifaceted concepts in a library of books, let alone in one chapter. Therefore, it is my goal here simply to outline, in the very broadest of strokes, some of the most commonly cited perspectives of historians and linguists regarding the invention of writing. I hope that you will read with an eye as to how understanding the historical aspects of this accomplishment can enable you to conceptualize literacy more completely, which will in turn enhance your clinical work in assisting individuals with reading and writing differences. After all, the development of first spoken and then written language across history parallels the development of first spoken and then written language by individual children and adults. See the box on the follow-

ing page for terms you should understand before reading this chapter.

What, Exactly, Is Language? What, Exactly, Is Literacy?

The American Speech-Language-Hearing Association (ASHA) is the credentialing, professional, and scientific organization for audiologists, speech-language pathologists, and speech and hearing scientists in the United States. ASHA's Committee on Language adopted this definition of *language* in 1982:

Language is a complex and dynamic system of conventional symbols that is used in various modes for thought and communication. Contemporary views of human language hold that: language evolves within specific historical, social, and cultural contexts; language, as rule-governed behavior, is described by at least five parameters—phonologic, morphologic, syntactic, semantic, and pragmatic; language learning and use are determined by the interaction of biological, cognitive, psychosocial, and environmental factors; effective use of language for communication requires a broad understanding of human interaction including such associated factors as nonverbal cues, motivation, and socio-cultural roles. (ASHA, 1982, "Definition of Language" section)

Terms to Know

Before beginning to read this chapter, you should understand the following terms:

- *Orthography*: “a method of representing the sounds of a language by written symbols” (Emmorey & Petrich, 2012, p. 194).
- *Writing system*: the basic or main unit of a language that its visual symbols represent.
- *Phoneme*: one speech sound; the smallest unit of language.
- *Morpheme*: the smallest unit of meaning (e.g., the word “unstoppable” has three morphemes: “un-,” “stop,” and “-able”).
- *Grapheme*: one written character.
- *Logographic writing system*: a writing system in which one character generally represents one morpheme, as in Chinese. Languages with logographic writing systems tend to be languages in which words are not morphologically complex.
- *Syllabic writing system*: a writing system in which one character generally represents one syllable, as in Japanese. Languages with syllabic writing systems tend to be languages in which words have a simple syllabic structure.
- *Alphabetic writing system*: a writing system in which one character generally represents one sound, as in English.
- *Transparent alphabetic writing system*: an alphabetic writing system in which each grapheme represents one phoneme and in which each phoneme is represented by one grapheme. For example, in Italian, each sound usually corresponds to a particular letter; Italian is therefore more transparent than English.
- *Opaque alphabetic writing system*: an alphabetic writing system in which each grapheme can represent more than one phoneme and in which each phoneme can be represented by more than one grapheme. For example, in English, sounds may correspond to a number of different letters; English is therefore more opaque than Italian.
- *Modality*: the mode in which language is expressed. Modalities include spoken, signed, or written language. (While literacy exists in a variety of modalities, including Braille and finger spelling, this volume will focus on literacy in the written modality.)

This definition is both classic—thanks to its endurance in the literature for four decades—and contemporary—thanks to its continued relevance to today’s practice.

Literacy comprises reading and writing. Let us turn again to ASHA for its def-

inition. ASHA describes *reading* as “the process by which an individual constructs meaning by transforming printed symbols in the form of letters or visual characters into recognizable words” (ASHA, n.d., “Overview” section), and *writing* as “the

process of communicating using printed symbols in the form of letters or visual characters, which make up words. Words are formulated into sentences; these sentences are organized into larger paragraphs and often into different discourse genres (narrative, expository, persuasive, poetic, etc.)” (ASHA, n.d., “Overview” section). This definition is consistent with ASHA’s goal of recognizing written language differences, especially as they relate to spoken language differences. Spoken and written language have an intricate relationship, and for literate individuals, are to a great extent indivisible. Kamhi and Catts (2012) describe reading as “thinking guided by print” (p. 3), which is a significant cognitive skill. Reading and writing are both language-based skills, and most developmental reading and writing difficulties have their source in developmental language difficulties (Kamhi & Catts, 2012). Simply put, language is language, regardless of the modality (spoken, written, or signed) in which it is presented. This begs the following questions: How did written language develop? And why was this type of progression even necessary in the first place?

The Historical Evolution of Writing

The invention of writing required many millennia to accomplish. According to Olson (2009),

Writing was never a matter of simply inventing a device for recording speech but rather a matter of discovering the properties of speech suitable for visual representation and communication. It was the latter task which

required generations of borrowing and invention. (p. 9)

It is impossible to study the development of the world’s writing systems, as well as the systems of contemporary world writing systems, without considering their historical, social, and political contexts. As expressed by Trigger (2004), “Religious, political, ethnic, and class loyalties, as well as cultural beliefs and preferences, have played an important role in both resisting and bringing about changes in scripts” (p. 67).

Early Precursors to Writing

Across cultures, the very earliest forms of writing consisted of rocks decorated with symbols of humans, flora, fauna, and astrological phenomena such as the sun, stars, and comets. From 50,000 B.C.E. to 30,000 B.C.E., most writing involved regular lines, dots, or hatch marks, and from 35,000 B.C.E. to 25,000 B.C.E., writing also included figurative art. In 15,000 B.C.E., cave paintings with more realistic figures emerged. Early writers produced decorative objects, carved wood and bone with flint, made coloring agents by scraping ochre and manganese, and created brushes out of animal hairs. Many followed a sense of logic or symbolic organization in these works; a writer would draw animals to appear larger if they figured more prominently in his culture (Martin, 1994).

This might lead one to assume that all societies developed painting before they developed writing. After all, isn’t it easier to understand a painting of a sheep than it is to understand a symbol representing a sheep? However, archaeological evidence does not support this assumption. Even in

the oldest cave paintings (such as those in the Chauvet cave in southern France from 33,000 years ago), early writers produced recognizable images of objects and animals using just a few strokes. These writers must have discovered that there was no need to reproduce laboriously a three-dimensional shape (as in the art form of sculpture) or even an elaborate two-dimensional shape when a figure would suffice (Dehaene, 2009).

Many ancient cultures around the world shared the view that writing had a supernatural source (Fischer, 2003). Dehaene (2009) summarizes some of these beliefs: Plato stated that in ancient Egypt, “there was a famous old god whose name was Theuth. . . . He was the inventor of many arts, such as arithmetic, calculation, geometry, astronomy, draughts, and dice, but his great discovery was the use of letters” (Dehaene, 2009, p. 172). Theuth was also the master of hieroglyphics, patron of scribes, and secretary to the gods. Because members of this culture believed that writing had tremendous powers, they considered Theuth a dangerous magician (Martin, 1994). The Judeo-Christian biblical account of the giving of the Ten Commandments to the prophet Moses on Mount Sinai describes tablets written in God’s own hand. The Babylonians believed that magic and writing were endowments from Ea, the god of all wisdom. The Assyrians worshipped Nabu, son of Marduk, who taught humankind arts including architecture and writing. In the Hindu religion, there is a belief that Ganesh, the elephant-headed god of wisdom, invented writing and broke one of his own tusks to use as a pencil (Dehaene, 2009). In China, legend has it that writing originated when Cang Ji, a minister to Emperor Huang Ti, studied the celestial bodies and the natural world, espe-

cially bird and animal tracks, in order to produce the first writing (Martin, 1994). Sometimes, when writing was considered to be a divine revelation, this knowledge was considered to be a privilege and was not shared widely (Trigger, 2004).

If writing was indeed a gift from above, what was the original reason for this gift? As necessity is the mother of invention, we can ask the question another way: What were the needs of ancient peoples that prompted and enabled them to develop writing? The answer may have to do with their needs to express their spiritual beliefs and values. Martin (1994) expressed it thus:

Recourse to graphic expression seems to have represented man’s need to give visual form to his interpretations of the external world; to fix those interpretations and make them concrete in order to define them better; to take possession of them, communicate with the superior forces, and transmit what he had learned to his fellows. (p. 4)

Civilizations may also have developed writing for more pragmatic reasons. Early writing was concerned with specifying terms of trade agreements, foreseeing the future, and representing lunar calendars (Martin, 1994). Even in early cave paintings, dots, lines, checkerboards, and curves—which historians surmise served as elementary mathematical or calendar devices—supplemented drawings of animals (Dehaene, 2009). As trade expanded, it became necessary for societies to develop tangible and durable ways of counting, recording transactions, and aiding memory. According to Fischer (2003), “Complete writing’s crucible was accountancy. Only social necessity could produce such an eminent tool as complete writing” (p. 22).

Consequently, *semasiography*—the use of signs as mnemonic devices—developed. These devices ranged from simple *tally sticks*—one of the oldest forms of record keeping in which writers notched artifacts such as bones to represent people, the passage of time, or hunting successes—to the elaborate multi-tiered systems of color-coded knots of the Incas that served as memory aids. Native Australians even conveyed such messages over great distances (Fischer, 2003). Some scholars indicate that writing began around the ninth millennium B.C.E., when ancient Sumerians used a system of distinctively shaped tokens to represent commodities such as livestock, oil, beer, and grain. As cities evolved, their members strung these tokens together or placed them in *bul-lae*—envelopes used to record individual transactions (Olson, 2009). Dehaene (2009) describes small clay objects dating from 8000 B.C.E. upon which are depicted *calculi*—cones, cylinders, spheres, half-spheres, and tetrahedrons that represent units or multiples of the arithmetic base 10 or base 60. Calculi were used to facilitate counting and calculation. Civilizations also often used *indexical symbols* where, for example, five pebbles might indicate five sheep (Fischer, 2003). Similarly, Dehaene (2009) reports that in the Middle East from 8000 B.C.E. to 3000 B.C.E., numerical tokens (as in the number 20) followed by a symbol of an object (as in a

goat) could be used to transmit a message (as in “20 goats”).

Interestingly, civilizations that were geographically remote developed writing systems following remarkably similar progressions. For example, four early scripts that have highly significant similarities (as well as some important differences) were those of the Sumerians, Egyptians, Chinese, and Mayans (Trigger, 2004). The media in which scribes recorded symbols also varied across cultures. Writing on stones prevented a given party from renegeing on a trade agreement (Martin, 1994). Writing on clay was common in the Middle East because clay was plentiful, easy to erase and preserve, and could be simply impressed with symbolic marks (Fischer, 2003).

Writing continued to develop across the globe and across the centuries as a way to convey messages and represent religious beliefs. The ancient Greek world used syllabic systems, known by historians as Linear A and Linear B (the former, earlier and simpler; the latter, later and more sophisticated; Bennett, 1996). These systems were composed of signs, ideograms, and symbols corresponding to numbers and were used primarily to keep accounts (Martin, 1994). South Americans began to represent units of time and ritualistic cycles around 2000 B.C.E. Around 600 B.C.E., these evolved to representations of the dates, places, and characters involved in historical events (Dehaene, 2009). The writings of the Mayans registered the passages of time and the works of the gods who governed them, and often contained remarkably accurate calculations of astronomers and priests. The Aztecs wrote down their laws, economic rules, mythology, calendar, and rituals on a material resembling paper (Martin, 1994) and in a system representing ideas, not sequences of words (Trigger, 2004).

Key Point



Ancient peoples commonly viewed writing as having a supernatural source. Writing likely developed to express their spiritual beliefs as well as to facilitate counting and record keeping.

**The Debate:
Representing Whole Words,
Sounds, or Both?**

The early systems described previously shared the limitation that they could neither record nor transmit particular information related to quality or characteristics. Therefore, again of necessity, these systems continued to evolve, some coming to represent whole words, others coming to represent sounds, and still others eventually moving toward representing a combination of words and sounds. We must ask two questions: which of these three structures is most effective and efficient given the nature of human communication? Which of these three structures has withstood the test of centuries of time?

See Table 1–1 for a summary of the advantages and disadvantages of each structure.

First, *pictography*—recording whole words with pictorial symbols—was born as “the fortuitous marriage of marks and mnemonics” (Fischer, 2003, p. 17). At some point in history (perhaps in Sumer around 3300 B.C.E.), pictures became standardized and abstract and were thereby transformed into symbols. In other words, the depicted objects became unrecognizable in and of themselves and began to stand for something external. When this change occurred, scribes were still able to read these texts but those who were unfamiliar with the symbolism could not (Fischer, 2003). Many of these writings consisted of *petroglyphs*—marks engraved or painted on walls or rocks—while others were

Table 1–1. Some Advantages and Disadvantages of Pictography, Phonetism, and Mixed Writing Structures

	Advantages	Disadvantages
Representing whole words (pictography)	<ul style="list-style-type: none"> Pictographs avoid ambiguity. Pictographs do not require translation. Pictographs are easy to interpret (sometimes). No extensive training is required to produce pictographs. 	<ul style="list-style-type: none"> It is difficult to convey abstract ideas using pictographs. Even pictographs cannot be universal because writing depends on the materials available to scribes. Writing in pictographs is slow. Too many symbols would be required to represent all of the words in the spoken language.
Representing sounds (phonetism)	<ul style="list-style-type: none"> Many fewer symbols are required in phonetism, reducing memory demands. Writing in phonetism is faster. 	<ul style="list-style-type: none"> Phonetism is very ambiguous, especially in its representation of homophones.
Representing both (mixed)	<ul style="list-style-type: none"> Mixed systems are the most efficient given the way our memory is structured and the way our languages are organized. Mixed systems may be the ideal balance between pictography and phonetism. 	<ul style="list-style-type: none"> Mixed systems are neither completely based on words nor completely based on sounds.