On the Role of Understanding in Reading and Reasoning

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> *"Then you should say what you mean," the March Hare went on.*
> *"I do," Alice hastily replied; "at least—at least I mean what I say—that's the same thing, you know."*
>
> *"Not the same thing a bit!" said the Hatter. (Alice in wonderland).*

Abstract What role does understanding play in reading and reasoning? Does the concept of understanding play any role in understanding? Does reading precede understanding as Augustine argued? I examine children's understanding of language in relation to their later acquisition of the verbal concept of understanding. I then apply this framework to the gap between how students "make sense" of what they read and the adult standard for reading comprehension. I do so by reference to the views of Bruner, Smith and especially Seidenberg's (Reading at the speed of sight. Basic Books, New York, 2017) recent analysis of learning to read.

Keywords Understanding · Making sense · Word meanings · Literacy · Reading

For a psychologist to find common ground with the distinguished linguist Dorit Ravid, on a topic important to Education, is one of the pleasures of international scholarship. Dorit Ravid is one of the few distinguished linguists who have examined the importance of writing, not only as record, but also as a structured "discourse style" with linguistic, psycholinguistic and educational implications (Ravid & Tolchinsky, 2002). "Written language takes over as a model for thinking about language in general…[and] learning to write imposes cognitive demands on

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memory, executive functions, and top-down processing" that are not readily met before adolescence (Berman & Ravid, 2009, p. 92). These authors noted, for example, that only high school students discussed conflict in terms of "misunderstandings" rather than as disagreements. To illustrate, an editor interviewing a prospective writer said "Now don't misunderstand me. I said "pretty good" not "very good" (John McPhee, New Yorker, April 19, 2021). Such observations suggest that although understanding is a fundamental human competence, the concept of understanding comes to play an important role in acquiring a higher level of literacy, and, I argue, in the very process of understanding itself. Ravid has also insisted on the importance of linguistic and metalinguistic concepts not only in speaking and writing but also in thinking and reasoning.

We adults commonly say that young children understand language with their first word. For example: When our daughter Joan was little more than a year old, on a whim I said to her "Joanie, go get your shoes". Up to that point she had never spoken a word or given any indication of understanding language, so my request was clearly unrealistic. Yet she looked at me briefly, then wheeled around and disappeared down the hallway. Moments later she returned, shoes in hand, and a smile on her face that expressed a pride matched only by that felt by her astonished father. She had understood what I said! As I shall say, I ascribed understanding to her, and I am quite sure I am right in making such an ascription.

Although we ascribe understanding at an early age, it will be a half-dozen years before children acquire a working concept of understanding expressed by the word "understand" such that they can ascribe understanding to anyone else. We commonly explain this gap by claiming that the concept of understanding is a metalinguistic concept, a part of children's "theory of mind", the ability to talk and think about what others say, think, believe, know and understand (Gopnik & Astington, 1988; Robinson et al., 1983). Understanding is one of the concepts that bridges oral and written language—although, as mentioned, attributing understanding or misunderstanding appears to be one of those skills that continues to develop well into adolescence, which is to say, the later school years. In my recent research I have attempted to sort out, as the title of my redcent book says "*What it means to understand*" (Olson, 2022). Answering that question offers a new way of thinking about what, in psychology, is studied either as metacognition or as a set of complex computational processes under the label of Comprehension and Comprehension Monitoring.

When children learn to talk, they learn to understand what was said; language without understanding is babbling. Similarly, to be a reader is to understand what one is reading; to read without understanding has many possible sources. Yet, children appear to understand many expressions long before they acquire the concept of understanding. Adults, on the other hand, have a relatively clear notion of what it means to understand, and they willingly ascribe understanding to young children. As I prefer to say, young children understand, but they are unable to ascribe understanding to themselves or others. My book is an extended examination of the implications of learning to ascribe understanding. To ascribe or attribute understanding one must have the concept of understanding expressed by the word "understand" or

one of its synonyms. The basic hypothesis of my book is that we may learn something important about understanding by examining how we adults go about ascribing understanding to children, other adults and even to computers. That is, instead of examining understanding as a skill or process or state, I examine, rather, how we adults talk about understanding—a shift of focus from process to concepts—from cognitive psychology to psycholinguistics.

The first task is to set out what we mean by "understanding", that is, the conditions under which we correctly and appropriately ascribe or attribute understanding to ourselves and to others. These conditions serve as the meaning or semantic features of the word "understand". The primary criterion for understanding is "correctness"—one may think one understands when, in fact, one misunderstands. "Thinking that one understands" I refer to as the feeling of understanding, the feeling that something "makes sense" to the listener or reader. The concept of understanding, in contrast, is defined in terms of correctness. To understand is to understand correctly. Thus, the claim that "I understand…" is true or false. The feeling of understanding is largely private and subjective, the concept of understanding assumes truth or correctness.

A second criterion for understanding, I argued, is intersubjectivity. The concept of understanding is applicable to self and other, what something means is not private but shared with others and in this way is both a psychological and a social achievement. Intersubjectivity follows from the fact that a language is a public, socially shared practice. The Mad Hatter was wrong when he claimed that he could use a word to mean anything; it is not just a matter of power. Intersubjectivity or self-other equivalence was first made clear by Wittgenstein (1958) in his argument against a private language of thought. There can be no private language, he claimed, because there is no criterion for judging correctness of a norm, rule, or concept other than agreeing or disagreeing with others about uses of words. Private thoughts or impressions lack such public criteria. In my view, what makes sense to a listener or reader may fail to meet this social criterion.

Equipped with a concept of understanding defined in terms of correctness and intersubjectivity, a person is in a position to judge whether or not someone or something understands. Understanding is simply meeting the criteria mentioned above. Thus, children learning a language meet the criterion of correctness and they share that understanding with the adult. Computer programs that pass the Turing Test may also meet those criteria. Thus, we as adult speakers may ascribe understanding to both young children and computers, even if they meet our two criteria in dramatically different ways.

However, in my book, I examine the fact that understanding is also the competence to ascribe or judge that one has met the criteria for correct understanding. Understanding in this sense is knowing the conditions under which understanding can be correctly ascribed. The view I attempt to defend is that one understands in a special way (to be spelled out) when one can correctly ascribe understanding to oneself, that is, when one knows that the criteria for understanding, namely, correctness and intersubjectivity, have been met. This is a level of understanding that exceeds young children and computers and that continues to develop through the

school years and into adolescence. Thus, the ability to ascribe understanding to oneself and others is, in my view, the paradigm for self-consciousness, an awareness of mind.

Having defined the concept of understanding in terms of correctness, we may return to the question as to the relation between the concept of understanding and the feeling of understanding. The theories of most analytical philosophers, beginning with Locke, and as well as modern psychological theories of comprehension and comprehension monitoring, dismiss feelings as subjective and misleading and exclude them from their account of understanding. That is, there is no place in such a theory for the feeling of understanding, the feeling that something makes sense. However, Joelle Proust (2014) argued that the philosophical picture of mind should be broadened beyond a concern with knowing to include the feeling of knowing. I draw the same distinction between understanding and the feeling of understanding and argue that both have a place in the account of understanding. Proust distinguishes the feeling from the concept in terms of a set of distinguishing features. Concepts, such as the concepts of knowing and understanding, are categorical and allow judgments of true or false. Feelings, on the other hand, are quantitative, evaluable, attuned to action and carry a phenomenal tone or tingle; they are cognitive emotions (Oatley & Jenkins, 1996). Cognitive emotions are affects that are adaptive and attuned to situations but are not categorically true or false. In the normal case of understanding language, one both correctly understands and feels that one understands. However, understanding may be correct even in the absence of the feeling, as is the case with computers. The feeling of understanding is the certainty that what one hears or reads makes sense. Misunderstanding, on the other hand, is not correct, but may still "make sense" to the holder. Hence, I distinguish what most writers take as synonymous, making sense to the listener and understanding correctly. Understanding correctly and justifiably, I argue, is available only to older children and adults who, in possession of the concept, are able to correctly ascribe understanding and misunderstanding to themselves and others. In the book I defend the claim that the possession of the concept is identical to knowledge of the *sense* of the word "understand"; for the moment it is sufficient to point out that the ability to ascribe depends upon knowing the word—ascription is a verbal practice. It is saying something, for which we are accountable to others, about meeting the criteria for the use of the word "understand".

One understands an expression when the conditions for the ascription of understanding—correctness and intersubjectivity—are met. Correctness is met when the expectations—roughly speaking, the beliefs and desires of the subject—are brought into congruence with the linguistic properties of the expression. Sometimes only a word or two are required; in other cases, subtle linguistic properties such as the tense of a verb or the technical meaning of a term are critical. Analysis proceeds until intersubjective agreement has been achieved. The correctness of an interpretation, ultimately, is resolved as any legal or scientific dispute would be resolved, namely, by reason and evidence. In ordinary spoken discourse little analysis is

required, as ordinary discourse is attuned to the needs and interests of the listener and the linguistic resources demanded are minimal.[1]

A half-century of psychological and linguistic research has examined the features that make the understanding of an expression easy or difficult. These features include properties of the expression or text, the context in which it occurs, and the role of prior commitments, beliefs and expectations of the listener–all of which have a bearing on understanding. But in each case, understanding is achieved when the two critical features of understanding—correctness and intersubjectivity—have been met, although these criteria are not explicitly stated in this research. This general claim, however, ignores the fact that young children and computers may be said to understand even if they lack the concept of understanding. A second step must be taken.

The second step in my account of understanding is to focus, not on the achievement of understanding but on who is ascribing understanding. The focus on the ascriber allows me to distinguish the theorist from the subject and hence to explain how we as theorists go about ascribing understanding to young children and computers. Computer programs that pass the Turing Test and those that translate between languages are widely claimed to understand language. It is the theorist who ascribes understanding to young children and computers on the basis of the fact that their response to an expression is both correct and shared with others.

What young children and computer programs cannot yet do is ascribe understanding or misunderstanding to themselves and others. Because theorists have neglected the issue of who is doing the ascribing, the ability to ascribe understanding has also been neglected. Hence, it is widely assumed that the process of understanding is far more important than the ability to ascribe understanding—the latter seen as a metalinguistic, reflective process carried out primarily by the theorist in the attempt to explain understanding.

Psychologists examine the processes of comprehension quite independently of the subject's knowledge of the concept of understanding that would allow those subjects to make the ascription. Of course, it is possible to argue that the ability to ascribe does not matter or at least does not matter as long as one understands. One may understand perfectly well, it may be argued, without the concept. In school, it is the teacher who judges that the student understands; whether the student can make the judgment does not matter, so long as his or her answer is correct in the eyes of the teacher.

However, the ability to ascribe understanding may bring important social as well as cognitive advantages. As mentioned, if disputes can be resolved by saying "you misunderstand" rather than "you are wrong", a discussion of meaning rather than of truth becomes possible, thereby elevating the level of discourse. Interestingly, Plato's account of Socrates' dialogues often began with the question "What do you mean?"

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[1] This is especially true for rhetorical speech which is designed exclusively for believers (Olson, forthcoming).

The more important consequence of the possession of the concept of understanding is on the process of understanding itself. Possession of the concept of understanding permits one to claim that oneself (or another person) understands. Thus, understanding and claiming to understand are importantly different. Claims can be made only with words. Obviously, one can claim to understand only if one knows the word expressing that concept. But in addition to claiming that one understands, one is giving one's word that understanding has occurred, a claim that is either true or false. Claiming that one understands is a judgment that is public and objective, that may be contested, and that may be defended by evidence and reason. Therefore, ascribing understanding is a rational activity that goes beyond simply meeting the two conditions for understanding. Stated another way, understanding is reflective; it is knowing that you understand or that another understands. One not only understands but knows that the criteria of correctness and intersubjectivity have been met, as well as the kinds of evidence that warrant that judgment. Furthermore, it is the possession of the concept that permits self-ascription; it makes understanding an introspectable mental state. Only now does one know what it feels like to understand!

The focus on the concept of understanding allows us to raise the question: Does a person with knowledge of the concept of understanding read and listen more critically than one lacking the concept? I will suggest one way this may be possible. If one knows that the conditions for the correct ascription of understanding including both correctness and intersubjectivity, one may "monitor" their comprehension to see that these conditions are met. Monitoring is a rational process that involves providing linguistic evidence for the correctness or incorrectness of the understanding, a process that requires a degree of linguistic awareness.

Judging the correctness of an interpretation is not always easy. This is especially true with written texts that are designed for and may be read by both believers and skeptics. Some texts, such as those found in academic books, are "unsponsored" in that no clear author is identified. Furthermore, written texts, unlike spoken utterances, make little accommodation to the prior beliefs and desires of any particular reader. Following James and Dewey, I would argue that understanding is the fixation of the beliefs of the reader in response to a text. Accommodating these beliefs to the properties of a text is not a simple matter; it may not be believed, for example. Finally, in reading, unlike oral discourse, there is no immediate way of determining that "agreement" has been achieved. In schools, it is the teacher who, adopting the status of the correct understander, determines whether or not understanding has been achieved. This, of course, is the goal of reading comprehension exercises and reading comprehension tests. In my book I review some of the evidence, admittedly limited, that indicates a change in behavior when children acquire mental concepts such as understanding.

1   Making Sense

The school's single-minded focus on correctness of interpretation of what one is reading runs afoul of the post-modern critique that objects to the notion that texts have a correct interpretation: interpretation depends not only on context and prior knowledge but on the interpretive standards of one's "textual community" (Stock, 1983). The exclusive focus on correctness tends to sideline the reader's partial and sometimes incorrect "feeling of understanding"—the feeling that what one is reading or hearing makes sense to the reader. The feeling of understanding, as mentioned earlier, is no guarantee that one actually and correctly understands. For that reason, the school is not wrong in overriding students' feelings and opinions and in insisting on evidence for correctness and validity of interpretation. However, all that a reader has to go on in the quest for understanding is the feeling that what they are reading makes sense. It is this feeling that allows the reader to go on, to persist in reading even if correct understanding has not been achieved.

The feeling of understanding, like the feeling of knowing, has come in for some attention. Bruner (1990) argued that the cognitive sciences had lost contact with the more basic goal of psychology, namely, the problem of meaning. By meaning, Bruner was referring not to the meanings in the language, that is, the semantic structure of the language, but rather to what language means to the listener or reader, what he called "making sense". What makes sense to a listener or reader, as mentioned, may not meet the standard or criterion for understanding as set by the teacher. Understanding is identified objectively; it is correct or incorrect quite independently of the feeling that what is read or heard makes sense. Clearly, computer programs that pass the Turing Test for understanding do not have the feeling of understanding or the notion that something makes sense. The feeling of understanding is somewhat independent of correctly understanding. It is subjective, quantitative, and evaluative, rather than true or false. Important future research could be done to determine how the feeling that something makes sense relates to correctly understanding. Jan Derry (2013, p. 56) pointed out that followers of Vygotsky and Bruner give priority to "pupils' own conceptions… over any concern to ensure that the pupils are able to distinguish clearly between correct and incorrect [justifiable] knowledge". She suggests that the trend to accept "multiple voices" tends to blur the distinction between subjective and normative understanding. Understanding implies correctness that is to be distinguished from subjective meaning-making.

Bruner's concept of meaning, I suggest, is problematic in that he fails to sufficiently distinguish between meaning as a property of language (what a word means, for example), and what the expression means in the minds of the speakers. Frege (Dummett, 1993), more than a century ago, dissolved the meaning of an expression into two parts: what he called its *sense,* essentially a word definition, and its *reference*, what the word or sentence refers to in a particular context for a speaker or listener. Frege's well-known example is that "Morning Star" and "Evening Star" have distinctive *senses,* but both refer to the same thing, the planet Venus. The *sense* of a word or expression is a uniquely linguistic property defined in relation to other

words. Words and their meanings make up the semantic structure of the language. In contrast, the *reference* of a term is the object or state in one's model of the world, in a word—one's subjective commitments and beliefs. Disagreement is an error of reference. An example of this is when I once called Pluto the Morning Star. Misunderstanding may occur for many reasons, including when one violates the conventional meaning, that is, the *sense* of the term as when one thinks that Venus is a star rather than a planet. Contrary to the Mad Hatter, one cannot mean whatever one wants by a term. Hence, it is the *sense* of the expression that is often critical in distinguishing understanding from misunderstanding. Distinguishing *sense* from *reference* is itself a form of linguistic awareness; hence attributing misunderstanding requires a level of linguistic awareness; it is a quibble about words rather than an argument about things. When a person has access to the concept of understanding, they can ascribe understanding and misunderstanding to themselves or others. They can justify their attribution on the basis of a property of the language, a particular word or grammatical feature. This high standard for the concept of understanding is the difference between having the concept applied to one, as we do to an infant or a computer program, and the child actually doing the ascribing him/herself. I return to the relation between sense-making and understanding in my discussion of Seidenberg's treatment of reading and reading comprehension.

Treating understanding as a linguistic concept provides a new way of thinking about what we are conscious of. We are conscious of understanding only when we possess a concept of understanding. This claim is parasitic on Donald Davidson's (2001) claim that one cannot have a belief without a concept of belief. That is to say, the experience of understanding is available only to one with the concept of understanding. It is the concept that permits self-ascription of understanding. Self-ascription is all that we mean by an awareness of understanding.

One of the goals of my account of understanding is to turn mental processes into linguistic ones, that is, to see understanding as little more than the knowledge and ability to use the word "understanding" correctly. The mental state of understanding is not a mysterious mental or brain state but rather the subjective side of the application of the concept. Again, understanding is to be identified with knowing that one has met the conditions for correct ascription of understanding. Rather than assuming that a mental state of understanding already exists and that one learns a word for it, the reverse may be true. That is, the mental state is the consciousness of the fact that one has met the conditions for correctly ascribing understanding to oneself. One can be in this state only if one has possession of the concept. If so, one cannot experience understanding without the concept of understanding, just as Davidson claimed for belief. Without the concept, it is just a feeling. So too for understanding, one understands only when one has a concept of understanding and the ability to ascribe understanding to self and other.

Familiarity with our own experience of understanding, enhanced by our easy recognition of understanding in young children and other adults, may lead us to assume that young children already know what understanding is. Both psychologists and educators assume that everyone knows what understanding is and that efforts should be directed to improving understanding by focusing on vocabulary

and grammar. On the contrary, it may be argued that children understand expressions but lack knowledge of the concept of understanding; and along with it the ability to correctly ascribe understanding to themselves and others. To possess the concept of understanding is to know the conditions for correct ascription and the evidence that would justify that ascription. Applying the concept to oneself is introspection. Introspection is not a survey of one's interior mental life (as Descartes may have thought), but simply applying to oneself the very concept learned for sharing understanding with others.

Equipped with the concept of understanding, one can introspect one's understanding of any expression by examining whether or not the conditions for correct ascription have been met. This, of course, is what writers do when they revise their writing to ensure, so far as possible, that a reader has the evidence they require to reach agreement with the writer.

To review: To ascribe understanding one must know the meaning and use of the word "understand". Like any new concept, the word calls attention to the salient facts relevant to its application. The primary use of "understanding" is to ascribe understanding or misunderstanding. In particular, one is justified in ascribing misunderstanding only if one has a reason or evidence. Although one may understand an expression without a concept of understanding, so long as it results in agreement, one cannot ascribe understanding without the concept of understanding. Attributing misunderstanding, on the other hand, calls on and brings awareness to the property of language that provides evidence for the judgment. This is what makes the ascription of understanding rational, as it is subject to reason and evidence.

2   Reading Comprehension

Tests of reading comprehension reveal that children often assume that they understand when, by adult standards, they are actually failing to understand. They are poor judges of their own understanding (Prinz et al., 2020). They willingly accept contradictory statements, fail to draw obvious inferences, draw inferences when they are not warranted, and so on. Even well into the school years, a majority of students have difficulty in evaluating arguments presented in a text and in evaluating evidence for their interpretations (National Center for Educational Statistics, 2010). Roughly speaking, it is a difference between reading and reading critically. Can the acquisition of the concept of understanding, implying as it does an awareness of the conditions to be met for correct understanding, help to explain this later achievement?

Empirical studies of comprehension (Kintsch, 1998) and comprehension monitoring (Markman, 1981), like all tests of reading comprehension, assume (more or less implicitly) that understanding can be defined in terms of correctness and intersubjectivity. Tests have an objective standard of correctness, namely, that of the educated community of which the test maker is a member. It is further assumed that with further analysis, intersubjective agreement may be achieved even if, as in the case of a test, no such opportunity is provided during the test. Teaching students to

"monitor" their comprehension by more careful reading is an attempt to gain inter-subjectivity, to bring the reader into a "textual community" shared by teacher and student. However, as noted, a strict focus on correctness may overlook the subjective experience of the reader in his or her attempt to make sense of what they read. The feeling of understanding may add confidence to what is understood. Moreover, making sense provides the motivation for action, allowing one to simply "go on". The feeling may assure one that one is on the right track and allow one to continue, in the hope of reaching understanding eventually. Thus, we need both the feeling of making sense and the achievement of understanding in any account of learning and comprehension.

The upshot is that we have two quite different concepts at play. *Understanding* requires truth or correctness; *making sense* requires only the subjective feeling of certainty that one's understanding is appropriate to one's own goals.

3 Understanding in Reading and Learning to Read

One of the unchallenged assumptions in the psychological study of reading is a firm distinction between reading and understanding. The idea is an old one. Augustine (1958), writing in the fifth century, insisted that reading preceded understanding. He did so to discourage readers from jumping to conclusions as to the meaning of sacred texts. Without this, he claimed, religious interpretations were no better than the "ravings of the astrologers". But one may ask, were readers not understanding what they read all along, at a level of understanding sufficient to allow them to go on? What Augustine was concerned with was correct understanding, not the feeling of understanding involved in reading itself. To do so, he argued one must command the important linguistic concept that distinguishes words from things and literal from metaphorical meaning, the concepts that make up linguistic awareness. The process of understanding, however, may involve the continuous monitoring of understanding as making sense, the plausibility that allows one to go on.

Making sense is the process of assigning meaning to a text by revising and updating one's beliefs on the basis of the available textual and contextual evidence. The process is one of constraint satisfaction, making the best of what is at hand. The goal and the outcome of reading is not only to make sense of what is read, but also to decide that one has met the conditions for correct understanding. This is achieved when the evidence bearing on truth and the intersubjective standards for use are assumed to have been met. Only then can one claim one knows what an expression or text means. This is not to discount personal subjective understanding, but only to distinguish it from socially agreed upon, justifiably correct understanding.

Minimally, this suggests that reading and making sense of what is read are interactive processes rather than sequential ones. In understanding ordinary speech, the listener can count on the speaker attuning the utterance to fit into the listener's framework of beliefs and expectations. This is less the case for written texts, even those designed to teach children, yet the principles are the same, namely, that

reading is not distinct from understanding but rather the attempt to achieve understanding of what one is reading. Making sense is quantitative, subjective, and a pleasant emotion, but, as I argued, is not to be mistaken for valid "understanding". Understanding is the product or outcome of the processes of sense-making.

In the psychological study of reading, understanding is commonly referred to as "comprehension". Comprehension is defined as the achievement of correct understanding, meeting an objective standard set by experts and measured by a test. The subjective experience of "making sense" plays no role in that theory. In advancing what he called the Simple View of Reading (SVO), Gough et al (1996) argued that reading could be considered in two parts, decoding and understanding. He pointed out that even before they learn to read, children know how to understand language; all that remained to be learned was the skill of decoding from print to speech. Decoding was essentially phonics. The distinction between reading and understanding is pervasive in the scientific study of reading. In his recent book *Reading at the speed of sight,* Seidenberg (2017) adopts the notion that phonics precedes understanding, claiming "A child who has gained a basic understanding of the relation between print and sound (i.e. phonics) can get on with the task of learning to read words" (p. 123). He denies that understanding of print could precede learning to decode even if he grants that "The insight that writing could represent speech was an epochal event in human history". Yet he goes on to assert that "we aren't obligated to use that information when we read" (p. 124). I would say that that is the pivotal insight that children must acquire in learning to read. They have to realize that the stream of speech can be analyzed into components that can be represented by written marks (Morais et al., 1987; Homer & Olson, 1999). Consequently, literate people tend to reflect on their language in terms of the properties of the script (Olson, 1994; Davidson, 2001). Once they have learned to recognize a few known words, they are in a position to learn how phonological components are represented by individual letters.

Seidenberg adopts the "dual route" model of reading, namely that in an alphabetic orthography, written signs provide both phonological and morphological information, that is, clues to both sound and meaning. Individual letters represent phonemes, but letter strings represent recognizable morphemes and words. But he then goes on to dismiss the relevance of morphological cues (essential to word recognition) while claiming that phonetic clues are primary. He reviews abundant evidence showing that decoding, learning the relation between graphemes and phonemes, is the knowledge most lacking in beginning and poor readers; and that teachers fail in not teaching those relations. But he pays insufficient attention to how morphological information may inform phonological decoding.

One of the problems is that 'whole-word', that is, morphological reading, is not well understood. Children have no difficulty in learning to read written numerals such as 1, 2, 3, in which each sign represents a morpheme rather than a phoneme. Moreover, Cattell, in the nineteenth century, showed that words are recognized as quickly as individual letters. The victim of a stroke, Howard Engle, lost the ability to recognize words even if he continued to be able to write while unable to read. He could recognize letters but not words! The importance of the distinctive role of

morphological as opposed to phonological features of written words became obvious when reading theory attempted to account for learning to read scripts other than alphabets that have signs that are uniquely morphological, as in written Chinese. Share (2014, p. 3), who has studied a range of writing systems, points out that morpheme distinctiveness and morpheme consistency "are crucial for rapid silent reading". He further points out that teachers do not teach children how to read. Rather, they teach children how to teach themselves by providing information about the systematics of the writing system.

Although Seidenberg acknowledges that there are two routes to word identification, he insists that "the initial hurdle is grasping the alphabetic principle", that is, grapheme-phoneme relations. I would say, it is the second, admittedly the most challenging hurdle, made more difficult by ignoring the prior and simpler way of recognizing a word as an orthographic unit. While he acknowledges that learning letters and their associated sounds is interactive, namely, that learning letters is a route to phonological awareness, he denies that the two routes to word recognition are also interactive. Recognizing that a letter string may represent a word is the first and most important step. The second is recognizing that the letter string indicates the phonemes of the word (Ehri & Wilce, 1980).

I think that Seidenberg's emphasis on decoding follows from Gough's sharp and misleading distinction between decoding and comprehension. The relation is not an if-then temporal or causal relation, but rather a class inclusive relation: Decoding is in the service of word recognition and comprehension. In scanning letter strings, one is looking for recognizable units, known words. Recognizing words is the key to skilled reading, but that in no way discounts the importance of the ability to decode print into sound and to use sound to work out words one does not recognize, as Seidenberg points out. The ability to go from letters to sounds is essential for many words and for all new words, as well as for learning to write and spell. Once one decodes an unfamiliar letter string into a known word, the letter string on a subsequent occasion may be recognized orthographically as a whole word. Morpheme recognition permits rapid reading as Share claimed.

Seidenberg's commitment to phonics leads him to disparage English spellings in which the relation between graphemes and phonemes is one to many rather than one to one. Rather than consider the possibility that many of the most familiar words such as *have* and *some* may have irregular spellings for good reasons (such as encouraging whole word recognition of "closed class" words), Seidenberg sees such irregular spellings as undesirable and confusing to children and. In my view, only children schooled on phonetics independently of its connection to known words find such word spelling confusing. Indeed, people of my generation who were taught by the look-say method have difficulty in seeing such words as irregular! What is missing is a clearer analysis of how making sense interacts with learning to decode.

A cognitive view that takes seriously the premise that experience is processed in terms of the already known would reverse the decoding plus understanding formula. It would insist that children expect that what they encounter in print makes sense and, hence, that attempts at making sense precede and are critical to decoding. In

fact, the general impression of the book is that Seidenberg never grasped the basic principle of the "cognitive revolution", namely, that prior beliefs affect perception, the basic assumption of views Seidenberg rejects.

The primary subject of Seidenberg's critique of theories of reading and learning to read is Frank Smith (1971), the foremost critic of the decoding plus understanding model. Smiths' view, now seen as part of the Whole Language Model, is based on the claim that reading is essentially prediction combined with constraint satisfaction to achieve understanding. The account argues that a reader already possesses a great deal of knowledge about the world, about stories, about language, as well as some knowledge about words and letters. Such prior knowledge functions as a set of expectancies that allow for predictions as to what is likely to come next in the attempt to determine what is meant by an expression or a text. These predictions provide the meanings that are at play in understanding a text. Reading is seen as bringing prior knowledge and expectancies to a text, rather than as decoding words and only then assigning meaning to them. In my view, prediction was sometimes misleadingly described as guessing and reading as a "psycholinguistic guessing game". Guessing implies explicit invention. Rather, in my view, prediction is a set of expectancies in terms of which we interpret what we see or read rather than explicit guesses. One could reasonably ask "Do you know what it says or are you guessing?". These are quite different things.

Smith's view that reading depends on prediction gets a great boost from recent advances in the field of Machine Learning (ML). ML of language is based entirely on the prediction of what is likely to come next, based on what has occurred in the past. Any stimulus is seen in a context provided by prior experience. In ML the prediction principle applies at all levels of linguistic structure including letters, words, sentences, and extended text. Indeed, ML predictions are so powerful that ML not only can "understand" texts to a level that permits translation to another language, it can write texts as well. The predictive principle, as mentioned, is a rather general premise of the cognitive revolution, the claim that any stimulus is perceived in the light of prior knowledge rather than as a "thing in itself". ML would seem to endorse Smith's claims that fluent reading makes little or no appeal to the phonological value of individual letters. As Share pointed out, rapid reading is morpheme recognition.

Seidenberg (2017) claims to have provided important evidence from current research on reading that demonstrates the inadequacy of Smith's theory. In fact, the interesting research he summarizes offers little of relevance to the nature of reading or the nature of understanding beyond showing that knowledge of grapheme-phoneme relations is important and lacking especially in poor readers. But poor readers are not only poor at decoding. They are also poor at prediction, inference, and comprehension in general. Correlations amongst such variables imply that reading ability is a general ability, a fact well captured by the Whole Language movement.

For Smith, reading is making sense, bringing meaning, in the form of expectancies, to a text. Seidenberg quotes Smith as saying that "It has become crystal clear to me– and it has taken about ten years to come to this understanding—that children

learn phonics best after they can already read". I would amend Smith's claim only by adding "at least a few words". That is, letters have meaning only as representations of phonemes, units of spoken words. Yet Smith's claim that they can actually read without any knowledge of grapheme-phoneme relations—as if they were written numerals—although not impossible to imagine, seems to me to be implausible. More defensible, in my view, is the idea that knowing how to recognize a few words provides a good basis for working out how letters serve to represent the sound of a word.

The Cognitive Revolution was the attempt to shift the study of cognition from what was given in a stimulus or text to what the reader brings to a text in the form of expectancies and prior knowledge. Prior knowledge was acknowledged as "top down" in contrast to stimulus driven "bottom up" processes. The prediction theory annuls the distinction; it is prediction all the way down, prior experience determining what can be seen in a word or letter.

Seidenberg correctly insists that letter sound relations, phonetics, is fundamental to reading and he provides ample evidence to show that decoding problems are an important source of reading difficulty for young children. Although he acknowledges that in learning the alphabet one is becoming more aware of the phonological properties of spoken words, he more often treats decoding as simply learning the sounds associated with letters, as if they were the sounds produced by the keys of a piano. In my view, phonics should be seen as learning the relation between the letters and the sounds that are to be found in actual spoken words and sentences. Phonics, that is, should be seen as learning phonological awareness. Learning to read is learning something important about one's own speech. Seidenberg is appropriately alarmed that Ken Goodman (1994), a reading as prediction theorist *par excellence,* actually denies the relevance of sound values of letters altogether calling phonological awareness "narrow and sterile". I agree with Seidenberg that sound-letter relations are fundamental, while at the same time I assert that sounds are heard in relation to meaningful words. The invention of an alphabet, a system of writing that creates signs carrying both semantic and phonological information, was a major invention. To deny children access to the principles of this invention and the ways to make use of the information provided by an alphabet is as misguided as teaching phonics independently of their relation to known words.

Where the prediction theory of reading is somewhat misleading, in my view, is in its somewhat narrow view of the expectancies that even beginning readers bring to their encounters with print. By focusing on the larger structures of the text such as making sense of the story, Smith's prediction theory minimizes and Goodman entirely dismisses the other kinds of expectancies a reader either brings or has to learn, primarily how the letters represent sounds and how letter strings represent known words. As ML systems show, prediction applies to all regular patterns in the linguistic form, prediction as to the next sentence, the next word as well as to the next letter. Knowing the sound associated with a letter allows prediction of the next letter, the next word just as much as does an expectation of what is likely to happen in the story being read.

   A more serious criticism of the prediction theory of reading is its alliance with theorists of sense-making. Specifically, the outcome of reading in the Whole Language movement is identified with what makes sense to the reader, a subjective criterion. Understanding, as I argued earlier, also meets an objective criterion, truth or correctness. These standards of correctness are sometimes to be met only by the reader paying "scrupulous" attention to the very words of a text. Success is monitored by the teacher and may be assessed by an objective test. Only through such objective monitoring can subjective meanings be shown to be limited.

   My amendment of Smith's suggestion that learning phonics is easy when one already recognizes "a few words" gains some support from one traditional way of teaching reading. Phonological awareness was once taught by showing learners how letters work in identifying known meaningful words. The "Horn book" used in teaching reading before printed books became widely available provided a text, one per classroom, protected by a layer of animal horn, of a familiar text such as the Lord's Prayer that children knew by heart. Teaching reading was then a matter of showing the children how the printed words represented the memorized verbal form: "Lord" says "lord"; "L" says /l/ and so on. For the learner, learning this mapping is a discovery; some children had and continue to have particular difficulty in grasping the letter-sound relationship. The primary difficulty here is in phonological awareness not in letter-sound matching. Much easier is learning the relation between the printed word and a spoken word, although this is not to be taken for granted either (Homer & Olson, 1999).

   Phoneme-grapheme relations are essential but only in relation to word recognition. Seidenberg provides some evidence showing that even in reading known words, knowledge of the phonetic values of letters comes into play. I consider such evidence equivocal in that the letter "b" in a word is a clue to the orthographic identity of a word just as much as it is a clue to its phonological identity—just as the dual-route theory of word identification implies. What such studies suggest to me is that even pseudo-homophones evoke an attempt to find a meaningful word. This would imply that knowledge of a word as a unit of meaning is fundamental and inescapable. Seidenberg claims the opposite, namely, that decoding proceeds semantics. Researchers could test this hypothesis: Do children who can sound out a letter string also know if what they have produced is a real word or not a real word? That is, is decoding a non-word simply a matter of forming sounds or is it testing to see if one can arrive at a known word? It is known that good readers can sound out non-words. Do they do this without any appeal to their knowledge of real words? I suspect their primary concern is in determining if they are known words, that is, words with a meaning. If so, phonics is in the service of word recognition. Of course, my conjecture may be false. But if it is true, teaching phonics as simply associating signs with sounds, rather than as visual signs of known words, is misplaced. Can children learn to read by reading Jabberwocky "mome raths outgrabe"? To me, this is not only false, it is foolish. Only after one can read a few words and recognize the possibility of non-words may the experience of encountering Jabberwocky be interesting and educational.

Seidenberg reviews considerable evidence that shows that good readers, as Smith argued, are better predictors. If prediction theory is broadened to include phonological regularities as well as expectancies of meaning, there would be very little difference between the views of Smith and Seidenberg. Both embrace to some degree the principle of prediction based on prior experience. Smith acknowledged that sounding out was an important skill to be used in conjunction with other forms of knowledge such as making sense. But in so doing he may have inadvertently encouraged readers to ignore the value of phonological information.

Regardless of how the relations between decoding and understanding are resolved, Seidenberg raises two further criticisms of Smith and the Whole Language approach. The first is his call to reject the so-called reading wars. He finds it unconscionable that reading theorists would pit structure against meaning as if these excluded each other. I agree. Yet he rejects so-called "balanced" reading programs for claiming that sounds and meaning "aren't independent, they bootstrap each other. [And that] reading is a system of interacting components (p. 267). In fact, Marie Clay's "three cueing systems" approach—semantics, syntactics, grapheme-phoneme relations— to word identification is a plausible alternative to the decoding plus comprehension model endorsed by Seidenberg, who sees these systems as independent and insists that if one, decoding, was mastered first, comprehension and reading difficulties would be averted. It does seem inescapable that an alphabetic writing system provides both morphological and phonological information and to ignore one or to fail to acknowledge their interdependence is inexcusable.

I am far more sympathetic to Seidenberg's criticism of what he sees as a general bias in educational as opposed to psychological research of the sort he defends. Educational theories, he claims are often based on subjective judgments, personal experience, and anecdotal evidence. Science demands a degree of objectivity. He writes: "The educational worldview takes subjectivity as an existential condition" (p. 261). He traces the emphasis on subjectivity to theorists such as Vygotsky and Bruner and to "a constructivist philosophy… It is discovery learning and social construction of knowledge par excellence" (p. 299). When applied to reading and learning to read, that "subjectivist" and "relativist" view would seem to delegitimize both systematic instruction and with it—objective methods of assessment.

I take Seidenberg to have raised an important point. Educators are indeed concerned with the subjective experiences of the learner in a way that experimental psychology and objective testing does not. One of the guiding principles of teaching is that the situation or the text should make sense to the child. Yet, as I have argued, making sense, although important, is an inadequate criterion. Understanding must also meet an objective standard of correctness. If so, how are the subjective and the objective to be reconciled?

In my view, understanding, like knowing, must meet a socially shared standard of correctness. For knowing, the standard involved allows the distinction between true and false; for understanding, the standard allows the distinction between understanding and misunderstanding. One understands only when one achieves a level of

correctness.[2] In education, adopting notions of sense making, meaning making, or social discourse, while instrumental to learning, may not adequately meet the standard of objective correctness. Educators who fail to set and monitor that standard, or who fail to teach the children what that standard is as well as how to meet that standard, are failing to meet their responsibilities as educators. As mentioned, Derry is eloquent on this point.

On the other hand, educators who merely monitor the standard of correctness and ignore the learner's own subjective feelings of understanding lose access to a major motivation for reading and for learning. Furthermore, when out of range of the teacher, that feeling of understanding is all that a reader has to go on for evaluating whether or not they understand. Empirical psychologists have yet to invent devices for measuring that feeling or determining its relevance to further learning.

There is a long running conflict between imposing objective standards on learners and allowing students to rely on their own intuitions and judgments. The classical view was that experts "knew" and were in a position to judge and reject—when necessary—students' own judgments. The Dewey revolution, greatly elaborated by Piaget, Vygotsky and Bruner, was to recognize that learners were not passive but rather actively involved in learning and thinking. Educators succeeded, it was claimed, only when they learned to take advantage of the interests and thoughts of the learners.

Critics of Dewey, like modern critics such as Seidenberg, point out the limitations of the learner's judgments. There is abundant evidence that children will often think they understand a text, for example, yet be unable to reject false paraphrases or fail to see necessary implications. In my view, understanding has to meet two criteria: one is correctness in terms of available evidence, the second, intersubjectivity, namely that the understanding would be shared by others. An understanding that meets these criteria would go beyond subjective sense making, the feeling of understanding. Educators both model this standard and have responsibility for helping learners recognize when they have met that standard. The pervasive reliance on making sense as well as familiar attacks on objective assessment undermine the goal of teaching children to correctly understand what they read. Sense making is fundamental to both learning to read and to achieving understanding; it is a necessary but not sufficient condition. Conversely, the fact that these are developmental achievements hides the extent to which such developments are the result of explicit teaching.

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[2] Needless to say, correctness is not absolute. Rather it is a standard that readers would agree is justified by the available evidence.

4   Conclusion

Understanding language allows the formation of consciously held knowledge. Acquiring the concept of understanding raises anew the centrality of meaning. One important step is taken when we recognize that understanding is a concept that allows the ascription of understanding to oneself and others. Acquiring the concept is therefore a milestone in human development. Just as "What do you mean?" was an important part of Socrates educational program, so "Do you understand?" is an important part of our own.

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