of the data, a ranking such that the best theory is the correct one (cf. Glüer 2006, 342). This amounts to a form of semantic holism; the principle of charity determines all the meanings of the expressions of *L* together, and on the basis of the totality of the evidence (cf. Pagin 1997, 13, 18). **INDETERMINACY,** then, is the claim that there can be more than one "best" T-theory for any given natural language *L*.

Davidson provides what he calls a "crude outline" ([1973] 1984, 136) for the process of devising a T-theory on the basis of data about holding true attitudes. It has three steps: First, the **LOGICAL FORM** of the sentences of *L* is determined. Use of a T-theory as a formal semantic theory requires paraphrasing the expressions of L in the language of first-order quantified **LOGIC** (plus identity). The relevant evidence for this first step consists of sentences that are held true (or false) under all circumstances (candidates for logical truth or falsity) and of patterns of inference, that is, sentences held true on the basis of other sentences held true.

The second step focuses mainly on sentences containing **INDEXICALS**, expressions whose interpretation depends on features of the context, such as "I" or "here." Take the sentence "It is raining" or its German equivalent *Es regnet*. Their truth value varies with easily observable circumstances in the environment of the speaker. The idea (according to Davidson [1973] 1984, 135) is to take data of the form

(E) Kurt belongs to the German speech community and Kurt holds true *Es regnet* on Saturday at noon and it is raining near Kurt on Saturday at noon as evidence for a T-sentence of the form

(R) *Es regnet* is true-in-German when spoken by *x* at time *t* if and only if it is raining near *x* at *t*.

Together, these two steps significantly limit the possibilities for interpreting the predicates of *L*. The third step deals with the remaining sentences of *L*.

### Questions and Criticism

Over the years, there has been extensive discussion of radical interpretation and the underlying Davidsonian philosophy of language. Davidson's views on meaning determination have been criticized as verificationist (see also VERIFIABILITY CRITERION) or idealist, charges he was keen on refuting. His semantic individualism and holism have been issues of debate. With respect to the principle of charity, such questions as whether it overrationalizes empirical speakers or illegitimately imposes our logic on alien speakers have been raised. The most important philosophical issues here concern the epistemic and metaphysical status of the principle, and the questions of whether and how it can be justified. Whether radical interpretation is possible, what kind of argument is required for its possibility, and the precise role it plays in Davidson's philosophy of language, as well as its wider significance, are topics on which there is no general consensus among the commentators. Today, many philosophers of mind and language are of the opinion that the basic semantic behaviorism characterizing both Davidson's and Quine's philosophy of language has been superseded by the (social and physical) **MEANING EXTERNALIM** currently dominating the theory of meaning and content. However, foundational issues such as these remain insufficiently explored; because of the role the shared environment plays in radical interpretation, Davidson thought of himself as a social and physical externalist, though clearly not of the mainstream kind (cf. 2001). So long as a systematic comparison of these competing accounts of meaning determination is lacking, it remains premature to simply write off semantic behaviorism; prima facie, it is not even clear that Davidsonian semantic behaviorism and mainstream (physical) externalism are incompatible.

– Kathrin Glüer

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## READING

Reading is the process of decoding and comprehending written language. Decoding, the conversion of written forms into linguistic messages, is central to this definition to the extent that the comprehension of written language shares its features with the comprehension of spoken language.

Reading connects printed information conveyed in a **WRITING SYSTEM** with the reader's knowledge of the language encoded by that system. Writing systems vary in their mapping principles, in their implementation in a particular language (the orthography), and in their visual appearance (the script). Alphabetic writing systems map graphic units to **PHONEMES**. Syllabary systems,

represented by Japanese Kana, map graphic units to spoken language syllables. Chinese is usually classified as logographic because its graphic units (characters) correspond primarily to **MORPHEMES**. However, the fact that characters have components that provide syllable-level pronunciation information justifies an alternative designation of morpho-syllabic (DeFrancis 1989).

## Written Word Identification

Visual processing of a letter string results in the activation of the *grapheme units* (individual and multiple letters) of words. In representational (or symbolic) models of reading, words are represented in the reader's mental *lexicon*. Successful word reading is a match between the graphic input and the corresponding word representation. *Phonological units* are also activated and play an important role in securing identification.

In *dual route models* of reading, identification occurs along two pathways, a direct route to the word identity and an indirect route through phonological units (Coltheart et al. 1993). The direct pathway must be used for "exception words" (e.g., *iron)* for which an indirect phonological route would fail and may also function for any word that becomes highly familiar. The phonological route must be used to read pseudowords (e.g., *nufe*) for which there is no lexical representation and may be used for words with regular grapheme-to-phoneme patterns. Single-route **CONNECTIONIST MODELS** simulate these two pathways with a single mechanism that learns how to read letter strings on the basis of experience (Plaut et al. 1996). Alternative models use dynamic resonance mechanisms to capture interactions between existing states and new inputs (Van Orden and Goldinger 1994). In a resonance model, the patterns of graphic-phonological activation stabilize more rapidly than do patterns of graphic-**SEMANTIC** activation, simulating a word-identification process that brings rapid convergence of orthography and phonology, with meaning slower to exert an influence.

In studies of nonalphabetic reading, research has overturned the idea that reading Chinese involves only meaning and not phonology (Perfetti, Liu, and Tan 2005). Even when single-character words are read silently for meaning, the pronunciation of the character appears to be activated. This role of phonology, where the writing system does not require it, may reflect a universal phonological principle (see PHONOLOGY, UNIVERSALS OF*)* that is grounded in spoken language. Nevertheless, **NEUROIMAGING** studies of the brain's implementation of word reading show differences as well as similarities between alphabetic and nonalphabetic reading (Siok et al. 2004; see also WRITING AND READING, NEUROBIOLOGY OF). It is interesting to note that English-speaking adults learning to read Chinese show brain activation patterns that partly overlap those shown by native Chinese speakers, suggesting that properties of the writing system recruit specific brain areas (Perfetti et al. 2007).

Individuals with word-identification problems are said to have a specific reading disability, or **DYSLEXIA,** provided they also show a discrepancy between reading and achievements in other domains. However, the processes that go wrong in a specific disability may not be much different from those that go wrong for an individual who also has a problem in some other area (Stanovich and Siegel 1994).

Dual route models allow two different sources of word-reading difficulties: Either the direct route or the indirect phonological route can be impaired (Coltheart et al. 1993). Surface dyslexics have trouble with exception words, explained as selective damage to the direct route. Phonological dyslexics have trouble with regular words and pseudowords, explained by selective damage to the indirect phonological route. A different view from single mechanism models is that only phonological dyslexia is the result of a processing defect. Surface, or orthographic, dyslexia is a delay in the acquisition of word-specific knowledge (Harm and Seidenberg 1999), which comes through experience.

## Reading Comprehension

Reading comprehension shares linguistic and cognitive processes with spoken language and correlates highly with it among adults (Gernsbacher 1990). Because this correlation is based on the use of equivalent texts across listening and reading, it may miss the differences between ordinary spoken language and typical written texts that arise from their divergent syntactic structures, lexicons, and other aspect of their different registers. While reading comprehension strongly depends on listening comprehension, reading and speech each place specific demands on comprehension processes**.**

Reading comprehension processes begin with word identification and include context-relevant selection of **WORD MEANINGS** and parsing (see PARSING [HUMAN]), the basic process of extracting grammatical relations among words in a **SENTENCE**. Beyond these word- and sentence-level basics, higher-level comprehension involves readers' constructions of **MENTAL MODELS** of text information. One mental model is based closely on the language of the text, and another, the situation model, reflects what the text is about (van Dijk and Kintsch 1983). The reader builds a situation model from the linguistically based model (the text base) by combining knowledge sources through additional inference processes. A situation model may contain nonlinguistic representations, including spatial imagery (Glenberg, Kruley, and Langston 1994) and the temporal organization of events (Zwaan 1996), among others. Reading multiple texts that refer to the same situation challenges the construction of a single situation model (Perfetti, Rouet, and Britt 1999) and requires additional comprehension skills in document use and evaluation (Rouet 2006).

Because texts are never fully explicit, comprehension research has had an enduring interest in inferences. Inferences that link **ANAPHORA** (e.g., pronouns) with their antecedents to establish coreference are a routine part of comprehension. The extent of elaborative and predictive inferences (Graesser, Singer, and Trabasso 1994) is more in doubt (McKoon and Ratcliff 1992). For example, the sentence "The American tour group went to London for its annual holiday" may evoke an inference that the group traveled by airplane, but whether a reader actually makes this inference appears to be highly variable. Inferences about cause–effect relations may be more likely than other kinds of elaborative inferences (Trabasso and Suh 1993).

Comprehension skill is highly variable. Some children appear to have a comprehension-specific problem (i.e., without

a decoding problem) that is general across reading and spoken language (Nation and Snowling 1999; see also DISORDERS OF READING AND WRITING). The potential causes for comprehension problems include failures to make inferences during reading (Oakhill and Garnham 1988) and limitations in **WORKING MEMORY** functions, among other factors (Nation 2005). Unstable knowledge of word form and meaning (low *lexical quality*) also contributes substantially to comprehension problems (Perfetti and Hart 2001).

## Learning to Read

In an alphabetic writing system, a child learns that letters and strings of letters correspond to speech segments. For English, this process is complicated by inconsistent orthography at the letter-phoneme level, for example, the contrasts between *choir* and *chore* and *head* and *bead*. Most European languages tend to be coded by orthographies that more consistently map graphemes to phonemes, and learning to read reflects this fact; for example, children's errors reflect letter-to-phoneme decoding procedures more than in English (Wimmer and Goswami 1994; see also CHILDREN'S GRAMMATICAL ERRORS).

Important for the alphabetic principle is phonemic awareness (see PHONOLOGICAL AWARENESS), the explicit understanding that the speech stream can be segmented into a set of meaningless units (phonemes). Children's phonemic awareness correlates with early reading success, and phoneme segmentation instruction produces gains in reading. However, alphabetic **LITERACY** experience itself affects awareness of phonemes, as shown by studies of adults without exposure to alphabetic writing (Morais et al. 1979) and of Chinese who learned to read prior to the introduction of the alphabetic Pinyin system (Read et al. 1986) as well as by longitudinal results that show a bidirectional relation between phonological sensitivity and literacy (Perfetti 1992).

Theories of learning to read have usually referred to a series of stages (Ehri 1991, 2005; Frith 1985; Gough and Hillinger 1980). Alternative theoretical accounts emphasize the incremental acquisition of decodable lexical representations and the role of phonology to establish word-specific orthographic representations (Perfetti 1992; Share 1995; see also WRITING AND READING, ACQUISITION OF).

– Charles Perfetti

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## REALIZATION STRUCTURE

This term was coined by Keith Oatley (2002) to indicate how one experiences a piece of literature. One does not just receive or interpret it but realizes it, bringing it into being. The idea that fiction involves such a realization or mental performance of the piece by the reader or audience member was discussed in philosophy by Wolfgang Iser (1974) and in psychology by Richard J. Gerrig (1993). Russian Formalists proposed that a literary work has aspects of *fabula* and *siuzhet*, often translated as "story" and "plot." The *fabula* is a story structure: time-ordered events in the story world. William Brewer and Ed Lichtenstein (1981) suggested that the *siuzhet* may best be called the *discourse structure*: the ordered set of **SPEECH-ACTS** of the writer to the general reader or listener to prompt the story mentally into being. Oatley suggested that two further aspects are necessary: One is the **SUGGESTION STRUCTURE**, the associations set off by the story idiosyncratically in individuals. The other is the realization structure, the complete mental performance as realized in the mind of the reader or audience member. The matter was well put by Virginia Woolf (1957, 174):

> Jane Austen is thus a mistress of much deeper emotion than appears upon the surface. She stimulates us to supply what is not there. What she offers is, apparently, a trifle, yet is composed of something that expands in the reader's mind and endows with the most enduring form of life scenes which are outwardly trivial.

The relationship among the four aspects of a piece of literary prose or poetry can be illustrated by the diagram in Figure 1 (from Oatley 2002, 45). The implication of the layout of the diagram is that the *event structure* starts off a story, usually by means of a setting, that the discourse structure and suggestion structure occur simultaneously, and that the realization structure is a resultant of the other processes.

– Keith Oatley

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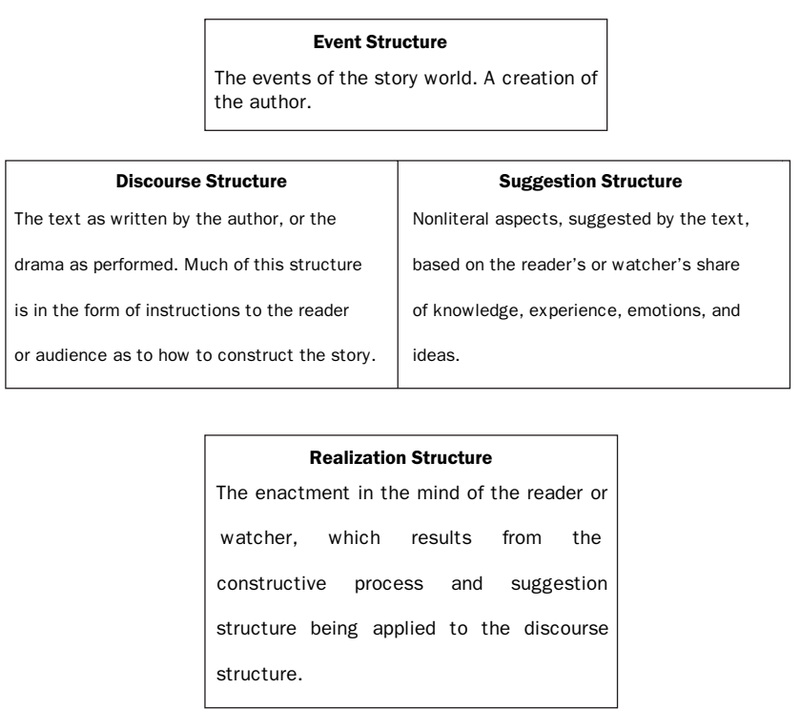


**Figure 1.**