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Semantics

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SEMANTICS is the study of MEANING¹. It is not surprising that "semantics" can "mean" different things to different researchers within cognitive science. Notions relating to meaning have had long (and often contentious) histories within the disciplines that contribute to cognitive science, and there have been very diverse views concerning what questions are important, and for what purposes, and how they should be approached. And there are some deep foundational and methodological differences within and across disciplines that affect approaches to semantics. These have partly impeded but also stimulated cooperative discussion and fruitful cross-fertilization of ideas, and there has been great substantive progress in semantics, in the sister field of PRAGMATICS, and at the SYNTAX-SEMANTICS INTERFACE in recent decades.

The logico-philosophical tradition divides semiotics (the study of signs, applicable to both natural and constructed languages) into syntax, semantics, and pragmatics (Morris 1938). On this view, SYNTAX concerns properties of expressions, such as well-formedness; semantics concerns relations between expressions and what they are "about" (typically "the world" or some model), such as reference; and pragmatics concerns relations between expressions and their uses in context, such as IMPLICATURE. Some approaches reject the characterization of semantics as dealing with relations between language and something external to language, especially between language and "the world" (see (1) and (2) below). And many approaches have challenged, in different ways, the autonomy of semantics from pragmatics implied by the traditional trichotomy. We return to some of these foundational issues below.

One of the basic issues that any theory of semantics must deal with is how we can understand the meanings of novel sentences. Syntax describes the recursive part-whole structure of sentences; semantics must account for how the meanings of smaller parts are combined to form the meanings of larger wholes (see COMPOSITIONALITY, LOGICAL FORM). There are many controversial issues surrounding the Principle of Compositionality, which contains several crucially theory-dependent terms: *The meaning of an expression is a function of the meanings of its parts and of how they are syntactically combined*. But most explicit semantic theories, especially formal semantics, accept it as a basic working principle. The extension of compositional semantics beyond the level of the sentence, to the interpretation of DISCOURSE, has been of increasing importance.

¹ [Note: Capitalized expressions, like 'MEANING', signal cross-reference to other entries in the encyclopedia.]

Another basic issue for semantic theory is the nature of the meanings of the smallest meaningful units of language, words or morphemes (or even smaller units if some morphemes are viewed as decomposable into submorphemic “features”.) Lexical semantics has an even longer history than compositional semantics, and is connected with the most fundamental problems in the philosophy of language and the psychology of concepts (see SENSE AND REFERENCE, THEORIES OF REFERENCE, CONCEPTS, LEXICON).

Crucial *interfaces* include the syntax-semantics interface and the interfaces of semantics with pragmatics, with encyclopedic and common-sense knowledge, and perhaps directly with PHONOLOGY (e.g. with respect to the semantic/pragmatic interpretation of PROSODY AND INTONATION.) Other important areas of research concern acquisition (see ACQUISITION OF SEMANTICS, ACQUISITION OF WORD MEANING), human semantic processing, and computational semantics.

Among the most important semantic properties of linguistic expressions that need to be accounted for, most semanticists would include the following:

AMBIGUITY: having more than one meaning. Strongly compositional theories require all semantic ambiguity to reflect either *lexical* or *structural* (syntactic) ambiguity.

VAGUENESS: a challenge for some theories of the nature of word meanings as well as to classical theories of concepts. (See also PROTOTYPES.) Drawing the distinction between ambiguity and vagueness is a classic problem (Quine 1960, Zwicky and Sadock 1975.)

Anomaly: Some expressions, like the famous *Colorless green ideas sleep furiously* (Chomsky 1957), are judged to be *semantically anomalous* although syntactically well-formed. The lines between semantic and other sorts of anomaly are crucially theory-dependent and often debated.

Entailment: Sentence A *entails* sentence B if sentence B is true in every possible state of affairs in which sentence A is true. Entailment has always been a central semantic concern in logic and the philosophy of language, and remains so in POSSIBLE WORLDS SEMANTICS. Cognitive semanticists replace concern with logical entailment by concern with human inference; formal semanticists see the relation of entailment to actual human inference as indirect. But most semanticists are concerned with some notion of entailment or inference, and many agree about the importance of revising (incrementally or radically) the formal logics invented by logicians to model the "natural logic(s)" implicit in the semantics of natural languages.

PRESUPPOSITION: a precondition for the felicity or truth-valuedness of an expression in a context. Presupposition research has been important in theorizing about the relation between (or possible integration of) semantics and pragmatics.

Context: Expressions are interpreted in the (linguistic) context of other expressions, and in the (non-linguistic) context of an utterance situation in which the participants have various beliefs and intentions. Any approach to semantics has to take a stand on the relation of "semantics proper" to various aspects of context, including the treatment of INDEXICALS AND DEMONSTRATIVES (Kaplan 1979). One important trend in formal semantics has been the shift from "meanings as truth conditions" to "meanings as functions from contexts to contexts" (with truth conditions as a corollary; Heim 1982); see CONTEXT AND POINT OF VIEW, SITUATEDNESS/EMBEDDEDNESS, DYNAMIC SEMANTICS.

Referential opacity: The construction exemplified in "Jones is seeking ____" is *referentially opaque*, since the substitution of one coreferential expression for another in that context does not always preserve the truth-value of the whole. It may be true that Jones is seeking the president and false that Jones is seeking Mary's father even though the president is Mary's father. Frege's distinction between SENSE AND REFERENCE, Carnap's distinction between intension and extension, and Montague's intensional logic all treat the phenomenon of referential opacity, pervasive in PROPOSITIONAL ATTITUDE constructions.

Other issues important to semantics include ANAPHORA, negation and QUANTIFIERS, TENSE AND ASPECT and modality; other issues important for semantics and pragmatics together include topic-FOCUS structure and the interpretation of questions, imperatives, and other speech acts.

Many foundational issues of semantics are relevant to cognitive science; some are particularly linguistic, others overlap heavily with issues in the PHILOSOPHY OF LANGUAGE and PHILOSOPHY OF MIND. We mention a few central issues that divide different approaches to semantics; see also MEANING.

(1) The non-psychologistic tradition of "objective" (though abstract) meanings (Frege 1892, Tarski 1944, Carnap 1956, Montague 1973) vs. the psychologistic view of meanings "in the head" (Fodor 1975, Lakoff 1987, Jackendoff 1983, and all psychologists). Do expressions refer to objects or to concepts? Is semantics a branch of mathematics, or is it (as on the Chomskyan view of all of linguistics) a branch of psychology? Classical formal semanticists, who take the first disjunct in these choices, distinguish semantics from knowledge of semantics (Lewis 1975, Cresswell 1978), making semantic competence interestingly different from syntactic competence. Jackendoff (1996), following Chomsky (1986) on "I-language" and "E-language", distinguishes "I-semantics" (internalized semantics, semantic competence) from "E-semantics" (an abstract relation external to language users), and characterizes his own Conceptual Semantics as well as COGNITIVE LINGUISTICS (Lakoff 1987) as studying the former while formal semantics studies the latter. Many today seek an integration of these two perspectives by studying mind-internal intuitions of mind-external relations such as reference and truth-conditions. See Putnam (1975) for an influential philosophical perspective.

(2) Model-theoretic vs. representational approaches. Many linguists think of semantics in terms of a "level of representation" of expressions analogous to a syntactic or phonological level.

Psychologists generally think of semantics as relating expressions to concepts, regarding concepts as something like elements of a LANGUAGE OF THOUGHT. In AI, semantic interpretation is sometimes expressed in a language of KNOWLEDGE REPRESENTATION. A representational view of semantics is quite congenial to the popular COMPUTATIONAL THEORY OF MIND (Jackendoff 1983). The contrasting model-theoretic view sees semantic interpretation relating expressions to elements of models (possibly MENTAL MODELS) defined in terms of constituents such as possible situations, entities, properties, truth-values, etc. Intensional objects may be modelled, for instance, as functions from possible worlds or situations to extensions (see POSSIBLE WORLDS semantics.) The question of the mental representation of such model-theoretic constructs is open (see Johnson-Laird 1983); the inclusion of Marrian "2 1/2 -D sketches" in Conceptual Structure in Jackendoff (1995) suggests the possibility of mixed approaches.

(3) The issue of "Natural Language Metaphysics" (Bach 1986) or the "naive picture of the world" (Apresjan 1974) and its role in semantics. What presuppositions concerning the constitution and structure of the world as humans conceive it are built into human languages, and how, and which are universal (see LINGUISTIC RELATIVITY HYPOTHESIS, NAIVE PHYSICS, FOLK BIOLOGY)? These questions may concern both semantic structure and semantic content, from the semantic difference between nouns and verbs to the content of color terms. Their investigation may challenge the lines between semantic knowledge and common-sense, encyclopedic, or other kinds of knowledge. Formal semantics, following the logical tradition, has employed relatively "austere" model structures; recent investigations, particularly into lexical semantics, tend to invite richer models.

(4) The Semantic Atomism question: Are all meanings decomposable into combinations of "semantic atoms", "semantic primitives", or "atomic concepts" drawn from some fixed, universal, and presumably innate set? The affirmative view goes back at least to Leibniz (Kretzmann 1967), and is popular in cognitive science in spite of little progress on identification of a suitable set of primitives (see Wierzbicka's work (e.g. Wierzbicka 1985) for the most sustained attempt.) A "yes" answer implies that lexical semantics will take the form of semantic decomposition; a "no" answer is compatible with various approaches to word meaning including the use of meaning postulates or a FUNCTIONAL ROLE SEMANTICS approach to word meaning.

(5) The relation between meaning and use. The distinction between "sentence meaning", the literal meaning of a sentence abstracted away from any particular context, and "speaker's meaning", the intended interpretation of a particular utterance of a given sentence, presupposes a boundary between semantics and pragmatics, sometimes disputed. One traditionally influential approach (Austin 1962) is based on the identification of meaning and use.

See also ANALYTIC/SYNTHETIC, NARROW CONTENT, INTENTIONALITY, METAPHOR, LANGUAGE AND THOUGHT, INDETERMINACY OF INTERPRETATION.

References [**...** signals *italics*]

- Apresjan, Ju. D., 1974, **Leksicheskaia Semantika**. Moscow: Nauka. English translation, 1992, **Lexical Semantics**. Ann Arbor, MI: Karoma.
- Austin, J.L., 1962, **How to Do Things with Words**. London: Oxford University Press.
- Bach, E., 1986a, 'Natural language metaphysics.' In **Logic, Methodology and Philosophy of Science** VII Barcan Marcus et al., eds. Elsevier Publ., 573-595.
- Carnap, R., 1956, **Meaning and necessity**. 2d. edition with supplements. Chicago: Chicago University Press.
- Chomsky, N., 1957, **Syntactic Structures**. The Hague: Mouton.
- Chomsky, N., 1986, **Knowledge of Language: Its Nature, Origin, and Use**. New York: Praeger Publishers.
- Cresswell, M. J., 1978, 'Semantic competence', In **Meaning and Translation: Philosophical and Linguistic Approaches**, M. Guenther-Reutter and F. Guenther, eds. London: Duckworth.
- Fodor, J. A., 1975, **The Language of Thought**. New York: Thomas Y. Crowell.
- Frege, G., 1892, 'Ueber Sinn und Bedeutung', **Zeitschrift fuer Philosophie und philosophische Kritik** 100, 25-50. Translated as 'On sense and reference.' In **Translations from the Philosophical Writings of Gottlob Frege**, P. T. Geach and M.Black, eds. Oxford: Blackwell 1952, pp. 56-78.
- Heim, I., 1982, **The Semantics of Definite and Indefinite NP's**, Ph.D. dissertation, UMass, Amherst: GLSA, UMass.
- Jackendoff, R., 1983, **Semantics and Cognition**. MIT Press, Cambridge, MA.
- Jackendoff, R., 1995, **Semantic Structures**. Cambridge, MA: MIT Press.
- Jackendoff, R., 1996, 'Semantics and cognition.' In **The Handbook of Contemporary Semantic Theory**, S. Lappin, ed. Oxford: Blackwell Publishers, pp. 539-559.
- Johnson-Laird, P. N., 1983, **Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness**, Cambridge: Harvard University Press.
- Kaplan, D., 1977, 'The Logic of Demonstratives.' **Journal of Philosophical Logic** 8, 81-98.
- Kretzmann, N., 1967, 'Semantics, History of.' In **The Encyclopedia of Philosophy**, P. Edwards, editor in chief, Vol.7. New York: Macmillan Publishing Co., pp.358-406.
- Lakoff, G., 1987, **Women, Fire, and Dangerous Things**. Chicago: University of Chicago Press.
- Lewis, D., 1975, 'Languages and Language.' In **Language, Mind and Knowledge**, K. Gunderson, ed. Minneapolis: University of Minnesota Press, pp.3-35.
- Montague, R. 1973, 'The Proper Treatment of Quantification in Ordinary English,' In **Approaches to Natural Language**, K. J. J. Hintikka, J. M. E. Moravcsik, and P. Suppes, eds., Reidel, Dordrecht, 221-242, reprinted in Montague, R., 1974, **Formal Philosophy: Selected Papers of Richard Montague**, edited and with an introduction by R. Thomason, New Haven: Yale Univ. Press. pp. 247-270.
- Morris, C. W., 1938, 'Foundation of the theory of signs.' In **International Encyclopaedia of Unified Science** 1, No. 2, O. Neurath, R. Carnap, C. Morris, eds. Chicago: University of Chicago Press, pp. 1-59.
- Putnam, H., 1975, 'The Meaning of Meaning.' In **Language, Mind and Knowledge. Minnesota Studies in the Philosophy of Science**, K. Gunderson, ed. Minneapolis: University of Minnesota Press, pp. 131-193. Reprinted in Putnam, H., 1975, **Mind, Language and Reality**. Philosophical Papers, Vol. 2. Cambridge, MA: MIT Press, pp. 215-271.
- Quine, W.V.O., 1960, **Word and Object**. Cambridge, MA: MIT Press.
- Tarski, A., 1944, 'The Semantic Conception of Truth And the Foundations of Semantics.' **Philosophy and Phenomenological Research** 4: 341-375.
- Wierzbicka, A., 1985, **Lexicography and Conceptual Analysis**. Ann Arbor, MI: Karoma.
- Zwicky, Arnold M., and Jerrold M. Sadock. 1975. Ambiguity tests and how to fail them. In *Syntax and Semantics, Vol. IV*, ed. J. Kimball, 1-36. New York: Academic Press.

Further Readings

- Bach, E., 1989, **Informal Lectures on Formal Semantics**, Albany: State University of New York Press.
- Van Benthem, J. and A. ter Meulen, eds. 1997, **Handbook of Logic and Language**, Amsterdam: Elsevier.
- Chierchia, G. and S. McConnell-Ginet, 1990, **Meaning and Grammar: An Introduction to Semantics**. Cambridge, MA: MIT Press.
- Davidson, D., 1970, 'Semantics for Natural Languages.' In **Linguaggi nella Societa e nella Tecnica**, B. Visentini et al, eds. Milan: Edizioni di Comunita.
- Dowty, D., 1979, **Word Meaning and Montague Grammar**, Dordrecht:Reidel.
- Dowty, D., R. Wall and S. Peters, 1981, **Introduction to Montague Semantics**, Dordrecht: Reidel.
- Fillmore, C.J., 1982, 'Frame semantics.' In **Linguistics in the Morning Calm**, The Linguistic Society of Korea (ed.), Seoul: Hanshin Pub. Co., pp.111-137.
- Fodor, J. A. 1987, **Psychosemantics: The Problem of Meaning in the Philosophy of Mind**. Cambridge, Mass.: Bradford Books, MIT Press.
- Gamut, L. T. F., 1991, **Logic, Language, and Meaning. Vol II: Intensional Logic and Logical Grammar.** University of Chicago Press, Chicago and London.
- Heim, I. and A. Kratzer, 1997, **Semantics in Generative Grammar**. Oxford: Blackwell.
- Kamp, H., 1981, 'A Theory of Truth and Semantic Representation.' In **Formal Methods in the Study of Language: Proceedings of the Third Amsterdam Colloquium**, J. Groenendijk, T. Janssen and M. Stokhof, eds. Mathematical Centre Tracts. Amsterdam; reprinted in **Truth, Interpretation and Information**, J. Groenendijk, T. M. V. Janssen and M. Stokhof, eds. 1984, GRASS 2. Dordrecht:Foris.
- Katz, J. J., 1981, **Language and Other Abstract Objects**. Totowa, NJ: Rowman and Littlefield.
- Lappin, S., ed. 1996, **The Handbook of Contemporary Semantic Theory**. Oxford: Blackwell Publishers.
- Larson, R. and G. Segal, 1995, **Knowledge of Meaning: An Introduction to Semantic Theory**. Cambridge, MA: MIT Press.
- Lewis, D., 1970, 'General semantics' **Synthese** 22: 18-67; reprinted in D. Davidson and G. Harman, eds. **Semantics of Natural Language**. Dordrecht: Reidel 1972, 169-218.
- Lyons, J., 1988, **Principles of Linguistic Semantics**. Cambridge: Cambridge University Press. Martinich, A. P., ed. 19xx, **The Philosophy of Language**, nth edition. Oxford: Oxford University Press.
- Partee, B. 1979, 'Semantics - Mathematics or Psychology?' In **Semantics from Different Points of View**, R. Bauerle, U. Egli, and A. von Stechow, eds. Berlin: Springer-Verlag, pp. 1-14.
- Partee, B., 1995, 'Lexical semantics and compositionality.' In **Invitation to Cognitive Science**, 2nd edition. D. Osherson, general editor; in **Part I: Language**, L. Gleitman and M. Liberman, eds. Cambridge, MA: MIT Press, pp. 311-360.
- Partee, B. 1996, 'The development of formal semantics in linguistic theory', In **The Handbook of Contemporary Semantic Theory**, S. Lappin, ed. Oxford: Blackwell, pp. 11-38.
- Sgall, P., E. Hajicova, and J. Panevova, 1986, **The Meaning of the Sentence in Its Semantic and Pragmatic Aspects.** Prague: Academia, and Dordrecht: Reidel.
- Stalnaker, R., 1978, 'Assertion.' In **Pragmatics** (=Syntax and Semantics, Vol. 9), P.Cole, ed. New York: Academic Press, pp. 315-332.
- Stechow, A. von and D. Wunderlich, eds.1991, **Semantik/ Semantics: An International Handbook of Contemporary Research.** Berlin: Walter de Gruyter.
- Talmy, L., 1991, 'Path to realization: A typology of event conflation.' In **Proceedings of the Berkeley Linguistic Society**, v. 17.