20. Truth, meaning, and ontology

20.1 Analysis of meaning in logical semantics

20.1.1 The meaning principle of logical semantics

> If a speaker-hearer knows the meaning of a sentence, (s)he can say for any state of affairs whether the sentence is true or false with respect to it.

20.1.2 Existential generalization

The truth of a proposition F(a,b) implies that a exists and that b exists. For example, the sentence Julia kissed Richard is analyzed semantically as a *kiss*-relation between the entities Julia and Richard. If Julia kissed Richard is true, then it must be true that Julia exists and Richard exists.

20.1.3 Substitutivity of identicals

The premises F(b) and b = c, F(b) implies F(c). For example, if Richard = Prince of Burgundy, then the truth of the sentence Julia kissed Richard implies the truth of the sentence Julia kissed the Prince of Burgundy. This substitutivity of Richard and Prince of Burgundy *salva veritate*, i.e. preserving the truth-value, is based on the fact that these two different expressions denote the same object.

20.1.4 Valid and invalid instances of existential generalization

1) Julia finds a unicorn. $>$ A unicorn exists.
2) Julia seeks a unicorn. $\not>$ A unicorn exists.

The premises in these two examples have exactly the same syntactic structure, namely F(a,b). The only difference consists in the choice of the verb. Yet in (1) the truth of the premise implies the truth of the consequent, in accordance with the rule of existential generalization, while in (2) this implication does not hold.

20.1.5 First problem for extensional ontology

How a relation can be established between a subject and an object if the object does not exist. How can Julia seeks a unicorn be grammatically well-formed, meaningful, and even true under realistic circumstances?

20.1.6 Isolating the first problem

Part of the solution consisted in specifying certain environments in natural sentences in which the rule of existential generalization does not apply, e.g., in the scope of a verb like seek. These environments are called the *uneven* (Frege 1892), *opaque* (Quine 1960), or *intensional* (Montague 1974) *contexts*.

20.1.7 Second problem for extensional ontology

How should the difference in the meaning of different expressions for non-existing objects, such as square circle, unicorn, and Pegasus, be explained? This is necessary because of the second inference rule, the substitutivity of identicals.

For example, if we were to use the empty set as the referent of square circle, unicorn, and Pegasus in order to express that no real objects correspond to these terms, then the truth of Julia seeks a unicorn would imply the truth of Julia seeks Pegasus and Julia seeks the square circle because of the substitutivity of identicals.

20.1.8 Frege's solution to the second problem

Frege 1892 concluded from the non-equivalence of, e.g., Julia seeks a unicorn and Julia seeks a square circle that in addition to the real objects in the world there also exist natural language meanings, called *sense* (Sinn), which are independent of their referents *referents* (Bedeutung).

20.1.9 Ontological status of meaning (sense)

Frege attributed a similar form of existence to the meanings of natural language as to the numbers and their laws in mathematical realism. Mathematical realism proceeds on the assumption that the laws of mathematics exist even if no one knows about them; mathematicians *discover* laws which have extemporal validity. Frege supposed the meanings of natural language to exist in the same way, i.e., independently of whether there are speakers-hearers who have discovered them and use them more or less correctly.

20.2 Intension and extension

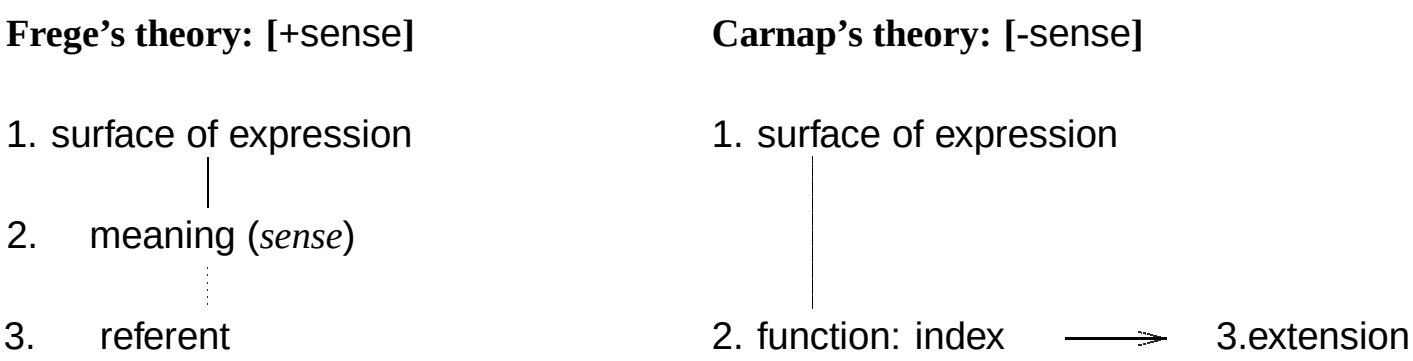
20.2.1 Examples of Carnap's *Intensions*

$$\text{proposition:} \quad \overset{\textit{intension}}{I \times J \rightarrow \{0,1\}} \qquad \overset{\textit{extension}}{}$$

$$\text{proper name:} \quad \overset{\textit{intension}}{I \times J \rightarrow a \in A} \qquad \overset{\textit{extension}}{}$$

$$\text{1-pl. predicate:} \quad \overset{\textit{intension}}{I \times J \rightarrow \{a1, a2, ..\} \subseteq A} \qquad \overset{\textit{extension}}{}$$

20.2.2 Two approaches to meaning



20.3 Propositional attitudes

20.3.1 Two basic problems of logical semantics for natural language

- the Epimenides paradox and
- the problem of propositional attitudes.

20.3.2 Example of a propositional attitude

Suzanne believes that Cicero denounced Catiline.

20.3.3 Assumption of modal logic regarding proper names: rigid designators

According to the intuitions of modal logic, a proper name denotes the same individual in all possible worlds (rigid designator). For example, because Cicero and Tullius are names for one and the same person it holds necessarily (i.e, in all possible worlds) that Cicero = Tullius. Therefore, it follows necessarily from the truth of Cicero denounced Catiline that Tullius denounced Catiline.

20.3.4 Problem for propositional attitudes

Even though the referents of Cicero and Tullius are necessarily identical, this could be unknown to Suzanne. Therefore, a valid substitution *salva veritate* would require the truth of Suzanne believes that Cicero is Tullius.

Determining what an individual believes depends on what the individual chooses to report. Because it cannot be checked objectively whether this is true or not, individual 'belief-worlds' have justly been regarded as a prime example of what lies outside any scientific approach to truth.

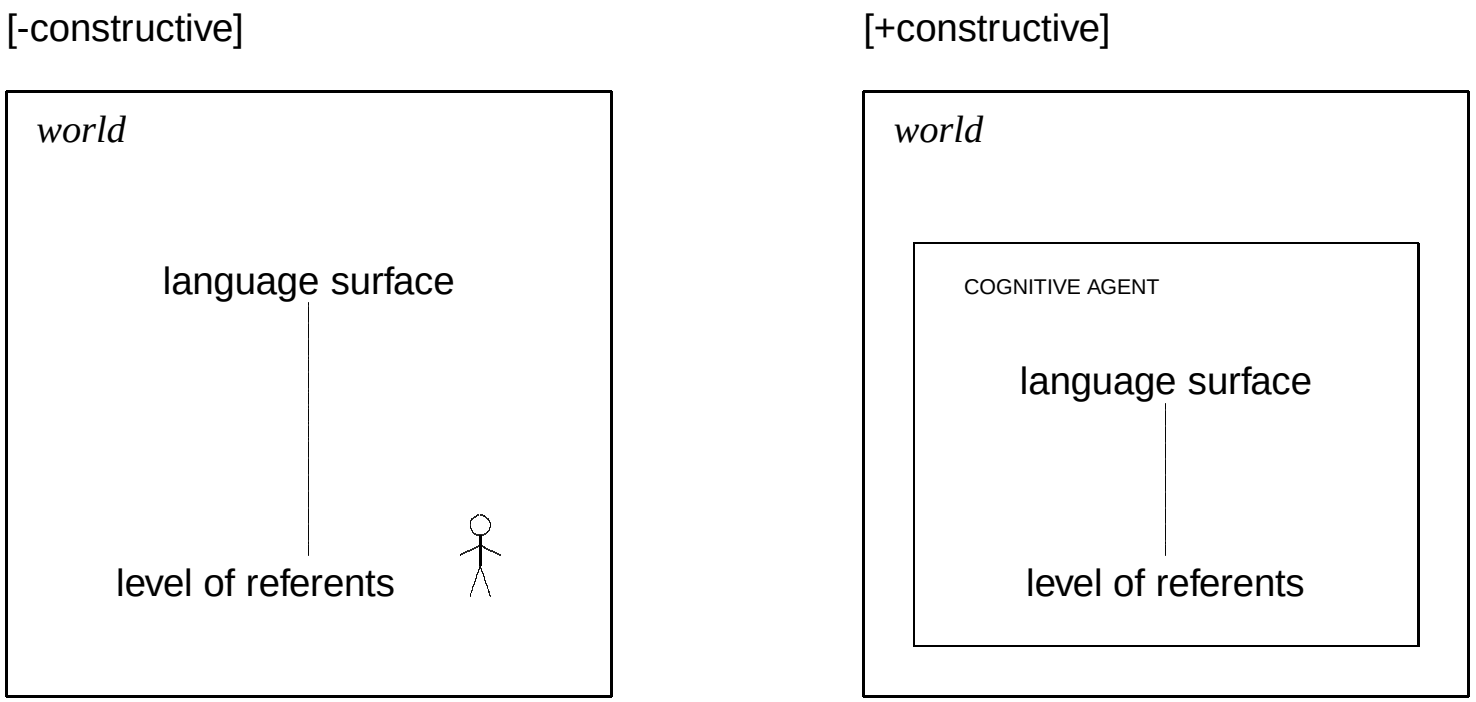
20.3.5 Fundamental question of logical semantics: Formulation I

Definition of truth (conditions) by means of meaning or
definition of meaning in terms of truth (conditions)?

20.3.6 Fundamental question of logical semantics: Formulation II

Is the speaker-hearer part of the model structure or
is the model structure part of the speaker-hearer?

20.3.7 Two ontological interpretations of model theory



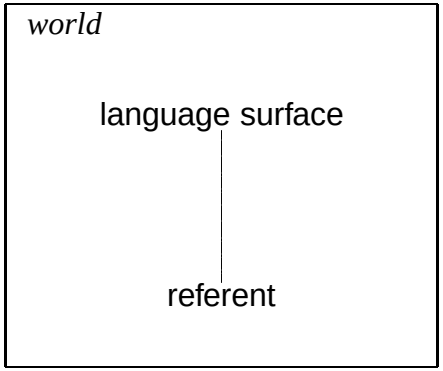
20.3.8 The most fundamental difference between [±constructive] ontologies

- Any system based on a [–constructive] ontology must have a metalanguage-based semantics.
- Any system based on a [+constructive] ontology must have a procedural semantics.

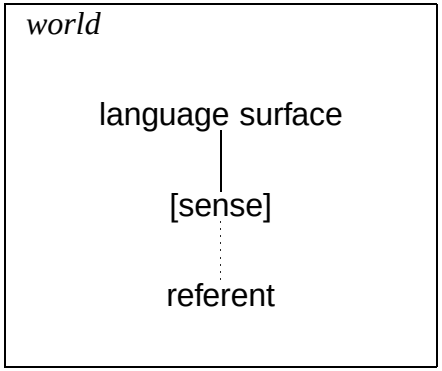
20.4 Four basic ontologies

20.4.1 Ontologies of semantic interpretation

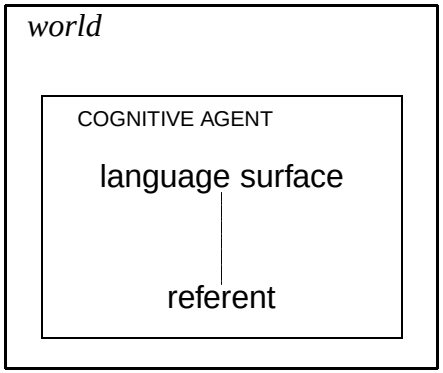
i [–sense, –constructive]
Russell, Carnap, Quine, Montague



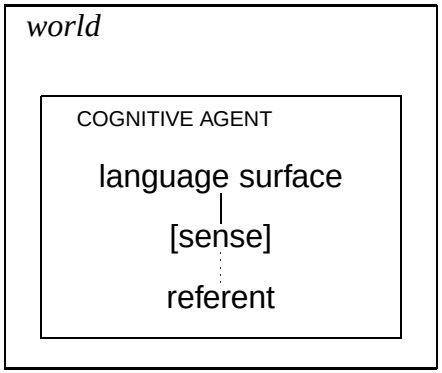
ii [+sense, –constructive]
Frege



iii [–sense, +constructive]
Newell & Simon, Winograd, Shank



iv [+sense, +constructive]
Anderson, CURIOUS, SLIM-machine



20.4.2 The [–sense,–constructive] ontology (i) of logical semantics

Concerned with a solid foundation for truth, logical semantics uses only referents which are considered to be real. Given its ontological foundations, logical semantics is in principle unsuitably for a complete analysis of natural language meaning.

20.4.3 The [+sense,–constructive] ontology (ii) of Frege

Attempt to analyze uneven (opaque, intensional) readings in natural language. As a theory of truth, any [-constructive], metalanguage-based semantics is necessarily incompatible with representing cognitive states.

20.4.4 The [–sense,+constructive] ontology (iii) of programming languages.

Designed to control electronic procedures via the commands of a programming language. A direct, fixed connection between language expressions and their referents prevents autonomous classification of new objects in principle. Therefore, [–sense, +constructive] systems are limited to closed worlds created by the programmer.

20.4.5 The [+sense,+constructive] ontology (iv) of the SLIM theory of language

The [+sense] property is the structural basis for matching of meaning_1 and the context of use, while the [+constructive] property allows the matching to occur inside the cognitive agent.

20.5 Sorites paradox and the treatment of vagueness

20.5.1 Sorites paradox or paradox of the heap

One grain of sand does not make a heap. Adding an additional grain still doesn't make a heap. If n grains do not form a heap, then adding another single grain will not make a heap either. However, if this process of adding a grain is continued long enough, there will eventually result a genuine heap.

20.5.2 Vagueness as motivation for non-bivalent logic

Sensitive students of language, especially psychologists and linguistic philosophers, have long been attuned to the fact that natural language concepts have vague boundaries and fuzzy edges and that, consequently, natural-language sentences will very often be neither true, nor false, nor nonsensical, but rather true to a certain extent and false to a certain extent, true in certain respects and false in other respects.

G. Lakoff 1972, p. 183

20.5.3 Future-contingent propositions as motivation for non-bivalent logic

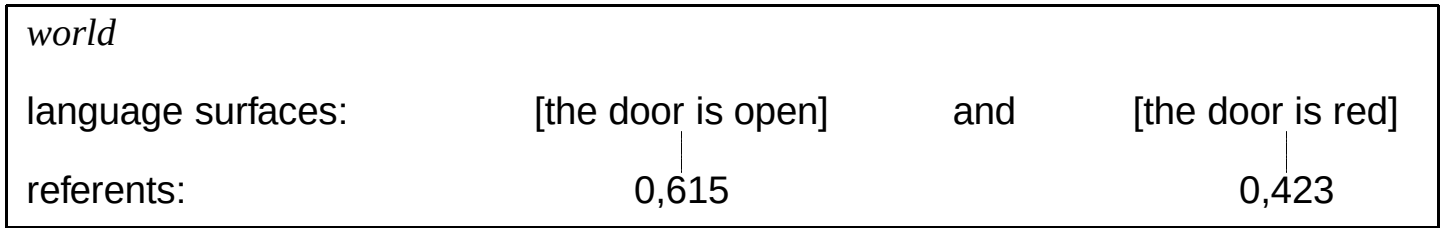
> Throughout the orthodox mainstream of the development of logic in the West, the prevailing view was that every proposition is either true or else false - although which of these is the case may well neither be *necessary* as regards the matter itself nor *determinable* as regards our knowledge of it. This thesis, now commonly called the "Law of Excluded Middle", was, however, already questioned in antiquity. In Chap. 9 of his treatise *On Interpretation (de interpretatione)*, Aristotle discussed the truth status of alternatives regarding "future-contingent" matters, whose occurrence – like that of the sea battle tomorrow – is not yet determinable by us and may indeed actually be undetermined.
>
> N. Rescher, 1969, p. 1

20.5.4 The basic problem of three-values logics and the many-valued logics

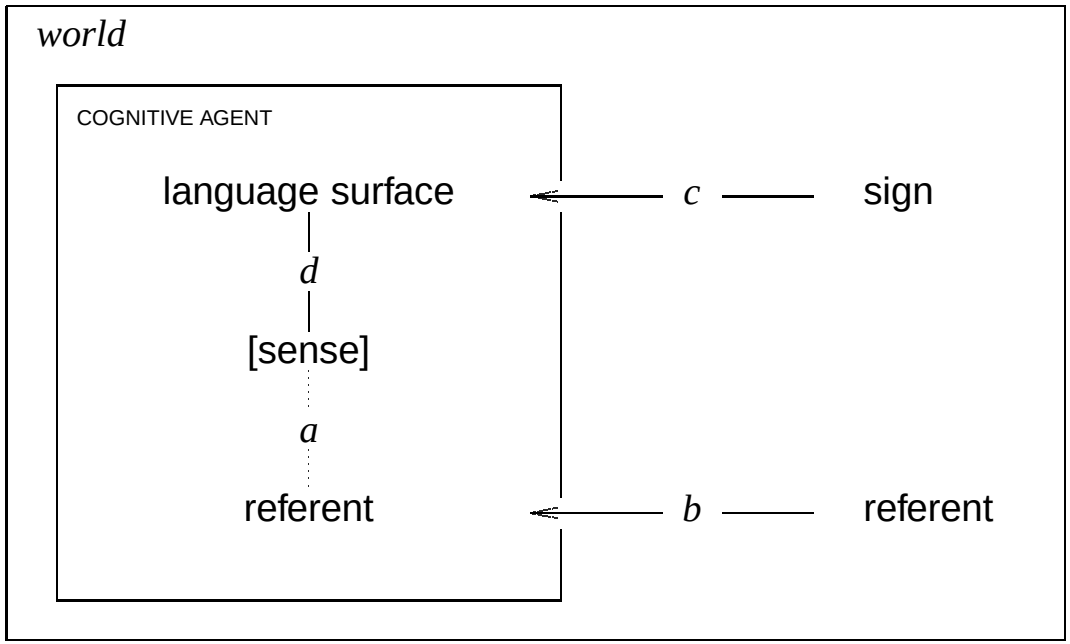
> Which truth-value should be assigned to complex propositions based on component propositions with non-bivalent truth-values?

For example: What should be the value of, e.g., A&B if A has the value 1 and B has the value #? Similarly in a many-valued system: if the component proposition A has the truth-value 0.615 and B has the value 0.423, what value should be assigned to A&B?

20.5.5 Vagueness in [-sense,-constructive] semantics

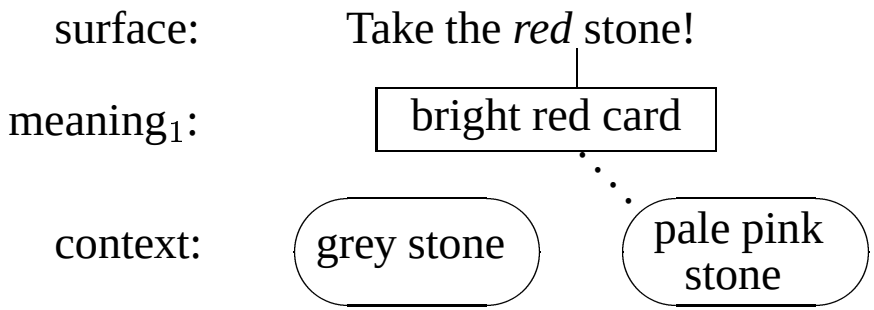


20.5.6 Vagueness in [+sense,+constructive] semantics

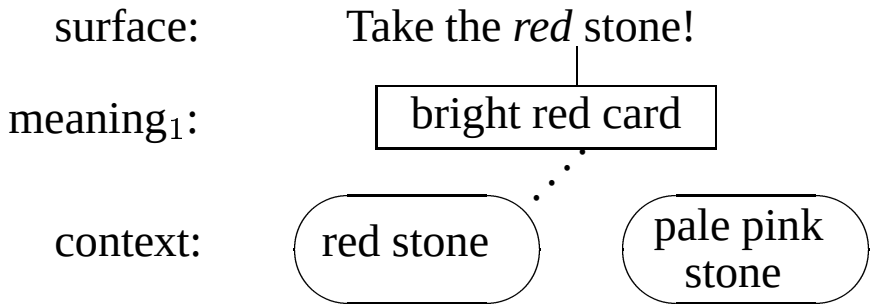


20.5.7 Why vagueness is not a property of language meaning

The hearer is faced with a context consisting of a grey stone and a pale pink stone. Responding to the utterance Take the red stone, the cooperative hearer will pick the pale pink stone. For simplicity, the meaning$_1$ of red is represented by a bright red card.



If the grey stone is replaced by a dark red one, the pale pink stone ceases to be the best match. Responding to Take the red stone, the cooperative hearer will not pick the pale pink stone, but the red one.



It is not the meaning$_1$ of red which changed, but the context.