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A			B			C				
P	$\sim P$	$\approx P$	Q:	T	F1	F2	Q:	T	F1	F2
T	F1	F1	P: T	T	F1	F2	P: T	T	T	T
F1	T	F1	F1	F1	F1	F2	F1	T	F1	F1
F2	F2	T	F2	F2	F2	F2	F2	T	F1	F2

Figure 8 Truth tables for Presuppositional Propositional Calculus (PPC).

' $G(f_1) \vee G(f_2) \vee G(f_3) \vee \dots$ ', until all members f_n of $[[F]]$ have been enumerated. Yet this is only so if $[[F]] \neq \emptyset$. If $[[F]] = \emptyset$ there will be neither a conjunction nor a disjunction of its members. In general, since ABPC was rejected in favor of SMPC, which had its logic reduced to the conversions, the obvious parallelism of \forall with \wedge and of \exists with \vee has been more of an embarrassment than of a help to logicians. Yet, if ABPC can be restored to its traditional position, the isomorphism of ABPC with propositional calculus will be a reason for looking further into logical systems with such properties as ABPC and propositional calculus have in common.

Unlike ABPC, propositional calculus is not logically faulty. It does not need a fourth space because there is no null class to cater for. Yet it can be made trivalent so as to cater for presuppositions (Seuren *et al.*, 2001). The minimal, presupposition-preserving negation (\sim) toggles between T and F1 and yields F2 in cases of presupposition failure. The radical presupposition-canceling negation (\approx) yields T only in cases of presupposition failure and yields F1 otherwise. (The standard negation \neg is equivalent with the disjunction of minimal and radical negation: $\sim P \vee \approx P \equiv \neg P$.) Conjunction (\wedge) selects F2 over F1 and T, and F1

over T; disjunction (\vee) selects T over F1 and F2, and F1 over F2, as shown in Figure 8.

When the logic of language is seen as being defined by the semantic descriptions of the logical constants involved, an entirely new perspective on logic emerges, one that has so far hardly been explored.

See also: Aristotle and Linguistics; Extensionality and Intensionality; Multivalued Logics; Presupposition; Virtual Objects.

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Propositional Attitude Ascription: Philosophical Aspects

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Paradigmatic **propositional attitude ascriptions** (in English) are sentences of the form **A Vs that S**, where **A** is a singular definite noun phrase referring to a rational agent, **S** is a sentence, and **V** is a propositional attitude verb. Paradigmatic propositional attitude verbs include 'believe,' 'doubt,' 'realize,' 'hope,' 'regret,' etc. Such verbs refer to **intentional mental states** with **representational content**, where this content can

be evaluated for truth or falsity, and thus can be identified with a **proposition**. (What are sometimes called *verbs of saying*, e.g., 'say,' 'deny,' 'announce,' are closely related to, but typically distinguished from, propositional attitude verbs.) Because propositional attitude verbs refer to intentional states with propositional content, it is natural to endorse a **relational analysis** of propositional attitude ascriptions: an assertion of 'John hopes that Mary won' says that the referent of 'John' bears the mental relation (or *attitude* in Russell's 1940 terminology) referred to by 'hopes' toward the proposition expressed by the complement clause 'that Mary won.' Similarly, an assertion of

'John doubts that Tom is happy' says that John bears a different relation, viz. doubting, toward a different proposition, viz. that Tom is happy.

Analytic philosophers have been, and continue to be, concerned to formulate an adequate semantic analysis of propositional attitude ascriptions for several reasons. One reason stems from philosophers' desire to understand the nature of mental states. What is, e.g., a belief? Is the existence of beliefs compatible with **physicalism**? If not, then should we be **eliminativists** about mental states, and deny that they really exist, or should we reject physicalism in favor of some sort of **dualism**? How can a mental state **represent** things as being a certain way? i.e., what is it for one entity to be **about** another? Does having a belief require one to instantiate some sort of internal representational state (as **cognitivists** claim), or is it merely a matter of being disposed to behave in various ways (as **behaviorists** claim)? Whatever view one adopts toward these broader philosophical issues concerning the nature of mental states must be compatible with an adequate semantic analysis of how we talk about such states.

Another reason, perhaps the principle reason, philosophers are concerned with propositional attitude ascriptions stems from the close relationship between natural language and thought, and the apparent **compositionality** exhibited by both. What we can think is what is expressed by utterances of declarative sentences; if what we think are **thoughts**, and if what is expressed by utterances of declarative sentences are propositions, then what we think are propositions. Moreover, philosophers have argued that in order to explain the **productivity**, **interpretability**, and **systematicity** of language, and thus thought, some sort of **principle of semantic compositionality** must hold for language, and thus thought (see Frege (1914) and Davidson (1965) for appeals to productivity and interpretability. See Evans (1982) and Fodor (1998) for appeals to systematicity. Frege also appealed to compositionality to explain the **unity of the proposition**. See Frege (1891 and 1892b). Consequently, many analytic philosophers have endorsed some version of the following **principle of semantic compositionality**:

The proposition expressed by a sentence S in a context c is a function of (i) the **logical form** of S, and (ii) the **semantic values** invoked by S in c.

(The relativization to context is necessary to account for sentences containing **context sensitive** words.) The reason that philosophers interested in language and thought have been especially concerned with propositional attitude ascriptions is that these sentences provide apparent counterexamples against this otherwise well-motivated principle; this is known as the **opacity**

problem for attitude ascriptions. The focus of my remarks here will be on the opacity problem and influential proposals for its solution.

Consider the classic case of the hapless ancient astronomer: He used 'Hesperus' to refer to the first heavenly body to appear at dusk, and 'Phosphorus' to refer to the last heavenly body to disappear at dawn. But he did not realize that these names are coreferential; they both refer to Venus. Now consider the following attitude ascriptions:

- (1) The astronomer believed that Hesperus was visible at dusk.
- (2) The astronomer believed that Phosphorus was visible at dusk.

Given the astronomer's ignorance of the identity of Hesperus and Phosphorus, (1) is true and (2) is false. But that (1) and (2) differ in truth value is at least an apparent counterexample to the compositionality principle: If it is granted that (1) and (2) have the same logical form, and that the semantic value contributed by a word is its referent, then, given that 'Hesperus' and 'Phosphorus' are coreferential, semantic compositionality seems to require that (1) and (2) express the same proposition, and thus cannot differ in truth value. The opacity problem is sometimes called *substitution failure*: in (1) 'Phosphorus' cannot be substituted *salva veritate* for 'Hesperus.' Linguistic environments in which coreferential terms cannot be substituted *salva veritate* are known as **opaque**, as opposed to **transparent**, contexts.

Responses to the opacity problem can be divided into **conservative** proposals and **radical** proposals. Conservative proposals attempt to preserve the principle of semantic compositionality by somehow explaining away the apparent counterexamples. Conservative proposals can be subdivided into **semantic** conservative proposals, which appeal to the **meanings** of expressions to explain away the apparent counterexamples, and **pragmatic** conservative proposals, which appeal to how expressions are **used**. In contrast to conservative proposals, **radical proposals** accept the apparent counterexamples provided by attitude ascriptions, and thus reject the principle of semantic compositionality and offer alternative conceptions of semantics in its place.

To propose a **semantic conservative solution** to the opacity problem, then, is to provide an account of semantic values, and how they are invoked and combined, which preserves the above principle of compositionality yet explains why, e.g., (1) and (2) express different propositions. If the datum that (1) and (2) express different propositions is granted, and it is granted that (1) and (2) have the same logical form, then the general strategy one must adopt is clear: one

must argue that (1) and (2) somehow invoke additional, extrareferential, semantic values. Semantic conservative proposals all have this general strategy in common; where they differ is over **what** they take the requisite additional semantic values to be, and over **how** attitude ascriptions invoke different such additional semantic values.

The first, and probably most influential, semantic conservative proposal was presented by Frege (1892a). Indeed, Frege was the first to clearly formulate the opacity problem, and most subsequent work on the problem is a development of, or response to, Frege's seminal paper. A key feature of Frege's proposal is the thesis that words embedded in the complement clauses of attitude ascriptions **shift referents**; when words occur embedded in such **opaque** contexts, their semantic values are not their 'ordinary referents,' but are instead more finely individuated entities, which Frege called 'indirect referents.' Frege posited abstract objects he called **senses** to serve as indirect referents. A sense of a word is alleged to be a 'mode of presentation' of the referent of the word (if the word has a referent). To return to the hapless astronomer, Frege would say that the referent, Venus, is presented to the astronomer in two different ways; one of these ways is the sense of 'Hesperus,' and the other is the sense of 'Phosphorus.' The astronomer fails to recognize that Hesperus is Phosphorus because he fails to realize that these different modes of presentation are in fact modes of presentation of, or ways of thinking about, the same referent. If it is granted that 'Hesperus' and 'Phosphorus,' though coreferential, nonetheless express different senses, then, because of referent shifting, (1) and (2) invoke different semantic values. And consequently, that these sentences express different propositions, and have different truth values, is no threat to semantic compositionality.

Many theorists endorse Frege's thesis that words embedded in the complement clauses of attitude ascriptions shift referents, yet, influenced by broader philosophical commitments, they reject senses, the abstract objects Frege posited to serve as indirect referents. Other sorts of entities posited to serve as indirect referents include **intensions** (Montague, 1974), **sentences** (Carnap, 1946), and **mental representations** (Fodor, 1978). All theories which allow for referent shifting, however, face a common difficulty: As Quine (1956) noted, attitude ascriptions are ambiguous (or at least context sensitive). For some utterances of attitude ascriptions, what is relevant for determining truth conditions is simply the referent of an embedded word, rather than the word, or some other sort of indirect referent. And for these so-called *de re* utterances of attitude ascriptions, Frege's

referent shifting thesis is inappropriate. But, as Frege noted, for other, so-called *de dicto*, utterances of attitude ascriptions, it seems that something other than the referents of embedded words is relevant for determining truth conditions. It is now widely accepted that in different contexts the same attitude ascription (sentence type) can express different truth conditions; in particular, some utterances of, e.g., the type of (1) are *de re* (or **transparent**), while other utterances like (1) are *de dicto* (or **opaque**).

The recognition of the context sensitivity of attitude ascriptions has led philosophers to add complexities to the semantic conservative strategy. Quine (1956) proposes that, if propositional attitudes are to be countenanced at all, propositional attitude verbs ought to be treated as ambiguous between a **relational** (*de re*) sense, and a **notional** (*de dicto*) sense. More recent proposals build on Carnap's (1946) theory, and identify indirect referents not with words, but with abstract structures composed of both words and their ordinary referents (relative to a context) combined. These Carnap-inspired theories attempt to account for the context sensitivity of attitude ascriptions by allowing what is necessary for an agent to hold the relevant mental relation to the combined entity to vary across contexts (see Richard, 1990 and Higginbotham, 1991).

Thus far, I have reviewed semantic conservative proposals that follow Frege in maintaining that words in complement clauses of attitude ascriptions shift their referents; where the proposals discussed thus far have differed from each other concerns **what** the additional semantic values are. Other semantic conservative proposals, however, disagree with Frege not only concerning **what** the requisite additional semantic values are, but they also reject Frege's referent shifting thesis. An early alternative to Frege's indirect reference strategy was proposed by Russell (1919). Russell's proposal preserves the simple idea that semantic values are **always only** ordinary referents, but he achieves this result at the cost of allowing the **logical form** of a sentence to differ significantly from its **surface form**. According to Russell, what appear to be referring terms, e.g., 'Hesperus' and 'Phosphorus,' are merely abbreviations for "denoting phrases" composed of quantifiers and unpronounced genuine referring terms; Russell called these posited unpronounced genuine referring terms "logically proper names." According to Russell then, despite appearances, Venus is not the referent of any genuine referring term in the logical form of either (1) or (2). Rather, the apparent names 'Hesperus' and 'Phosphorus' abbreviate denoting phrases comprised of different, noncoreferential, logically proper names. Thus, that (1) and (2) express different propositions is

not a counterexample to semantic compositionality, because, according to Russell, the sentences invoke different semantic values. (Not surprisingly, Russell never presents a full reduction of an apparent name into a denoting phrase comprised of logically proper names.)

A more recent proposal similar in spirit to Russell's is the "hidden indexical" analysis (see Schiffer, 1977 and Crimmins, 1992). This proposal maintains that the additional semantic values required for distinguishing the propositions expressed by utterances of (1) and (2) are the referents of 'hidden' – phonologically unrealized – indexical items that are somehow present in the logical form, but not in the surface form, of the sentence. Crimmins takes the posited hidden indexicals to refer (in contexts) to "mental particulars," token mental representations that, similar to Frege's senses, are ways of thinking of ordinary referents. The hidden indexical analysis thus does not deny that, e.g., Venus is a semantic value invoked by both utterances (1) and (2), because Venus is the referent of both 'Hesperus' and 'Phosphorus.' But that such utterances express different propositions is nonetheless not a counterexample to semantic compositionality because the presence of hidden indexicals allows the utterances to invoke different mental particulars as 'unarticulated' semantic values.

Another influential semantic conservative proposal that rejects referent shifting is Davidson's (1968) "paratactic" analysis of indirect speech. Davidson proposes that an indirect speech report with the surface form 'A said that S' has the logical form of two sentences: first, 'A said that,' and second, 'S.' The word 'that' in the first sentence is interpreted as a **demonstrative**, and in an utterance with the surface form 'A said that S,' the demonstrative refers to the subsequent **utterance** of 'S.' Thus, in Davidson's proposal, the additional semantic value invoked by an utterance of an indirect speech report is the very act of uttering the sentence embedded in the complement clause. According to Davidson's proposal, an utterance with the surface form 'A said that S' is true just in the case the agent referred to by 'A' performed an utterance that is relevantly similar to the referent of 'that,' where this referent is the **utterance** of the embedded 'S.' Davidson applied his analysis only to indirect speech reports, but others, such as Lepore and Loewer (1989), have extended Davidson's analysis so that it applies to attitude ascriptions.

Whereas semantic conservative proposals accept that, e.g., (1) and (2) express different propositions and attempt to reconcile this datum with the principle of semantic compositionality, **pragmatic conservative proposals** reject the datum and thereby undermine

the apparent counterexample to semantic compositionality. According to pragmatic conservative proposals, (1) and (2) do not present a counterexample to compositionality because, despite our pretheoretic judgments to the contrary, they do not express different propositions, and they do not differ in truth value. Support for this seemingly implausible strategy comes from two principle sources: First, there are influential arguments due to Kripke (1972) and Kaplan (1977) in support of the **thesis of direct reference**, according to which the only semantically relevant feature ever associated with some terms – names, demonstratives, and indexicals being the paradigmatic cases – is the referent of the term. The thesis of direct reference thus entails that, e.g., utterances (1) and (2) express the same proposition. Second, there is Grice's (1975) distinction between **what is said** by an utterance and **what is merely implied** by an utterance. According to Grice, **what is said** is the domain of **semantics** and thus must conform to the compositionality principle, while **what is implied** is the domain of **pragmatics**, and thus need not conform to the principle. According to the pragmatic conservative strategy then, utterances (1) and (2) semantically say the same thing, but they pragmatically imply different things. And our pre-theoretic judgment that utterances (1) and (2) say different things is a result of our naively conflating **semantically expressed** information with **pragmatically implied** information. Pragmatic conservative proposals are developed by Salmon (1986) and Soames (2002).

In contrast to **conservative proposals** which attempt to preserve semantic compositionality by somehow explaining away the at least apparent counterexamples posed by attitude ascriptions, **radical proposals** accept the counterexamples and reject semantic compositionality. Given the fundamental role that the principle of compositionality has played in semantics and analytic philosophy generally, a theorist who endorses a radical proposal must provide an alternative conception of what it is to provide a semantic analysis. Moreover, this alternative conception must be at least compatible with the phenomena of **productivity**, **interpretability**, and **systematicity**. One sort of radical proposal falls within the broader movement known as **Radical Pragmatics**. Radical Pragmatics is characterized by the thesis that the linguistic meaning associated with an utterance underdetermines what is said by the utterance; i.e., knowing the logical form of an utterance and knowing the referents of all the words (or other relevant features) does not suffice for determining what is said by the utterance; in order to arrive at something truth-evaluable, additional processing is required. **Relevance Theory**, as proposed by Sperber and Wilson (1986), is a

paradigmatic example of Radical Pragmatics. Thus, from the perspective of Radical Pragmatics, it is not particularly problematic that utterances (1) and (2) express distinct truth conditions. A version of Radical Pragmatics is applied to attitude ascriptions in Bach (1997).

Another sort of radical proposal falls within the broader movement known as **Dynamic Semantics**. According to Dynamic Semantics, the semantic content of a declarative utterance is not a truth-evaluable proposition, but rather linguistically encoded general instructions (i.e., a 'context change potential') for updating the set of beliefs shared between the speaker and his audience (i.e., the 'common ground'). To determine **what is said** by an utterance, one must apply the linguistically encoded general instructions to the set of shared beliefs. Thus, **what is said** depends not only upon the logical form of the uttered sentence and the semantic values of the words in it, but also upon what the shared beliefs of the speaker and his audience happen to be. A paradigmatic example of Dynamic Semantics is **Discourse Representation Theory**, as proposed by Kamp and Ryle (1993). Because utterances (1) and (2) encode different instructions for updating sets of shared beliefs, **what is said** by such utterances (relative to the same set of shared beliefs) can differ. Thus, from the perspective of Dynamic Semantics also, it is not particularly problematic that such utterances are interpreted as expressing distinct truth conditions. This sort of dynamic approach is applied to the phenomenon of opacity in Asher (1993).

See also: Functional Discourse Grammar; Indexicality: Philosophical Aspects; Metaphysics, Substitution Salva Veritate and the Slingshot Argument; Semantic Value.

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