Projection Problem

The 'projection problem' is posed by the behavior of presuppositions (see *Presupposition*) of embedded clauses. When a sentence B presupposes a sentence A ($B \gg A$), then (a) B logically entails A ($B \models A$), and (b) any bit of text composed of A followed by B will be 'sequential' in the sense set out in the articles on presupposition (see *Presupposition*) and on discourse semantics (see *Discourse Semantics*) (i.e., 'A and B' is an orderly bit of discourse). When B_A (that is, B presupposing A) is embedded in a larger sentence C, then either $C \models B_A$ or $C \not\models B_A$. If $C \models B_A$, generally speaking (i.e., always except for the operator *and*), $C \gg A$. Likewise, if $C \gg B_A$, $C \gg A$. That is, when B_A is entailed or presupposed by its embedding clause C, then C inherits the presuppositions of B_A. For example, (1a)≫(1b) and (1c)⊨(1a). Therefore, (1c)≫(1b). Analogously for (1d–f). (Example (1f) is a case of factive presupposition; see *Factivity*):

Susan got her money back. (1a)

Susan had lost her money. (1b)

Susan managed to get her money back. (1c)

Bob is divorced. (1d)

Bob was married. (1e)

Susan realizes that Bob is divorced. (1f)

The operator *and*, however, behaves differently. In a conjunction of the form 'A and B_A,' B_A is entailed yet A is not presupposed. Thus (1a)≫(1b) and (2)⊨(1a), yet (2)$\not\gg$(1b):

Susan had lost her money and she got it back. (2)

If, on the other hand, $C \not\models B_A$ (and hence $C \not\gg B_A$), then in all cases but one $C \not\models A$ (and hence $C \not\gg A$). The one exception is negation, which sometimes preserves presuppositions, as is shown in (3c), which still both entails and presupposes (3b), a presupposition of (3a), even though *not* generally cancels entailments (see *Presupposition*):

Only Jim laughed. (3a)

Jim laughed. (3b)

Not only Jim laughed. (3c)

In the cases, however, where entailment is lost, A normally remains a so-called 'invited inference,' or 'default assumption' (DA), of C (i.e., $C > A$). If $C > A$, the suggestion is that A is true if C is true, but the inference can, again normally, be overruled by contextual factors. If so, one speaks of a 'weak DA'; if it cannot be overruled one has a 'strong DA.' Moreover, if $C > A$, A followed by C is sequential (makes for an orderly bit of discourse). In this respect, presuppositions differ from other entailments, which are never kept as DAs across non-entailing embeddings. Thus, (4a)≫(4b) and (4c)$\not\models$(4a), but (4c)$>$(4b). This (weak) DA is overruled in (4d), which can only be understood as saying that Harry wrongly believes that he has a son, and that this (nonexistent) son lives in Kentucky:

Harry's son lives in Kentucky. (4a)

Harry has a son. (4b)

Harry believes that his son lives in Kentucky. (4c)

Harry has no son, but he believes that his son lives in Kentucky. (4d)

In contrast, although (5a)$\not\vdash$(4a), (5a)$\not\succ$(4b), and there is thus nothing to be overruled. Likewise for (5b):

If Harry has a son, his son lives in Kentucky. (5a)

Either Harry has no son, or his son lives in Kentucky. (5b)

On the other hand, (6a)$\not\vdash$(4a), and (6a)$>$(4b), but this (strong) DA cannot be overruled by context, as appears from (6b), which is incoherent:

Harry's son may live in Kentucky. (6a)

!Harry has no son, but his son may live in Kentucky. (6b)

The property of presuppositions to be sometimes preserved, albeit usually in a weakened form, through embeddings is called 'projection.' The 'projection problem' consists in formulating the conditions under which the presuppositions of an embedded clause (a) are kept as presuppositions of the superordinate structure, or (b) remain as a (weak or strong) DA, or (c) are cancelled. The answer to (a) has already been given: When $C \vdash B_A$ or $C \gg B_A$, $C \gg A$ (except with *and*). To answer (b) and (c), however, has proved more difficult. This problem gave rise to a considerable body of literature in the 1970s. For a while it even seemed as though the projection problem constituted the whole of presuppositional theory.

It must be observed that standard logic cannot account for projection phenomena, mainly because of the deviant behavior of *and* and *not*. Even nonstandard logics, however, find it hard to account for these phenomena, as DAs are generally not considered to be the business of logic and, moreover, the phenomena appear to run counter to what logical systems are capable of handling. The consensus is, therefore, that a projection theory should be nonlogical. Various approaches have been developed.

The first, and best-known, theory was developed by Karttunen in various publications. He observed that projection is operator-driven for some embedding operators, but not for others. This observation is correct: entailing operators (except *and*) maintain presuppositions. Some non-entailing operators, such as *believe*, always generate weak DAs; others, such as *may*, always generate strong DAs. Other non-entailing operators, however, do not display such uniform behavior. *If* and *or* sometimes do and sometimes do not generate weak DAs, and *not*, though generally producing weak DAs, occasionally preserves full presuppositions, as in (3) above, and in other cases requires the cancelling of some presupposition, as in (7):

Bob does *not* hardly feed his dog: he doesn't even have one. (7)

(Here, *hardly* is a 'positive polarity item' and thus allows for a higher *not* only if some presupposition is cancelled.)

Karttunen thus distinguished between 'plugs,' 'holes,' and 'filters.' Plugs are operators that always cancel presuppositions and DAs. Holes are operators which always let them through, either as presuppositions or as DAs (e.g., *believe, may*). Filters sometimes let them through and sometimes do not (e.g., *not, if, or*). He did not succeed, however, in formulating adequate conditions for the three classes, in particular the filters. Their filtering conditions proved too hard to be treated in this taxonomic way. It is now generally agreed that though Karttunen's work focused attention on these phenomena, it failed to provide a satisfactory solution.

The second main approach is that of Gazdar (1979). Here, presupposition is equated with DA, and is not an entailing property other than in simple sentences. Presuppositions are brought together with entailments (including assertions) and implicatures into one system of hierarchically ordered cancellation conditions. The notion of entailment is classical, and so is the logic administering it. In principle, all implicatures and presuppositions are deemed to 'survive' through embeddings, unless there is a conflict, in which case selective cancelling ('filtering') takes place. Implicatures and presuppositions of the smallest possible sentential structures are spelled, respectively, 'implicatures' and 'pre-suppositions.' Only when they have made it to the surface, through all embeddings, are the spellings implicature and presupposition (i.e., without hyphen) used.

Im-plicatures are of two kinds, 'scalar' and 'clausal.' Scalar im-plicatures are generated by expressions that occupy a position on some semantic scale (Horn 1972). An expression *e* occupying a position on a semantic scale *s* and occurring in a sentence A induces a scalar im-plicature K($\neg\alpha$) for any α such that $\alpha = A$ except that α contains an analogous expression e' occupying a stronger position on *s*. 'K($\neg\alpha$)' reads intuitively as 'for all the speaker knows, not-α.' Thus, a sentence like *Some men died* has the scalar im-plicature K(not all men died). The counterpart of the (epistemic) K-operator is the P-operator, for epistemic possibility.

Clausal im-plicatures are properties of sentences α containing as a subpart some clause β such that α entails neither β nor $\neg\beta$. The im-plicature is then of the form $P(\beta) \wedge P(\neg\beta)$ (see Gazdar 1979: 58–59). Thus, *Nob thinks that Bob is brave* clausally im-plicates P(Bob is brave) $\wedge$ P(Bob is not brave).

A pre-supposition A of a sentence B_A is of the form 'K(A)' and is entailed by B. A presupposition, that is, as a property of a larger embedding sentential structure S, may or may not be entailed by S.

The 'filtering mechanism' works as follows. Given a sentence A, an inventory is made of its eventual entailments (**E**), of its accumulated im-plicatures (**I**), and of its accumulated pre-suppositions (**P**). If **E** contains contrary entailments, A is uninterpretable, i.e., not usable in any context (unless quoted). If some $e \in \mathbf{E}$ is incompatible with any $\mathbf{i} \in \mathbf{I}$ or $\mathbf{p} \in \mathbf{P}$, then **i** or **p** is cancelled and A remains interpretable in all contexts compatible with **E**. If some $\mathbf{i} \in \mathbf{I}$ is incompatible with some $\mathbf{p} \in \mathbf{P}$, then **p** is filtered out and **i** remains. Mutually incompatible im-plicatures or pre-suppositions cancel each other out. There is thus a hierarchy where entailments take precedence over im-plicatures, and im-plicatures take precedence over pre-suppositions. For example, a sentence of the form *if A then B* generates the implicature P(A) $\wedge$ P(not-A) $\wedge$ P(B) $\wedge$ P(not-B), all four being admissible knowledge states. If B pre-supposes A, the presupposition K(A) is cancelled by the incompatible implicature P(not-A).

Gazdar was among the first in the English-speaking world to stress the relevance of presupposition and projection phenomena for an incremental theory of discourse semantics (see *Discourse Semantics*). Given a context (that is, a set of propositions) C, a newly presented sentence A is incremented to C, thus creating a new context C' for a

following sentence. Eventual implicatures and presuppositions are also incremented to C (Gazdar 1979: 132). Incremented propositions are considered to be linked by the truth-conditional operator 'and.' When $C \wedge A$ is inconsistent, A is uninterpretable in C. When C is incompatible with some $\mathbf{i} \in \mathbf{I}$ or $\mathbf{p} \in \mathbf{P}(A \not\vdash \mathbf{p})$, then **i** or **p** is filtered out and A loses that im-plicature or pre-supposition in C. It is easily seen that this incremental aspect of Gazdar's theory is an extension of the filtering mechanism to any context C, as the same results are obtained by conjoining A with (the sentences expressing) the propositions in C. Contextual incrementation, defined in this way, thus does not affect the compositionality of the filtering mechanism.

Proponents of discourse semantics feel that the projection problem should be treated in the context of the theory of domains and subdomains. Presuppositions of embedded clauses are incremented not only in the appropriate subdomain, but also in the higher domain(s), including the truth-domain, unless stopped by lack of cognitive backing or inconsistency. This projection tendency of presuppositions through domains is part of the general property of discourse domains to maximize internal unity and coherence. This accounts for projection in general.

Some subdomains are subject to the requirement that they be themselves incrementable to their superordinate domain. The subdomain created by the epistemic modal verb *may*, for example, requires, quite naturally, that what is said to be possible is a proper potential increment to the higher domain and could thus be taken to be real. Hence the fact that presuppositions under *may* are projected as strong DAs, as in (6a) above. Likewise for disjunctions and conditionals: 'A or B' is incremented as two alternative subdomains 'A' and 'not-A and B,' i.e., with the second alternative headed by the polar opposite of the first. Both alternatives must be incrementable to the higher domain. This general condition automatically blocks the projection of (4b), that is, *Harry has a son*, from the disjunction (5b): if (4b) were added to the higher domain the first alternative would not be incrementable. Analogously for conditionals.

The behavior of *and* is explained by the assumption, made in discourse semantics, that each conjunct forms a separate incrementation unit, and that presuppositions can be carried only by single incrementation units. The behavior of *not* is explained by the assumption that *not* is ambiguous between a (nonclassical) presupposition-preserving *not* and a special metalinguistic *NOT* which says of its argument sentence that it does not fit into the discourse at hand for reasons of presupposition failure. This presupposition-cancelling *NOT* can only occur (in English) in construction with the finite verb, and is required over positive polarity items, as in (7). The position of *not* in (3c) shows that it can only be the presupposition-preserving *not* (see Seuren 1988).

This approach integrates some of the ideas developed in Gazdar (1979), but instead of requiring a separate (modular) projection or filtering mechanism it lets projection phenomena follow epiphenomenally from the machinery of domains and subdomains.

See also: Presupposition; Discourse Semantics; Discourse Domain.

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