Semantic Underspecification & Pragmatic Interpretation of Polysemous Adjectives

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Abstract
Polysemous adjectives seem to make irregular contributions to the meaning of adjective-noun phrases. This thesis provides a systematic explanation of this problem. Polysemous adjectives are considered semantically underspecified. The underspecified semantic meaning has to be pragmatically enriched with due consideration of world-knowledge and linguistic context. The treatment follows Blutner’s bi-directional optimality theoretic approach to pragmatic enrichment. Interpretations alternatives for adjective-noun phrases are computed via weighted abduction from a knowledge base that contains common conceptual world-knowledge. Optimal interpretations are chosen on the basis of certain pragmatic interpretation principles economising on speaker and hearer effort.
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Introduction

I do not know how it is with you, but back then it never really occurred to me, if it had not been for some strangely unsettling philosophical literature, that the people around me, my parents say, might be just physical objects like sand, trees or records. The reason why I have never been a sceptic is simple. Unlike sand, people move. In this respect they are comparable to trees swaying in the breeze. But the sounds produced by waving trees does not make sense to me. How about records then? - Well, I have been talking to my collection for quite some time now and I have come to think that they never listen, because their response is always music, whether I ask, threaten or insult them. So, the most compelling reasons for me to think that my mother is an emotional creature not entirely unlike myself has always been the fact that sometimes the sounds that she produces seem to relate to the sounds that I produce. In the end, when I got tired of worrying and because it works out so perfectly, I got convinced that she really understands what I say and that she really means what I take her to mean.

I am neither kidding nor exaggerating. I am genuinely impressed by the marvels of communication. And to make matters worse, the more you are impressed, the more marvellous it seems when you come to think about it. We converse, talk, chat or gossip as if it was the most natural thing in the world. Well, maybe it is pretty natural seen from a reserved, distanced and dispassionate point of view. But if we dare to creep closer and peek behind the curtains of the naturalness, we find that communication in fact relies not only on simple words and a little bit of syntax, but also on a delicate cluster of mutually shared beliefs and communication strategies without which not a single thought would have ever been conveyed.

This thesis will focus on a very small part of man’s amazingly complex competence to understand natural language utterances. The central question is: What is involved in understanding polysemous adjectives? I want to give an account of the contribution of polysemous adjectives to the meaning of adjective-nouns combinations. It will transpire that this is indeed an interesting and crucial problem for theoretical linguistics. Part of the solution will be to stipulate that polysemous adjectives are semantically underspecified. Underspecification is resolved by a pragmatic mechanism of contextual enrichment.

In particular, this thesis is based on a number of papers by Reinhard Blutner (1998a, 1998b, 2000, 2002, Blutner et al. 1996). In his papers, Blutner proposes a bi-directional optimality theoretic approach to pragmatic interpretation. The interpretation mechanism rests on world-knowledge, context and pragmatic interpretation principles. I want to pick up some of Blutner’s ideas and apply them to the interpretation of polysemous adjectives. Although there are already suggestions for the pragmatic treatment of polysemous adjectives in Blutner’s papers (Blutner 1998a, 1998b), I have tried to execute Blutner’s proposals with a little more detail. In effect, the solutions that I will sketch are rather minor amendments of the theory of Blutner.
The structure of this thesis is as follows: The first section makes us acquainted with the problem of polysemous adjectives. I want to work out criteria for a successful solution and therefore deal with some alternative accounts in order to produce a small set of exemplary problem cases that serve as running examples during the whole thesis. I also want to make the theoretical point of view, namely radical underspecification and two-level semantics, explicit in section 1, although the justification of this view will be postponed to section 4 where we can rely on the formal results of the preceding parts for a more reasonable discussion.

In section 2 the structure of the pragmatic mechanism of contextual enrichment will be elaborated. It combines elements of optimality theory and pragmatic interpretation principles. The combined view is that interpretation alternatives are generated and the optimal interpretation is chosen. The criteria of evaluation are neo-Gricean speaker and hearer economy principles (Horn 1984). They will be formalised towards the end of section 2.

The generation of interpretation alternatives is dealt with in section 3. Following Blutner, the mechanism that computes possible pragmatic enrichments is weighted-abduction (Stickel 1989, Hobbs et al. 1993). The running examples will all be exercised in section 3. Sections 2 and 3 are essentially explications of and amendments to the Blutner approach in so far as it is relevant to the pragmatic interpretation of polysemous adjectives.

Finally, section 4 is dedicated to discussion and evaluation of the results. Especially, the implications of the formal treatment for the semantics-pragmatics interface shall be examined. On top of that, in order to have a general look at human interpretation competence, some of Davidson’s thoughts about radical interpretation are related to the formal treatment of the previous sections. In Section 4 I try to integrate material which has not been covered by Blutner originally.

I made an effort to give a concise summary at the end of each section. If you read these and the overviews at the beginning of each section, you will miss all the interesting detail, but know what has been covered.
Section 1: The Problem of Polysemous Adjectives

First the semantic underspecification of polysemous adjectives is introduced as a significant problem for theoretical linguistics in Section 1.1. Next, two ideas for a solution are discussed and evaluated in Section 1.2, because this gives rise to a comprehensive set of criteria for a successful treatment of the problem. Finally, the theoretical foundations of our own solution are outlined in Section 1.3.

1.1 – Some Adjectives are Semantically Underspecified

Semantic Underspecification

Underspecification is the property of a representation which allows further selection from a number of possibilities by a context. An illuminating example can be found in phonology. Phones in complementary distribution are contextually uniquely defined realisations of one phoneme, e.g. [x] in German, is uniquely realised as either /x/ or /ç/ depending on the quality of the preceding vowel. In this case, the phonological representation is said to be underspecified, since its actual realisation depends on the phonemic context.

Correspondingly, semantic underspecification is the property of a semantic representation whose meaning is not definite but depends on context to be made precise. Cast in a Kaplan-style context-dependent semantics (Kaplan 1978), this amounts to saying that:

Semantic Underspecification – Intuitive Criterion

Given a sentence $S$ and a context $c$, the resulting sense $s$ of $S$ in $c$ is semantically underspecified if there are worlds for which $s$ yields no definite assignment of a truth-value.

Note that this indefiniteness is not due to insufficient knowledge of the worldly facts; the sense $s$ is supposed to be well-defined. But the contextual information leaves the sense semantically underspecified. Accordingly we say that a sentence $S$ is semantically underspecified if there is a context $c$ such that the sense $s$ of $S$ in $c$ is semantically underspecified. Even less formally, if it is uncontroversial that a particular constituent is responsible for the semantic underspecification, we can further extend the terminology to say that the constituent itself is semantically underspecified. Being responsible for semantic underspecification of a sentence roughly means that a substitution is conceivable for the constituent in question such that the resulting sentence is not semantically underspecified any more.

As an example for a semantically underspecified noun phrase, consider sentence (1) where what is meant with Italian cheese is unclear, since the it can refer to cheese from Italy, in the sense that it is produced in Italy, or in the sense that it is a kind of cheese that originally stems
from Italy, but has been produced somewhere else, as is the case with most of the Mozzarella cheese you can buy in German supermarkets for instance.

(1) Is this Italian cheese?

Suppose (1) has been uttered with reference to such a piece of Mozzarella. The trouble is that we cannot answer straight away and it seems that this is entirely the fault of the noun phrase Italian cheese. We would likely ask the questioner how the question was meant, or answer something like: “If you mean whether it is produced in Italy, the answer is no, but the sort is originally Italian.” Such a reply which enumerates and tries to cope with at least some of the obvious possibilities how to understand (1) exemplifies the idea of precisification developed in Pinkal (1985).

I am referring to Pinkal here, because his ideas of precisification help further understand semantic underspecification in a context-dependent semantics. Formally, we say that the sense $s$ of a sentence $S$ is more precise than the sense $s'$ of a sentence $S'$ if $s'$ is true (false) in all possible worlds where $s$ is true (false) and has a definite truth-value in at least one world where $s$ is indefinite. Precisifyability means that for a sentence $S$ and a context $c$ a different context $c'$ can be conceived such that the sense of $S$ in $c'$ is more precise than the sense of $S$ in $c$. I will also say that a context $c'$ precisifies a sense $s$ with respect to another context $c$ if $s$ is more precise in $c'$. Using the notion of precisification we get a definition of semantic underspecification:

**Semantic Underspecification – Pinkal Criterion:**

(i) A linguistic expression $S$ is semantically underspecified in a context $c$ iff the sense of $S$ in $c$ is semantically underspecified.

(ii) A sense $s$ of a linguistic expression $S$ is semantically underspecified iff it can be precisified.

Unfortunately, although the Pinkal Criterion looks as if our intuitions about semantic underspecification have been successfully pinned down, some problems remain. The necessary and sufficient condition in (ii) is equivalent to the conceivability of a suitable context and therefore unsuited as a formal criterion for the presence or absence of semantic underspecification. Consequently, I will stick to uncontroversial cases of semantic underspecification only. However, the Pinkal Criterion is helpful. Firstly, it provides an additional criterion for the delineation of homonymy, polysemy and related phenomena (see below) and, secondly, it brings to attention the dynamic role that the context plays, i.e. that by changing the context what is underspecified can be made more definite.

I want to stress that the Pinkal Criterion is, contrary to the belief expressed in Pinkal 1985, not equivalent to the aforementioned intuitive criterion. The latter states that a sense is underspecified iff it has an indefinite truth-value for some possible world while the former states that a sense is underspecified iff there is a precisifying context. This is only equivalent
iff every sense that is underspecified due to the intuitive criterion can be precisified. And this is not the case for all phenomena which may be responsible for semantic underspecification according to the Pinkal Criterion, e.g. presupposition failure and vagueness.

Hence, the Pinkal Criterion allows a variety of linguistic phenomena to be responsible for precisifyability and consequently semantic underspecification, some of which are interesting for the present purpose, some of which are not. By using the Pinkal Criterion we can therefore conveniently delimit the scope of this thesis. Some phenomena can be safely put aside, like tropes (2), syntactic ambiguity (3), scope ambiguity (4).

(2) Jason drank each word the moment it dripped from her luxurious lips.
(3) Mark spoke to the postman smoking a cigarette.
(4) Three middle schools kids bought four guns and two grenades.

Other phenomena have to be put aside more carefully. Vagueness, for instance, may not be mistaken for semantic underspecification, although both look familiar on the surface.

(5) Betty is blonde.

A predicate, like (5) is vague if it splits the set of objects that the predicate can be attributed to without sort violations into three: Those that it holds of, those that it does not hold of and those of which it cannot be said whether it holds of or not. An often conjured metaphor is that of a penumbra in the middle of a clearly positive and a clearly negative pole. Although this resembles the situation for semantic underspecification of sentences, vagueness is one possible origin of semantic underspecification, but not to be equated. Vagueness is a property of predicates, not of sentences. We can think of vagueness as the result of incomplete definition (Bosch 1983). It is a linguistic property, not one found in the world, but arguably vagueness is an indispensable linguistic property, because perception is also ‘vague’ (Read 1995, chapter 7). Though vagueness is certainly an interesting topic in itself and is also responsible for semantic underspecification, it will not be covered.

The focus of this thesis will be on polysemous adjectives as causes for semantic underspecification. In order to prevent confusion, I would like to separate cases of homonymy (6) from polysemy (7,8).

(6) My canary has very light feathers.
(7) HW 76 was a fast highway.
(8) Clara is a talented student.

Intuitively, sentence (6) contains the homonymous adjective light which, in (6), may refer to colour or weight respectively. In (7) several possibilities can be conceived, of what a fast highway might be. This example will be enlarged on extensively below. Another example of polysemy is (8) where what is left unspecified is the dimension of evaluation of the adjective talented. Knowing that Clara is talented, there is still interpretative freedom left to think of
Clara as a talented future researcher or a talented future teacher both of which are talent features that do not necessarily coincide after all.

The usual rough-and-ready distinction between homonymy and polysemy is that homonymous words have a finite set of etymologically unrelated senses while polysemous expressions have a number of related senses (Ravin & Leacock 2000). But relying on etymology is obscure practice to me, so a slightly more competent differentiation can be drawn in terms of precisifyability: Polysemous expressions can be left unprecisified whereas true homonymous expressions require precisification (Pinkal 1985). This means, upon hearing (6), I am doomed to choose one interpretation: either the feathers weigh only little or they do not have a dark colour. To maintain both readings simultaneously seems impossible in (6). In contrast, examples (7) and (8) do not necessarily call for more precision.

Obviously Pinkal’s is not a marketable distinction between homonymy and semantic underspecification either, because when exactly is it that I can leave an expression unprecisified? Nevertheless, the fruitful idea to peel out of Pinkal’s criterion is that the treatment of homonymous and polysemous expressions, though indiscernibly intermingled in reality, should in principle be distinguished. The different senses of homonymous expressions should be represented by different representational units, e.g. different logical predicates, while polysemous expressions should rather be equipped with an additional parameter. Here, I will only treat the latter case and neglect even homonymy as a phenomenon of interest for the time being. The concern of this thesis is thereby channelled into the question of semantic underspecification due to polysemy, more specific even, due to the polysemy of adjectives.

**Polysemous Adjectives**

A sentence like (7), repeated from above, can have a variety of interpretations according to the contexts in which it is uttered.

(7) HW 73 was a fast highway.

(a) People used to drive fast there.

(b) It was possible or allowed to drive fast there.

(c) It’s construction period was short.

(d) It did not take much time to get the permission to build this highway although several rural villages had to be torn down.

The readings (a)-(d) are only four paraphrased examples from an astonishingly large set of conceivable senses. With a little bit of effort and fantasy one could make a sport out of imagining ever more abstract, but somehow acceptable interpretations. The important point of example (7) is that even a seemingly harmless noun phrase like fast highway is underspecified, although we might not realise it straightaway. If the contextual clues as to which interpretation to choose are missing, adjective-noun patterns contribute to the semantic
underspecification of sentences. This then casts an interesting light on the meaning of adjective-noun combinations.

Adjectives modify a noun in an astonishingly broad variety of ways. Usually summoned examples are colour adjectives, such as in red apple, red skin, red traffic light or red grapefruit. With respect to this list of examples, it should be clear that:

(i) The meaning of red is different in all the occurrences in the sense that the redness of skin differs from the redness of traffic lights and

(ii) the part or aspect of the noun that is red in all the examples is different.

Theoretical linguistics has to explain this phenomenon, a problem henceforth referred to as the problem of polysemous adjectives. Of course, it is not enough to just list all the possible combinations of adjectives and nouns. We want to explain the seemingly arbitrary ways of meaning combination for adjective-noun patterns systematically.

To further complicate matters, we have to pay attention to the role of context. This can best be illustrated by an example (9) where the context is given in continuations (9a) and (9b).

(9) This is healthy lettuce.

(a) It will taste good with a slice of fresh bread and it is exactly what I need to be prepared for tomorrow’s tennis match.

[The depicted salad is good for your body if you eat it.]

(b) It grew so quickly and, look, how green the leaves have become! From now on I will always buy this brand of seed.

[The plant is strong and free from disease.]

It is obvious that healthy lettuce can have both of the contextual meanings paraphrased in (9a) and (9b) respectively. Consequently, it makes sense to say that the phrase is interpretation ambiguous and we have to explain how a given context influences the interpretation.

The process by which phrases like healthy lettuce or fast highway obtain their contextually relevant interpretations is outlined in Bierwisch (1983, p.76f.). The example discussed by Bierwisch is different, but can be easily applied to cases of polysemous adjectives. If we read (9) as (9a), the adjective refers to lettuce as food. The meaning of healthy shifts to something like ‘providing the basis for future maintenance of health’. In contrast, reading (9b) refers to the lettuce as an organism. The meaning of the adjective may be glossed with ‘free of diseases’. Similarly for fast highway. In Bierwisch’s terms, what happens is that the meaning of the adjective undergoes a conceptual differentiation and the meaning of the noun is conceptually transferred. Finally a selection mechanism relates what has been differentiated and transferred in such a way as to make it fit.
The approach will not be pursued in detail, but it plausibly suggests that the adjective picks a certain aspect related to or somehow provided by the noun. Which aspect that is, again depends on the adjective. Feasible meaning shifts and combinations are clearly a question of world-knowledge, for if lettuce were in principle not edible reading (9a) would not occur. Consequently, the systematic treatment of polysemous adjectives has to be:

(i) based on general world-knowledge and
(ii) context-dependent.

Bearing this in mind, I would like to have a look at alternative treatments of the problem in order to work out a list of requirements that we want our own theory to fulfil.

1.2 – A Brief Look at Some Solutions to the Problem of Polysemous Adjectives

Pustejovsky and Boguraev’s (1993) type coercion approach which will be introduced and discussed as one possible treatment of polysemous adjectives. It will transpire though that a crucial shortcoming of their treatment is the context-independence of interpretation. In contrast to the coercion approach, Bartsch’s (1987) analysis of semantically underspecified lexical items is context-dependent, but suffers from unsystematicity, because the interpretations from which to choose in a specific context are not generically computed, but manually provided. After we have considered alternative approaches which are insufficient or unsatisfactory in some respect, we can formulate a small set of exemplary problem cases and criteria for evaluation of our own theory. These examples will then be treated in the remainder of this thesis.

The Type Coercion Approach

Thinking about the multiplicity of ways in which an adjective might choose a meaning facet of a noun, makes us doubt that all the possibilities are memorised and wonder whether a systematic explanation accounting for the creativity of the process can be given. One such systematic approach is Pustejovsky and Boguraev’s type coercion approach (Pustejovsky & Boguraev 1993). They argue for an elaborate representational mechanism of lexical knowledge. Lexical representations should include, for instance, information about the word’s argument structure, relations between entries in the lexical knowledge base and, most important for our present concern, the word’s qualia structure.

The qualia structure of a word is a decompositional analysis of the word’s meaning that goes beyond the decomposition into meaning atoms. In the treatment under discussion, the qualia structure is four-fold and splits up into a word’s constitutive, formal, telic and agentive role (Pustejovsky & Boguraev 1993, p.204) such that:

(i) The constitutive role relates the parts the denoted object consists of.
(ii) The formal role places the object in the classification of entities.

(iii) The telic role gives purpose and function.

(iv) The agentive role includes the origin or the how and why of coming-into-existence in the lexical entry.

Qualia structures thus implement world-knowledge in the lexical knowledge representation. This information can be used to explain systematically what meaning aspect of a noun is referred to by a particular adjective. In order to do so, the account proposes a mechanism of type coercion which allows semantic types to be shifted in order to obtain the right interpretation. In the words of the authors, type coercion is a “semantic operation that converts an argument to the type which is expected by a function, where it would otherwise result in a type error.” (Pustejovsky & Boguraev 1993, p.209)\(^1\). The coercion mechanism is captured in the set of type-shifted expressions $$\Sigma_\alpha$$ given for each expression $$\alpha$$. The elements in $$\Sigma_\alpha$$ are called $$\alpha$$’s aliases.

If we apply type coercion to a concrete example of adjectival polysemy, the adjective fast say, the operation of the type-shift mechanism enables an adjective such as fast to be type-shifted so that it combines with the telic role of the accompanying noun. In other words, the set $$\Sigma_{\text{fast}}$$ contains an appropriate alias, so that fast can be linked to the nouns’ telic role. Omitting irrelevant technical detail, suffice it to say that the resulting representations for examples like fast car, fast typist, fast driver or fast computer, indeed match our intuitions. To have an example spelled out, the representation of fast car is given in (10).

\[
(10) \quad [[\text{fast car}]] = \lambda x. \[ \text{car}(x) \]
\]

\[
\quad & \text{CONST}(x) = \{\text{body, engine,…}\}
\]

\[
\quad & \text{FORMAL}(x) = \text{physical\_object}(x)
\]

\[
\quad & \text{TELIC}(x) = \lambda y. \[ \lambda e. \[ \text{drive}(e,y,x) \& \text{fast}(e) \] \]
\]

\[
\quad & \text{AGENTIVE}(x) = \lambda y. \[ \lambda e. \[ \text{create}(e,y,x) \] \]
\]

There are two related crucial objections against the type coercion approach. For one, there are occurrences of fast that do not refer to the telic role, e.g. (11).

\[
(11) \quad \text{a fast song}
\]

\[
\quad \text{fast meal}
\]

\[
\quad \text{fast meeting}
\]

A fast song, for instance, is one which is played fast, so that fast relates to the constitutive role in this example. This is indeed fatal to the coercion view. The reason is that, if $$\Sigma_{\text{fast}}$$ does not

\(^1\) More precisely, there are two types of coercion mechanism, one type coercion and one subtype coercion mechanism. The subtype coercion mechanism is actually responsible for the shift in the correct interpretation of our example fast car. The criticism is unaffected from the simplification of reproduction which is motivated in protecting the reader from an overflow of only marginally relevant detail.
contain the appropriate alias, then we cannot interpret the examples in (11). If, on the other hand, $\Sigma_{fast}$ does contain the appropriate alias, the problem arises which alias to choose. We would then need a mechanism on top of the mechanism to decide which alias is appropriate. Consequently, the type coercion approach is a step in the right direction, because it computes interpretations on the basis of world-knowledge, but cannot explain how the same adjective can relate to different roles in the qualia structure of nouns.

The other problem is similar. There are certainly cases which are ambiguous towards which word sense to choose in the given context (12).

(12) “Principles of Neural Science” is a hard book.

If we want to account for case like (12), we need an additional mechanism again to select the appropriate alias with respect to context. That is why, another general flaw of the type coercion account lies in the local character of interpretation, viz. that it is context-independent.

**Context-dependent Interpretation of Lexical Items**

In contrast to Pustejovsky and Boguraev, Bartsch (1987) gives a context-dependent analysis of, as she has it, *thematically weakly determined expressions*. These are, for instance, adjectives, such as *good*, *successful* or *appropriate*, whose dimension of evaluation is insufficiently determined. In our terminology, thematically weakly determined expressions are semantically underspecified, so her account is of great interest.

Bartsch spells out a compositional semantics for thematically weakly determined expressions and shows how context contributes to the selection of a specific sense. Here, context consists of (i) general context in the form of a *contextual theme* and (ii) more specific context in the form of, as I will call them here, *dimension-fixing expressions*. The contextual theme is given by an extension of a Kaplan-context (Kaplan 1978) to a six-tuple where the additional sixth dimension is the *thematic dimension*. On top of that, the contextual analysis can be made even more specific with respect to certain dimension-fixing expressions. Examples for dimension-fixing expressions are given with some suitable adjectives in (13).

(13) good *as a teacher*

successful *financially*

appropriate *with respect to one’s health*

One of Bartsch’s main concerns is to account for the interaction between general contextual theme and dimension-fixing expressions. More interesting for us is to see how a specific example of semantic underspecification gets its context-dependent interpretation. According to Bartsch, the interpretation of a thematically weakly determined expression, such as the Dutch adjective *flink* (strong, big, courageous …), depends on the meaning aspects of the noun which *flink* is combined with and the context, of course. In (13) combinations with
meaning aspects of the nouns *jongen* (boy) and *borrel* (liquor) are reproduced from the original (Bartsch 1987, p.4).

(14) een flinke jongen

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>wrt character</td>
<td>courageous</td>
</tr>
<tr>
<td>wrt posture</td>
<td>big</td>
</tr>
<tr>
<td>wrt posture</td>
<td>strongly build</td>
</tr>
</tbody>
</table>

een flinke borrel

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>wrt character</td>
<td>strong liquor</td>
</tr>
<tr>
<td>wrt volume</td>
<td>big glass of liquor</td>
</tr>
</tbody>
</table>

Bartsch then shows how, in a compositional semantics with an additional contextual theme and in due consideration of dimension-fixing expressions, the appropriate interpretations come about truth-conditionally.

Unfortunately, Bartsch does not deal with the question how the word senses come about. They have to be assumed as given and it is not clear, for example, why it is that *flink* can relate to *jongen* with respect to posture, but not in connection with *borrel*. Of course, we know why this is. Liquor, or a bottle, can hardly be said to have posture, but this is inference based on world-knowledge that the semanticist Bartsch spares out of her theory.

In sum, Pustejovsky & Boguraev’s coercion view and Bartsch’s context-dependent semantic treatment have inverted merits and flaws. We want a theory that reconciles the desirable aspects of both accounts. In other words, we want a mechanism for the computation of possible interpretations and the chance to select context-dependently.

**Problems to be Addressed in the Following**

The problems that I would like to focus on in the remainder of this thesis are instantiations of the most interesting aspects of adjectival polysemy. A small set of re-occurring examples will be treated as representatives of these aspects. To begin with, the examples (15) – (17) are contrastive examples.

(15) Would you hand me one of the **red apples** from the kitchen table, please?

(16) **Sweet apples** are less appropriate for baking cake.

(17) On summer mornings like these all I like to have is a **pink grapefruit**.

With these examples I aim to show how world-knowledge influences the interpretation of adjective-noun combinations. In particular, I will provide an explanation why *red apples* seem to mean red-skinned apples while *sweet apples* are sweet-pulped and *pink grapefruits* pink-pulped (cf. Blutner 1998a). The example will be covered in Section 3.1.

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I also want to make an effort to include interpretation ambiguous cases where contexts are conceivable which do not allow commitment to either one interpretation (18) & (19).

(18) Farmer Joe is renowned for growing the healthiest lettuce in town.

(19) “Principles of Neuroscience” is a hard book.

Although I am convinced that the actual occurrences of interpretation-ambiguous phrases in concrete conversational contexts are rather seldom, I want the theory to include the possibility to have a no-commitment interpretation. The example will be treated in Section 3.1.

In a sense, one could say that if we cannot decide between two equally likely readings, this is a case of uninterpretability. Other kinds of uninterpretability that I want the theory include are strange formulations (20) and contradiction to interpretations (21).

(20) ? The tractor is pumped up.

(21) ? The apple is red, but its skin is not.

Both examples are taken from Blutner (1998a). I cover these examples in Section 3.2.

1.3 – Theoretical Point of Departure

In the remainder of section 1, I will introduce the theoretical position that serves as our starting point for a solution to the problem of polysemous adjectives and the formal notation with which to represent semantic underspecification in our framework.

Radical Underspecification and 2-Level Semantics

Semantically underspecified sentences occur frequently, they are not exotic exceptions. It was argued that a solution involves context and world-knowledge alike. Thus the problem of adjectival polysemy is situated interestingly at the border between semantics and pragmatics. The view propound here is that lexical units themselves are semantically underspecified and a pragmatic mechanism of contextual interpretation specifies the appropriate sense (Blutner et al. 1996, Blutner 1998a, 1998b).

So far, we have had only the vague notion that a sentential constituent is semantically underspecified if it is responsible for the underspecification of the whole sentence in which it occurs. Though not a major issue of controversy, the postulation of underspecified lexical entries can be supported by the prospects of semantic compositionality: In order to explain the creativity and systematicity of language use, the principle of compositionality comes in handy stating that the meaning of a complex expression can be computed as the meaning of its constituents and their way of combination. The additional premise that some sentences are in some contexts semantically underspecified, leads directly to the proposal that the lexical entries themselves contain a certain degree of room for interpretation, if we assume that the combinatorial system is fixed.
The view that emerges is the so-called *radical underspecification view* introduced in Blutner (1998a, b) according to which semantic compositionality is maintained, but thought to operate on lexical units that may be semantically underspecified. A non-compositional mechanism of pragmatic enrichment takes care of the meaning refinement. The mechanism rests on world- and discourse-knowledge, is hence non-compositional, even non-representational, because it makes direct reference to non-representational measures such as informativeness, salience or relevance (Blutner 1998a, p.139-143).

The notion of meaning bifurcates into a semantic and a pragmatic meaning. Semantic meaning is pure, literal, possibly underspecified meaning devoid of conceptual knowledge. Pragmatic meaning is computed on the basis of the semantic meaning and relies on conceptual world-knowledge and context. In his *two-level semantics*, Bierwisch (1983) proposes the functional notation (22) to express this idea.

\[(22) \quad F (\text{sem. meaning}, \text{context}) = \text{prag. meaning}\]

The pragmatic mechanism of contextual interpretation F maps a semantic meaning and a context onto a pragmatically enriched meaning. The function F is then strictly speaking a transfer function from grammar to conceptual representation.

Two-level semantics and the radical underspecification view are our theoretical point of departure from which to address the problem of adjectival polysemy. However, Blutner (1998a) explicitly makes a step towards dynamic semantics. Therefore, the pragmatic mechanism of contextual enrichment (PMCE) that I will spell out here operates on common grounds and outputs updated common grounds. So the functional formulation that we stick with is (23).

\[(23) \quad \text{The Pragmatic Mechanism of Contextual Enrichment:} \]

\[\text{PMCE} (\text{sem}(\alpha), \text{ct}) = \text{ct}'\]

Here, \(\alpha\) is an utterance, \(\text{sem}(\alpha)\) is its possibly underspecified semantic representation and \(\text{cg}\) and \(\text{cg}'\) are common grounds such that \(\text{cg}'\) is \(\text{cg}\) updated with the pragmatic meaning of \(\text{sem}(\alpha)\) depending on \(\text{cg}\). Sections 2 and 3 are entirely concerned with the elaboration of PMCE with respect to the pragmatic interpretation of the semantic underspecification of polysemous adjectives. But before we can tackle the problem formally, we have to find a formal representation for it.

**A Free Variable Represents the Dimension of Evaluation**

The semantic underspecification in a given semantic representation \(\text{sem}(\alpha)\) is represented with the help of a free variable \(\sigma\) that can, but need not, be instantiated by PMCE given a common ground. The idea of using free variables traces back to Bierwisch’s (1989) work on the semantic analysis of adjectives. Bierwisch treats the lexical entries for adjectives as underspecified in the way that each entry contains a pair of free variables \((Q, C)\) where \(C\) is a free variable for the comparison class and \(Q\) for the dimension of evaluation. While \(C\) is
crucial for the semantics of adjectives in normal, comparative, equitative and superlative use, Q is the key to deal with the problem of adjectival polysemy.

How then is the free-variable used to represent a particular problem case, say the discrepancy between, on the one hand, *pink grapefruit* having a pink inside and, on the other, the *pink panther* which is presumably blood-red inside? I propose to equip the semantic representation of a lexical item like *pink* with an additional argument variable $\sigma$ of a special status. Exemplary underspecified representations and possible specifications are given in like (24) and (25).

(24) $\text{pink}(x, \sigma) \& \text{grapefruit}(x)$

$\text{pink}(x, \sigma=\text{flesh}(y)) \& \text{grapefruit}(x) \& \text{part_of}(y, x) \& \text{flesh}(y)$

(25) $\text{pink}(x, \sigma) \& \text{panther}(x)$

$\text{pink}(x, \sigma=\text{fur}(y)) \& \text{panther}(x) \& \text{part_of}(y, x) \& \text{fur}(y, x)$

The need for an additional free variable is obvious, if we consider the alternatives. To begin with, from the underspecified representation (26) we cannot infer that the grapefruit is somehow related to the predicate *pink*.

(26) $\text{pink}(x) \& \text{grapefruit}(y)$

$\text{pink}(x) \& \text{grapefruit}(y) \& \text{flesh}(x, y)$

In other words, the predicate *pink* is not linked to the predicate *grapefruit* in any way. This is not the situation that results from hearing the phrase *pink grapefruit*. We know that something about the grapefruit is pink and what it is, is part to be inferred, but not that pink itself is related to the grapefruit.

Formulation (27) is no better. We know that the grapefruit is pink, but we cannot relate the colour to the appropriate part.

(27) $\text{pink}(x) \& \text{grapefruit}(x)$

$\text{pink}(x) \& \text{grapefruit}(x) \& \text{flesh}(x, y)$

Finally, the variant put forward by Blutner (1998a, p. 148) which is reproduced in (28), but adapted to the current example, is less ambitious than mine, because it already states that it is a part of the grapefruit which carries the colour pink.

(28) $\text{grapefruit}(x) \& \text{part}(d, x) \& \text{color}(x, u) \& u=\text{pink}$

$\text{grapefruit}(x) \& \text{part}(d, x) \& \text{flesh}(x) \& \text{color}(x, u) \& u=\text{pink}$

The question is plainly, Where does this information come from? If we really wanted to include the, admittedly far-fetched, case where *red apple* denotes a green-skinned apple with a red brand sticker, (28) has already made too much of a commitment which has to be retracted.
Consequently, semantic underspecification of adjectives will be represented by an additional free-variable \( \sigma \) in the way exemplified in (24) & (25). Although I write free variable in the tradition of Bierwisch, \( \sigma \) is not free in the sense that a variable is free in quantified predicate calculus. In the present context, \( \sigma \) is a free variable in the sense that it is not instantiated. To complicate matters more, what instantiates \( \sigma \) are literals. However, the confusing terminology is practicable since free and bound variables in the usual sense will not play a role in the theory.

Two things remain to be shown: How a free variable can be instantiated and that the specified representations can be given the desired semantics. If \( P \) is a formula in conjunctive normal form, a free variable \( \sigma \) in a literal \( \varphi(x, \sigma) \) of \( P \) can be instantiated with a literal \( \psi(y) \) iff \( \varphi(y) \) and \( \psi(y) \) both occur \( P \). Note that, \( x \) and \( y \) need not necessarily be distinct. For efficiency of future parlour, let’s say that \( \varphi(x, \sigma), \varphi(y) \) and \( \psi(y) \) unify to \( \varphi(x, \sigma = \psi(y)) \), \( \varphi(y) \) and \( \psi(y) \). If we extend the unification relation to cover instantiation of free variables, we can subsume the instantiation effortlessly under the factoring procedure of an abductive proof (cf. Section 3.1).

To make plausible that the \( \sigma \)-formulas sufficiently express what they are intended to, I propose to read a formula with \( \sigma \) either free (29) or instantiated (31) as spelled out in (30) and (32) respectively.

\[
\begin{align*}
(29) & \quad \text{healthy}(x, \sigma) \land \text{lettuce}(x) \\
(30) & \quad x \text{ is a lettuce which is healthy in some sense} \\
(31) & \quad \text{healthy}(x, \sigma = \text{organism}(x)) \land \text{lettuce}(x) \land \text{organism}(x) \\
(32) & \quad x \text{ is a lettuce which is healthy (in the sense that it is healthy) as an organism}
\end{align*}
\]

1.4 – Summary of Section

Semantic underspecification is the property of a semantic representation whose meaning depends on context to be made definite. Polysemous adjectives are one of several possible causes for the semantic underspecification of sentences and the aim of this thesis is to explain systematically the problem of polysemous adjectives. The task of the following sections is to spell out the pragmatic mechanism of contextual enrichment (PMCE) that interprets adjective-noun combinations. Conceptually PMCE rests on Blutner’s radical underspecification thesis (Blutner 1998a, b) and Bierwisch’s two-level semantics (Bierwisch 1983). PMCE can be depicted as a function, \( \text{PMCE} (\text{sem} (\alpha), \text{ct}) = \text{ct}' \), which operates on common grounds. With regard to alternative treatments of the problem of polysemous adjectives, we worked out a set of exemplary problem cases and requirements for a solution. In effect, we want PMCE to explain how world-knowledge provides interpretation alternatives and how context chooses the right candidate. The following section is therefore concerned primarily with the criteria for choosing the right interpretation.
Section 2: Pragmatic Interpretation

In the last section the problem of adjectival polysemy has alternatively been referred to as a problem of selection or as a problem of interpretation. This is not a matter of indecisiveness, but due to the fact that interpretation can be sensibly characterized as selection. In particular, this is the view on philosophical hermeneutics as an interpretative discipline propagated by Ineichen (1991) which fits beautifully as a frame into which to sketch the bi-directional optimality theoretic approach to pragmatic interpretation that I will introduce in this section.

Basically, a selection problem is of the following structure. First, a set of possible candidates has to be generated, or alternatively assumed as given from which to select. The selection mechanism is a set of criteria for choosing the right candidate. Applied to text interpretation in the field of philosophical hermeneutics, Ineichen sees the generation of possible interpretation hypotheses as an automated, uncontrollable process. His focus of attention rests on the criteria of evaluation according to which one hypothesis is preferable over another and, highly interesting for our present purpose, the norm for the quality of an interpretation hypothesis is the intention of the author (Ineichen 1991, p.69). In other words, a good interpretation is closer to the originally intended sense than a bad interpretation. We will find a parallel between this view on text interpretation in hermeneutics and a view on the interpretation of single sentences in linguistics.

The basic idea of interpretation via selection allows for at least two continuations. On the one hand, the general architecture of a selection problem outlined above finds a one-to-one correspondence in optimality theoretic semantics. On the other hand, considerations about interpretative principles have been core matter to radical pragmatics, a line of research that stands heir to Gricean ideas about conversational maxims. Both directions will be looked at separately in Sections 2.1 and 2.2. The two strands drawn together are the basis for our pragmatic mechanism of contextual enrichment. The general framework of PMCE will be presented in Section 2.3 as the synthesis of optimality theory semantics and radical pragmatics.

2.1 - Optimality Theory

The standard view of classical generative grammar is that linguistic forms are terminal representations of sequences of applications of rewrite rules. In contrast to that, the basic idea of optimality theory is that linguistic forms are not computed by rewrite rules, but by a three-component system consisting of a generator GEN, an evaluator EVAL and a set of ranked constraints CON. For each given input the generator creates a set of possible outputs out of which the evaluator chooses the optimal candidate with regard to the set of constraints such that an output is optimal if it violates fewer high-ranked constraints than all the others.
Only recently has optimality theory been extended to semantics and pragmatics. Hendriks & de Hoop (2001) characterize their optimality theoretic semantics (OTS) as “Optimality Theory applied to the interpretative domain.” The basic assumption is that natural language interpretation is an optimisation, or as I would prefer to call it, a selection problem: From a set of possible interpretations for a given sentence the optimal interpretation is selected. More precisely, in OTS the stance of the hearer is taken, the syntactic representation of an utterance functions as input and the output is the semantic interpretation of that utterance which scores optimal with respect to the given constraints. With this conception, Hendriks & de Hoop go to the extreme and abandon the classical idea of a compositional semantics based solely on syntax and semantic specification in the lexicon (cf. Heim & Kratzer 1998) and in its stead propose a free interpretation hypothesis according to which the set of possible interpretations as the generator produces it is initially unrestricted. Consequently, the step from syntax to interpretation is crucially and solely a matter of the content and the ranking of the constraints and the status and characteristics of OTS stand and fall in unison with CON.

The set of constraints employed by Hendriks & de Hoop is a heterogeneous accumulation of syntactic, semantic and pragmatic principles. Reference is made to concepts such as syntactic constituency, topic, markedness of expressions or semantic relations. Cast in this light, it is apparent that OTS is incompatible with the view of two-level semantics. We postulated underspecified semantic representations and we sought for a pragmatic mechanism of enrichment. OTS, in contrast, omits the level of semantic representation and moves directly from syntax to interpretation. So, unfortunately, OTS in the form presented by Hendriks & de Hoop (2001) does not suit our needs, although the general conception of interpretation as an optimisation/selection problem is appealing. In order to make it fit, we have to amend the nature and role of the constraints and the form of the in- and output. That is what we will do in Section 2.3. The constraints will ultimately be pragmatic interpretation principles of a Gricean provenance.

**2.2 - Pragmatic Interpretation Principles**

**Gricean Pragmatics**

Paul Grice sowed the seed for fruitful pragmatic research in his William James lectures delivered 1967 at Harvard University where his two main points of concern were a theory of meaning anchored on the notion of speaker’s intention and the bridging of the gap between the asserted content of a sentence, viz. *what is said*, and the intended content, viz. *what is meant*. The inference from what is said to what is meant relies on the assumption, so Grice proposed, that speaker and hearer are co-operating. Essentially, Grice formulated a central co-operative principle (1) and a number of subordinate maxims of conversation (2) which serve as interpretative principles to license the inference from what is said to what is meant (Grice 1989, p.26-7).
(1) **The Co-operative Principle:**

Make your contribution such as is required, at the stage at which it occurs, by the accepted purposes or direction of the talk exchange in which you are engaged.

(2) **The Maxims of Co-operation:**

- **The Maxim of Quality:**
  
  Try to make your contribution one that is true, specifically:
  
  (i) do not say what you believe to be false
  
  (ii) do not say what you lack evidence for

- **The Maxim of Quantity:**
  
  (i) make your contribution as informative as is required for the current purposes of the exchange
  
  (ii) do not make your contribution more informative than is required

- **The Maxim of Relevance:**
  
  Make your contributions relevant

- **The Maxim of Manner:**
  
  Be perspicuous, and specifically:
  
  (i) avoid obscurity
  
  (ii) avoid ambiguity
  
  (iii) be brief
  
  (iv) be orderly

Although the maxims seem to express a norm for the speaker, the rationale behind them is that the hearer assumes the speaker to be co-operating and to be obedient to the maxims. On the basis of this assumption, the hearer can infer what is meant. Thus, Gricean maxims are interpretation principles, inference drawn on the basis of which are called *conversational implicatures*.

Levinson (1983) explicitly states two distinct ways in which the maxims and the co-operative principle can be used to bridge the gap between *what is said* and *what is meant*. One is the *observation* of the maxims by the speaker which to assume forces me to take serious what I am told or asked (Quality) assume that all that is said is important (Quantity), or relate what I am told to what has been said earlier (Relevance). Example (3) is Grice’s own example for a relevance-based conversational implicature of this latter kind (Grice 1989, p. 32).

(3) I am out of patrol.

There is a garage round the corner.

The other type of inference stems from *floutings* or *exploitations* of the maxims. Here, the speaker obviously breaches a maxim, but is still thought to obey the overarching co-operative
principle, hence breaking the maxim for a communicative reason. The conversational implicatures that arise from infringements are more sophisticated. Usually, metaphor, irony or rhetorical questions are explained with this scheme. One of Grice’s examples is the metaphor in (4) which he treats as an example for an exploitation of the Quality maxim (Grice 1989, p.34).

(4) You are the cream in my coffee.

A basic weakness of the formulation of Grice’s maxims is that central concepts like informativeness or relevance are indeed obscure. Another is, that the arrangement of the maxims in direct allusion to the Aristotelian Categories is certainly sophisticated, but also bears an air of artificiality. Consequently, we are not satisfied with the original Gricean pragmatics due to *structure* and *formulation* of the maxims. We will have a look at amendments to both problems. The lack of formality persists to be a problem until Section 2.3.

**Neo-Gricean Pragmatics: Speaker and Hearer Economy Principles**

In the following, I want to introduce a line of research called *radical pragmatics* or *neo-Gricean pragmatics* which is constituted, among others, by the work of Atlas & Levinson (1981), Levinson (1987) and Horn (1984). As a solution to the redundancy and arbitrariness of the maxims, radical pragmatics proposes a reduction to only two opposing interpretative principles, namely *hearer* and *speaker economy*, or, for short, Q and I. The idea of counterbalancing forces of speaker and hearer economy is due to Horn (1984). Although thought to be opposing forces, both principles enrich the interpretation, i.e. make what is pragmatically interpreted *more* than what is actually said. I would like to introduce the idea of economy principles and their fundamental status as communication principles by an example of my own:

A man with a suitcase walks up to another man. They look sternly at each other without display of emotion, only a slight flicker of recognition escapes their fixed stare. The man with the suitcase nods slowly, the other man lets the gesture pass, settle and then repeats it. The men part. The informer with the suitcase has successfully delivered his message!

It goes without saying that this is not prototypical communication. But the extreme case is instructing to begin with. It is plausible to assume that the information had exactly 1 bit. That is why nodding was sufficient under the prerequisite that the recipient knew the question to which he was told the answer by nodding. Let the conveyed message be that the boss’ wife’s birthday party will include chocolate cake *as usual*. The fact that nodding is a gesture to express affirmation remains untouched. That is to say, we do not question the *conventional meaning* of symbols. Yet, in order to let the interpreter understand the nodding properly, he has to assume that the informer obeys the same communicational principles for expression that he himself employs for comprehension. Accordingly, the informer also relied on the fact that the decoding strategy of the recipient was equal to his encoding method. Had the
informer grimaced instead, the other party would not have known what to make out of it, and had the recipient asked: “What do you mean by nodding? Will we have chocolate cake or not?”, he would not only have undermined his coolness, but also have disproved his communicative capability. Hence, as the example shows, shared and mutually acknowledged communication strategies are seemingly banal, but fundamentally necessary.

The extreme example of tacit understanding did not only rest upon the fact that both parties knew what the communicative issue at hand was. On the contrary, even if it is shared knowledge, i.e. both know that the respective other knows that (…), this does not suffice, unless what is also shared is the principle that normal situations are described normally and the additional premise that nodding is a normal way to confirm a normal situation. Since the informer could rely on all that, it was not only sufficient to have nodded, but saying a hundred words about it is superfluous. This is the intuitively plausible idea of the speaker economy principle, or I-principle. Since the ratification of the unspoken contract on how to speak is bilateral, formulations of communication principles will naturally come in equivalent pairs, once for speakers, once for hearers. So the I-principle can be either formulated as in (5) where it is most obvious that it is the speaker’s effort that is economised, or as in (6) where the same idea is portrayed from the comprehension perspective and looks more like the interpretation principles that it actually is.

(5) Give the minimal amount of information necessary to be understood.

(6) Extract as much information out of a message as possible.

Viewed from the interpretation perspective, (6) means that if a speaker tries to economise on his speaking effort, what we infer to be the meaning of his speech is more precise than what he literally said (Atlas & Levinson 1981). Inference as such then crucially rests on mutually shared knowledge to trigger normal or stereotypical interpretations. In other words, when we have a usual setting to describe, there are usually efficient routine ways of doing so. The I-principle is said to collect the second part of Grice’s Quantity maxim, the maxim of Relevance, and arguably all the Manner maxims (Horn 1984). The most concise formulation is (7) where Q is the balancing principle introduced below. The apparent cross-reference between principles in formulations (7) and (14) will be dealt with after the Q principle got introduced. A very detailed, careful and elaborate reproduction can be found in Levinson (2000, p.114-5).

(7) I-Principle – Speaker Economy:

Say no more than you must (given Q). (Horn 1984).

The kinds of conversational implicatures usually attributed to application of the I-principle are pragmatically enriching inferences like bridging (8), conditional perfection (9), conjunction buttressing (10) or inferences to stereotype (11). The symbol ‘I→’ precedes inferences based on the I-principle.
(8) Dave unpacked his lunch box. The potatoes were still a little warm.
I→ The potatoes inside the lunch box were still a little warm.

(9) If there is a vowel on one side, then there is an odd number on the other.
I→ If there is an odd number on one side, then there is a vowel on the other.

(10) They married and got a child.
I→ They married and then got child.

(11) John spoke to the high-school student.
I→ John spoke to the drug-dealing teenage criminal.

It is obvious that a speaker economy principle alone would go berserk, since the most economic possibility for a speaker would just be one syllable with unlimited expressive power. To pick up the above example again with the two men making arrangements for the birthday party: Had the message been that not only chocolate cake, but this year for the first time strawberry ice-cream was also on the wish list, the informer could have nodded and shaken his head to the wildest. Without speaking, he would not have been understood. More often than not, we cannot understand out of the blue, and, also more often than not, things worthwhile communicating are not stereotypical or normal at all. Instead, we usually need clues at least and we need to be told enough to be able to interpret. Put the other way around, the whole inference load cannot be put on the shoulders of the recipient. Hence, what we need is a balancing force to the above speaker economy principle, namely a hearer economy principle or Q-principle, preliminarily glossed from the speaker perspective in (12) and from the hearer perspective in (13).

(12) Be as informative and precise as you can.

(13) Assume that what you got is all the speaker has to offer.

The mechanism by which the Q-principle contributes to specifying the communicated message is negative. That is, in assuming that the speaker is as informative as he can, the interpreter can rely on what has not been said to infer what is meant. The idea is that encoding what was meant sometimes depends not only on what has been said, but also on what has not been said. Foremost where close linguistic or conceptual alternatives are conceivable, speaker commitment to one alternative in favour of another is the water on the mill of the interpreter. Hence, the inferred meaning is more definite than the literal meaning (Atlas & Levinson 1981). The Q-principle is though to correspond to the first part of Grice’s Quantity maxim. Again, I will confine myself to the formulation in (14) (cf. Levinson 2000, p. 76).

(14) **Q-Principle – Hearer Economy:**
Say as much as you can (given I). (Horn 1984).

The way in which the Q-principle establishes conversational implicatures needs a little elaboration. Actually, there are two discernible paths from a sentence over hearer economy to interpretation to the effect that Levinson (2000) maintains two principles, Q and M, where we
only have Q. Both ways involve reasoning about what the speaker has not said, but the one employs Horn scales, while the other relies on the notion of markedness. However, the way use is made of the Q- and I-principles in Blutner’s account doesn’t need the further distinction entertained by Levinson (Blutner 2002, p.162).

The first strategy to use Q is that if there is an alternative linguistic candidate nearby which is stronger than the one used, the implicature is that the speaker purposefully refrained from giving the informationally stronger statement. We infer that the speaker knows that the stronger statement is false, for scalar implicature like (15) or (16), or that the speaker does not know whether the stronger statement is actually true, as in clausal implicature like (17).

(15) Some of my fellow students are bores.  
\[ Q \rightarrow \text{The speaker holds true that not all of them are.} \]

(16) You are a good kisser.  
\[ Q \rightarrow \text{The speaker holds true that you are not fantastic at it.} \]

(17) If Debbie goes to the concert with Jason, Cathy will feel left out.  
\[ Q \rightarrow \text{The speaker does not know whether Debbie goes with Jason or not.} \]

What expressions form suitable pairs for inferences within this reasoning scheme can be represented by so-called \emph{Horn scales}. Horn scales are n-tuples of expressions with related meaning, ordered in such a way that every element entails all the following, weaker expressions logically, e.g. \langle all, some\rangle, \langle hot, warm\rangle or \langle know, believe\rangle.

The other strategy relies on the notion of \emph{markedness} instead of Horn scales. On the signifié side, marked forms are more complex than their corresponding unmarked form, while on the signifiant side they seem to have a less usual connotation than their simplex. Examples for marked/unmarked-pairs are (to make rise, to raise), (mansion, house) or (not unhappy, happy). The reasoning scheme for Q-inference based on markedness is as follows: If a speaker chooses a marked from, he describes a marked situation. Horn (1984 p.22-3) termed this the \emph{division of pragmatic labour}. The Q-principle licenses this inference step, because if the speaker deliberately employs a more complex form M from a marked/unmarked-pair (M,U), he is aiming for that part of the meaning that M and U share which is not via I-implicature pre-empted by U. Examples of this kind are bountiful. Consider for instance cases where periphrastic phrases are used instead of simpler lexicalized ones (18), the effect of litotes (19) or the meaning shifts of lexical doublets (20).

(18) John made the plate rise.  
\[ Q \rightarrow \text{John did not really raise the plate. He may be a magician.} \]

(19) The chief was not unhappy with the development.  
\[ Q \rightarrow \text{He wasn’t exactly happy.} \]

(20) They build a mansion in Georgetown.  
\[ Q \rightarrow \text{It was not a house.} \]
At this point it becomes obvious why the formulations (7) and (14) were interdependent, i.e. why Q referred back to I and vice versa. The case of Q-implicatures based on markedness makes it all too clear when seen from the production perspective: Saying as much as possible, i.e. obeying Q, is only allowed within the borders set by I, because prolixity needs justification. It is by this cross-reference of principles that marked forms actually mean what they mean, namely that part of the meaning that the corresponding unmarked forms do not pre-empt (Blutner 1998a, 2000). In other words, as Blutner shows, the interdependency of formulation is necessary for the technical realisation of the division of pragmatic labour.

Let me briefly sum up what has been said about pragmatic interpretation so far. We saw that Gricean maxims, although formulated as norms for speech behaviour, are essential interpretation heuristics. Assuming the speaker is co-operating is a means for the listener to bridge the gap between what is said and what is meant. The workings of the maxims can be sensibly subsumed under two principles balancing hearer and speaker economy, viz. Q and I. Inferences drawn on the basis of these economy principles are both informational upgrades, but they operate in different directions. While I-ineferences are inferences to stereotypic or normal interpretations, Q based reasoning is negative, in the sense that it involves counterfactual ‘what else could have been said’-reasoning. The next important question is, how does pragmatic interpretation relate to polysemous adjectives.

Interpretation of Polysemous Adjectives can be explained by Q- and I-Inferences

Of course, Q and I also relate to the interpretation of adjectives as is shown by the following examples.

(21) It was a good movie.
    \[Q \rightarrow \text{The speaker holds true that the film was not excellent.}\]

(22) The audience was not unpleased.
    \[Q \rightarrow \text{The speaker holds true that the audience was not exactly pleased.}\]

The Q-implicature (21) rests on the Horn scale <excellent, good>. Double negation of an adjective gives rise to a Q-implicature based on markedness, as exemplified in (22). Most naturally, I-inference can be made responsible for the interpretation of polysemous adjectives as in (23) and (24).

(23) I like pink grapefruits best.
    \[I \rightarrow \text{The speaker likes grapefruits with pink flesh best.}\]

(24) Could you get me a red apple, please.
    \[I \rightarrow \text{The speaker wants to have an apple with a red skin.}\]

The reasoning that leads to the I-implicature in (23) is as such: Had the speaker meant the kind of grapefruits that are sold with the pink brand sticker, in contrast to the ones with the red brand sticker, he should have said so, because this would not be the normal or unmarked situation and should therefore not be described with an unmarked form. Analogous for (24).
The obvious problem now is that the I-implicatures are correct and exactly of the kind that we need to solve the problem of adjectival polysemy, but the reasoning is so far just based on the mythic knowledge of what is normal and what is not. It has to made explicit how world-knowledge feeds the pragmatic principles to allow the appropriate inferences. How world-knowledge licenses stereotypical inferences is explained in Section 3.1. The point to note here is that we can subsume the interpretation of adjectives under a general pragmatic principle.

Another thing that we cannot explain adequately at the present state is the role of context. As the explication of example (23) suggested, it might as well be the case that the conversation is strictly about two brands of white grapefruits. In such a case the phrase pink grapefruit might sensibly and non-ambiguously be used to refer to grapefruits with a pink brand sticker, if, for example, the brand sticker is a reliable perceptual criterion to keep the two kinds of grapefruits apart. Talking about the role of context thus also brings to mind the question of cancellability of interpretations.

**Cancellability of Interpretations is Context-Dependency**

One of the properties of conversational implicatures that was highly debated and still gives rise to some controversy (Levinson 1983 p.112-118, Blutner 1998a) is the cancellability of implicatures. Conversational implicature can be contradicted explicitly or by other implicatures so that they do not arise. In this sense the Q-based implicature in (25) that not all students came is overwritten by the explicit statement that all of them did.

(25) Some of the students came to the exam, in fact, all of them did.

Since I sought to explain pragmatic interpretation of adjectives in terms of Q- and I-implicatures, the question arises whether pragmatic interpretations are cancellable in any appropriate sense and, if they are, whether this can be included in the theory. The funny answer is that they are not cancellable in a reasonable way of saying so, but we can include cancellability in the theory anyway.

In order to shed light on the nature of cancellability a brief look at the concept of *monotonicity* is due. Monotonicity is the property of a consequence relation defined formally in (26).

(26) Let $\Sigma$ and $T$ be sets of formulas. $\varphi$ is a formula, and $\sim$ is an arbitrary consequence relation. $\sim$ is *monotone* iff the following holds:

$$\Sigma \sim \varphi \Rightarrow (\Sigma \cup T) \sim \varphi$$

Classical logical consequence is monotone in the sense defined in (26). In contrast, common sense reasoning is non-monotone, because it is possible to add premises to the

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2 The effect of context on the interpretation of adjectives does not fall under the scope of the Q- and I-principle, as far as I see it. One could argue that the I-principle in fact licenses it to refer to white grapefruits with pink brand stickers as pink grapefruits in an appropriate discourse and/or perceptual context. But the reason why this is licensed has to be explained somewhere else. That is why in the concrete model of Section 3 context affects the computation of interpretations while the general operation of the pragmatic principles is unaffected.
effect that formerly feasible inferences are no longer correct. The standard example in non-monotonous common sense reasoning is that if Tweety is a bird, Tweety can fly, but this conclusion is defeated, or cancelled, by the additional, non-contradictory, but more specific, hence over-ruling premise that Tweety is in fact a penguin. Thus, an inference \( \varphi \) from a set of premises \( \Sigma \) is cancellable if there is a set \( T \) such that \( \varphi \) does not follow from \( \Sigma \cup T \).

Pragmatic interpretations cannot be said to be cancellable in this sense, unless we provide an ordering on contexts, because to say that an interpretation is feasible in a given context \( c \), but not in an alternative context \( c' \) is not enough. In fact, classical logical derivability has this property: A formula \( \varphi \) may follow from a set of premises \( \Sigma \), but not from an alternative set of premises \( T \). To say that interpretations are non-monotonic inferences in the sense defined above, a further requirement has to be made on \( c \) and \( c' \), namely that \( c' \) is more specific than \( c \), or that \( c' \) is a refinement, but in essence the same as \( c \). That amounts to saying that we need an ordering on contexts according to their specificity if we want to make sense of the claim that interpretations are defeasible in the logical sense.

Although pragmatic interpretations are not cancellable in the strong sense, they may be said to be cancellable in another sense. Even in the absence of any ordering on contexts, we can make intuitive sense of normal and informationally rich contexts. Hence, we can speak of a cancellable interpretation if it arises in a normal context \( c \), and if there is a more specific, informationally rich context \( c' \) in which it does not arise. The difference to the strong cancellability notion refuted above is that here \( c' \) can be completely different from \( c \).

It should be clear now that speaking of cancellability with respect to pragmatic interpretations is not appropriate. Interpretations are context-dependent. That is what makes them hold in one context \( c \) and not in another \( c' \) – whatever relation holds between \( c \) and \( c' \). On top of that, we can make plausible that there are default interpretations, namely those which arise in a normal context. Default interpretations may not arise in informationally rich contexts. In the framework of PMCE, we could equate a normal context with the plain database which represents world-knowledge. An informationally rich context would then be any contextually modified database with different axiom costs or additional facts (cf. Section 3.2).

Taken together, we can subsume the interpretation of adjectives under I-inferences. It then has to be explained how exactly world-knowledge and context influence these inferences. Finally, I have argued that it is better to speak of context-dependency with respect to interpretations of adjectives than to refer to cancellability. Thus, we have found pragmatic interpretation principles, namely a speaker and a hearer economy principle, which can be brought to cover the interpretation of adjectives. It is now time to integrate the collected theoretical fragments and paint a concrete picture of the pragmatic mechanism of contextual enrichment on the basis of these.
2.3 – Architecture and Properties of the Pragmatic Mechanism of Contextual Enrichment

I will first give the outline of PMCE as the synthesis of optimality theory and neo-Gricean interpretation principles. Then, I will explain the concept of optimality in PMCE.

Bi-Directional Optimality Theory with Pragmatic Interpretation Principles

Two approaches to interpretation have been independently introduced that are now to be merged into one, preferably so that the particular weaknesses fall away and the respective strengths combine. As first part of the cake to bake, we had optimality theoretic semantics. Here we moaned that it does not match our initial theoretical point of departure, two-level semantics, because it transfers directly from syntax to pragmatic interpretation. The two flaws, as we noted, lay in the assumed form of the input-output pairs and the diversity of employed constraints. These will have to be amended. So, what is retained from optimality theoretic semantics is the general architecture of optimality theory consisting of GEN, CON and EVAL that fitted nicely into the picture of interpretation as selection.

The other half that adds up to the pragmatic interpretation mechanism are Q and I. This results in two more or less severe modifications to the optimality theoretic blueprint – modifications which correspond to the noticed drawbacks, of course. As a first amendment to the optimality theoretic frame, Q and I will take the role of the constraints. Doing so is obviously highly plausible, since Gricean maxims are pragmatic interpretation heuristics. But doing so also bears consequences to EVAL, because only two constraints are left which are, to make it even worse, not ranked as usual, but interdependent. Since the double claim is that (i) two are enough and (ii) interdependency is crucial, a different conception of optimality has to be defined. To make it clear, the normal definition that an output is optimal if it violates fewest high-ranked constraints in comparison to all the other generated candidates is unsuitable for a set of two interrelated constraints.

A novel conception of optimality, is called upon for another reason, too. We will not just generate and evaluate interpretations alone, but the competitors will be form-meaning pairs, because it makes no sense to say that an interpretation is *per se* good.3 An interpretation is only good as an interpretation of something. The point can be further supported by the sketchy line of argumentation that from the original Gricean maxims some concern what is said, others refer to what is meant (Blutner 1998a, p.131). Thus, what needs to be compared and evaluated are form-meaning pairs, not interpretations alone.

It is now discernible that the resulting optimality theoretic approach to pragmatic interpretation is, contrary to what we find elsewhere in optimality theory, a *bi-directional*

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3 The term form-meaning pair is slightly misleading. What is precisely meant are pairs of the form \( \text{sem}(\alpha), m \) where \( \text{sem}(\alpha) \) is the potentially underspecified semantic representation of an utterance \( \alpha \) and \( m \) is a possible pragmatic enrichment of \( \text{sem}(\alpha) \). To make matters worse, I will also write just \( \alpha \) instead of \( \text{sem}(\alpha) \) for readability reasons and congruence with Blutner (1998a, 2000).
optimality conception. We would speak of a *unidirectional* approach, if for a given input separate output representations would be generated, these alone applied to constraints and thereby evaluated. But we make reference to both input and output alike, because it has been shown that we need a of negative reasoning over alternative formulations in pragmatics. In other words, the comprehension perspective involves taking the stance of the speaker in order to understand why a certain formulation was chosen instead of another. That is why the Blutner’s program qualifies as a bi-directional optimality theoretic approach to pragmatic interpretation (Blutner 2000, 2002). As such, it also stands heir to radical pragmatics, because it crucially rests on communicative principles as interpretative heuristics.

**Optimal Interpretations**

It became clear that for several reasons the concept of optimality has to be revised. We are therefore looking for a formalisation of the idea that an interpretation *m* is optimal for a given semantic representation *α*. We will define an optimal interpretation of *α* simply as the meaning part of an optimal pair (*α*,*m*). Dealing with form-meaning pairs is not to suggest that there are two independent optimisations. Instead, what we would like to have is one procedure that optimises speaker and hearer economy at the same time, because else we would find two absurdities as optimal candidates for each strand, namely the omnipotent syllable as the choice of the speakers and the never-ending rapper as the choice of the hearers. That is why we define optimality of form-meaning pairs as in (27).

\[(27) \textbf{Optimality of a Form-Meaning Pair} \]

A pair (*α*,*m*) is optimal iff it satisfies both Q and I.

The crucial question is: When does a form-meaning pair satisfy Q and I? In order to answer this, we have to formalise Q and I. The only thing we need to do so is an ordering on pairs. If we can find a mapping COST: (*α*,*m*) → N which represents the numerical likelihood that *α* pragmatically means *m*, (28) and (29) are straight-forward.

\[(28) \textbf{I-Principle (Strong Version)} \]

(*α*, *m*) satisfies the I-principle iff there is no (*α*, *m’*) ∈ GEN(*α*) such that COST(*α*,*m’*) < COST(*α*,*m*)

\[(29) \textbf{Q-Principle (Strong Version)} \]

(*α*, *m*) satisfies the Q-principle iff there is no (*α’,* m*) ∈ GEN(*α*) such that COST(*α’,*m*) < COST(*α*,*m*)

It is apparent that the formulation of the principles allow exactly the kinds of inferences that we attributed to them. I-inferences are inferences to the stereotypic, normal or cost-minimal interpretations. Q-inferences consider what else might have appeared on the form side.

The one thing that the above formulations miss is the cross-reference between principles. Yet cross-reference was shown to be essential to interpret marked formulations properly. That is why we add further conditions as conjuncts in the antecedents to the formulation. The
obtained version of optimality, given in (29) and (30), is weaker than the previous, because more candidate pairs fail the antecedent with the additional cross-reference condition than without and hence satisfy the whole criterion.

(30) **I-principle – Preferred Weak Version**

$(\alpha, m)$ satisfies the I-principle iff there is no $(\alpha, m') \in \text{GEN}(\alpha)$ that satisfies the Q-principle and $\text{COST}(\alpha, m') < \text{COST}(\alpha, m)$

(31) **Q-principle – Preferred Weak Version**

$(\alpha, m)$ satisfies the Q-principle iff there is no $(\alpha', m) \in \text{GEN}(\alpha)$ that satisfies the I-principle and $\text{COST}(\alpha', m) < \text{COST}(\alpha, m)$

This is the reason why Blutner uses the terms *weak optimality* (Blutner 2000, p.203) and *strong optimality* (Blutner 2000, p.199-200). The previous discussion already showed that weak optimality is to be preferred.

I will write $\text{Opt}(\alpha)$ for the set of weakly optimal pairs with respect to $\alpha$. Sometimes I will speak loosely of optimal interpretations $m \in \text{Opt}(\alpha)$. These are any $m$ such that there is an $\alpha'$ with $(\alpha', m) \in \text{Opt}(\alpha)$. Likewise will I speak, more often than not, of the set of optimal interpretations for $\alpha$ when I mean $\text{Opt}(\alpha)$.

It is necessary to discuss some of the formal properties of the set of optimal interpretations for a given expression $\alpha$, because they play a crucial role in the following. In particular, the explication of $\text{Opt}(\alpha)$’s properties reveals some minor misconceptions in Blutner’s original proposal that I intend to amend.

The cost function was introduced as mapping into the natural numbers. Hence, the ordering relation is a well-founded relation. Jäger (2000) proofs that under this assumption the set $\text{Opt}(\alpha)$ has a *unique solution* despite the circularity in definition. Moreover, the set of optimal interpretations in also computable. A suitable recursive algorithm can be found in Dekker and van Rooy (2000, p.234).

I want to add some of my own: A unique solution is not necessarily different from the trivial solution. It needs to be shown that it is possible that $\text{Opt}(\alpha)$ is not the empty set. Since the ordering relation $<$ on $\mathbb{N}$ is a well-founded relation, it follows that there is a unique smallest element $(\alpha', m) \in \text{GEN}(\alpha)$ with respect to its COST-value. This $(\alpha', m)$ satisfies both Q and I. Hence $\text{Opt}(\alpha)$ contains at least one element.

$\text{Opt}(\alpha)$ may contain more than one element. This is for example the case, if two pairs $(\alpha, m_1)$ and $(\alpha, m_2)$ have the same COST-value $c = \text{COST}(\alpha, m_1) = \text{COST}(\alpha, m_2)$ and all other pairs in $\text{GEN}(\alpha)$ have non-smaller COST-values than $c$. This constellation will occur in the analysis of interpretation ambiguous phrases.

It also needs to be mentioned that I slightly altered Blutner’s definition of the Q- and I-principles. I wrote $\text{GEN}(\alpha)$ where originally there is reference to a “general constraint C
defining the set of possible pairs” (Blunter 1998a, p.131). If we quantify over all possible form-meaning pairs, as Blutner’s notation seems to suggest, the obvious result is that we have always the same set Opt(α) for all α. The elements of Opt(α) would not necessarily relate to α at all. That is why I wrote GEN(α) to refer to the set of all form-meaning pairs that are crucial for the interpretation of α. GEN(α) is formally defined in (32).

\[
\text{(32)} \quad \text{GEN}(\alpha) = \{ (f,m) \mid m \text{ is an interpretation of } \alpha \text{ & } f \text{ is either } \alpha \text{ or an alternative formulation for } m \}
\]

Using GEN(α) instead of a general constraint C, we take alternative formulations for all possible interpretations of α into account, as is necessary for a non-trivial application of the Q-principle. But we break the circle right when it threatens to start and do not consider any alternative interpretations of the alternative formulations.

An unfortunate consequence that thereby comes to attention is that the set Opt(α) may also lack a pair (α',m) with α=α'. That is to say, all the alternative formulations and some of their interpretations are optimal pairs, but there is no optimal interpretation for α. According to the analysis that I want to put forward in Section 3.3, this is one the reasons for the uninterpretability of pragmatically anomalous phrases.

2.4 – Summary of Section

In the beginning of this section, we equated interpretation with selection of an optimal candidate from a number of possible candidates. This general view is held by optimality theoretic approaches to interpretation and we had a look at one such approach, namely OTS by Hendricks and de Hoop (2001), in Section 2.1. After that I introduced a different line of pragmatic research which is based on Grice’s theory of conversational implicatures. We encountered the Q- and I-principle for speaker and hearer economy and saw how these are applied generally to account for pragmatic phenomena and how they can also be brought to cover the interpretation of adjectives in Section 2.2.

The resulting overall picture of the pragmatic mechanism of contextual enrichment was outlined in Section 2.3. PMCE combines optimality theory with neo-gricean interpretation principles. The constraints CON are formulations of speaker and hearer economy principles that make reference to form-meaning pairs. The evaluator EVAL selects the optimal pairs. A form-meaning pair is optimal if it satisfies Q and I simultaneously. I listed a number of properties of Opt(α), the set of optimal interpretations for α, which will play a role later on. Opt(α) has a unique, non-trivial solution. It may contain more than one element and may consist entirely of pairs in which α itself does not occur. The generator GEN generates all relevant pairs (sem(α'),m) for α: All possible interpretations m for α and alternative formulations for all such m are considered, but not alternative interpretations for the alternative formulations etc.
Apart from this latter restriction on GEN, the main focus of Section 2 was on the general outline of our PMCE as a bi-directional optimality theoretic approach with pragmatic interpretation principles and the formal treatment of CON and EVAL. The next section will therefore enlarge on the generator. In particular, we have to address the questions, how form-meaning pairs are generated and how the cost-measure that we need in Q and I is provided.
Section 3: The Pragmatic Mechanism of Contextual Enrichment

Understanding what is meant is relating what is said to what we already know. If we cannot connect the new information to previous utterances, or if the new information contradicts encyclopaedic or situational knowledge, or if the current statement impairs our picture of what the speaker believes or intends, the feeling of having understood is marred. This is the basic point of departure from which we set out to compute pragmatic interpretations on a knowledge base which represents world and discourse-knowledge which is shared by the participants of a conversation. I will introduce and discuss the properties of such a knowledge base as a common ground.

The inference process by which possible pragmatic interpretations are derived from the knowledge base is weighted abduction, because it fits the demands of natural language interpretation neatly, as will be shown. Given a logical formula \( \text{sem}(\alpha) \) as input to the common ground, abduction computes a set of possible pragmatic interpretations, or enrichments, \( m \). On top of that, it provides the necessary numerical measure \( \text{cost}(\alpha, m) \) which is needed for Q and I. The set of abducted pragmatic enrichments that satisfy the Q and I criteria count as optimal interpretations and are the basis on which the update is determined.

The resulting PMCE therefore consists of three steps:

(i) The abductive variants are computed on the basis of the knowledge base by weighted abduction.

(ii) The optimal form-meaning pairs are selected using the Q and I principles and the cost-measure supplied by the abductive proof.

(iii) On the basis of \( \text{Opt}(\alpha) \), the update is determined.

The pragmatic interpretation principles (ii) have been covered in sufficient detail in Section 2. This section is dedicated entirely to the remaining steps, namely abduction (i) and consistency checking (iii). That is why, first the status of the knowledge base and the abduction method will be explained in Section 3.1. On the way, we will be able to cover some of the prototypical examples of the problem of adjectival polysemy. The treatment follows by and large the account of Blutner presented Blutner et al. (1996) and Blunter (1998a, 1998b, 2000). I have here and there added depth of detail, but confined myself to small amendments only with respect to the treatment of polysemous adjectives. Next, the computation of a feasible update for the common ground is discussed in Section 3.2. Here I deviate largely from the proposal’s of Blutner. The reasons why I do so will be spelled out as we go along.
3.1 – Abduction Derives Possible Interpretations From the Common Ground

The Common Ground is Mutually Shared Knowledge

In order to account for the effect of world-knowledge on the interpretation of adjectives, we compute enrichments on a knowledge base that contains the knowledge mutually shared by all the participants of a conversation. This set of mutually believed facts about the world makes it possible to use semantically underspecified lexical items to convey a more precise and more definite meaning. It makes sense to speak of this mutually shared background knowledge as a common ground in the sense of Stalnaker (1978, p.321). We can further assume that the kind of world-knowledge in question is so fundamental that it is common knowledge in the sense given in Halpern (1995, p. 4) that “common knowledge is, informally, the infinite conjunction of the statements ‘everyone knows, and everyone knows that everyone knows, and everyone knows that everyone knows…”.

If we include only strictly common knowledge in the common ground, we can omit epistemic predicates and reasoning thereon (for an alternative treatment cf. Zeevat (1995)). This is indeed a simplification and some phenomena cannot be properly accounted for. There are certainly occasion where epistemic asymmetry, in the sense that the hearer knows something that the speaker does not, influences interpretation, but we will keep matters simple and represent only common knowledge in the knowledge base.

Doing so enables us to equate common grounds with sets of possible worlds or, alternatively, a conjunction of logical formulas. An update of a common ground cg with a proposition α is written and defined as cg[φ] = {m ∈ cg | m ⊨ φ}, that is each update discards all those possible worlds that are no longer consistent with the new information contained in φ. In concrete, the knowledge base will be represented as a Horn-clause knowledge base. An update of a Horn-clause knowledge base cg with a conjunction of literals φ is simply cg ∪ φ, that is φ is added as a new fact to the knowledge base. The represented world-knowledge is supposed to be as straight-forward, intuitively plausible and simple as possible.

Properties and Status of Abductive Inference in General

Abduction is the non-valid inference form given in (1).

\[
(1) \quad \Phi \Rightarrow \Psi, \quad \Psi \Rightarrow \Phi
\]

As a real life example, suppose you see the tree outside your window move (Ψ) and you conclude that it is a waving in the breeze (Φ), because you know that the wind moves trees like that (Φ ⇒ Ψ). Since abduction is logically invalid inference from, depending on what status we assign the implication, effect to cause or from observation to explanation, it is especially suited for the purpose of natural language interpretation which is, as we saw, inferring what is meant, i.e. what ‘caused’ the utterance, from what is said.
Abductive inference has a couple of interesting properties which make it especially suitable for natural language interpretation. To start with, it is uncertain inference to the extent that several, even incommensurable explanations may be derived. Just think of adding \( X \Rightarrow \Psi \) to the premises in (1). Doing so, we get both \( X \) and \( \Phi \) as alternative explanations, so-called abductive variants, and the problem arises how to compare and choose from the alternatives. The abduction mechanism thus serves as the generator: For a given logical formula \( \text{sem}(\alpha) \), our semantically underspecified representation, a set of interpretation alternatives is computed from which to select the optimal ones. The choice will be the task of the pragmatic Q and I principles, and the measure they compare numerically will be the proof-cost of each abductive variant. Abduction that includes numeric information to compute proof-costs is called weighted abduction (Hobbs et al. 1993, Stickel 1989).

Proof-costs are computed for all abductive variants as the abduction process proceeds. We assume that all axioms of the knowledge base are paired with a non-negative number called axioms costs and that further in each axiom the body’s literals are assigned non-negative numbers called weights. An entry in the abductive knowledge base therefore looks like (2) where the \( P_i \) are literals with weights \( w_i \) assigned. \( Q \) is the head of the clause and \( ac \) is the axiom cost.

\[
(2) \quad Q \leftarrow^{ac} P_1^{w1} \land P_2^{w2} \land \ldots \land P_n^{wn}
\]

A closer look at the meaning of the numbers in the knowledge base and their contribution to the abductive proof procedure is pursued later on in this section.

Another important property of the abductive inference procedure is non-monotonicity. If inference is taken to mean abductive inference to consistent explanations, then this is defeasible inference in the strong sense introduced in section 2.2. A consistent abductive inference from premises \( \Pi \), though derivable from \( \Pi \cup \Pi' \), need not be consistent with \( \Pi \cup \Pi' \). Take for instance the case where we add \( \neg \Phi \) to the list of premises in (1), we still obtain the abductive variant \( \Phi \), but obviously \( \Phi \) is no longer consistent with the knowledge base. This also highlights the necessity to check all abductive variants for consistency. Of course, we are only interested in consistent interpretations which do not contradict our prior knowledge. So, abductive inference to consistent interpretations is defeasible.

The particular mechanism of pragmatic interpretation is non-monotonous in another sense, too. While the above mentioned kind of defeasibility is due to consistency, the other kind arises if we furthermore employ the proof-costs to calculate optimal interpretations. Obviously, adding facts to the knowledge base can alter proof-costs. What had to be costly assumed beforehand, can be proven once we learn that it is a fact. So, abductive inference to the cost-minimal interpretation is defeasible, too.

Both sources of defeasibility not only make sense for natural language interpretations in general, but also affect the problem of adjectival polysemy. (3) shows how one interpretation
is out due to inconsistency and (4) shows how a preceding context introduces facts which render one interpretation more likely than the other.

(3) Due to bioengineering, it’s absolutely poisonous. It will kill you on the spot, if you eat the slightest bit, but it is healthy lettuce.

(4) I do not use any pesticide. Chemicals are no good. It’s healthy lettuce, for sure.

Apart from the aforementioned two there is yet another third source for defeasibility which should not go unmentioned. Pragmatic interpretation involves common-sense reasoning which is default reasoning in that it assumes normality – an assumption which may have to be retracted from time to time. For our present concern, this would come into play if we were to employ, for instance, the world-knowledge that normally apples have a green or a red skin. In more or less exceptional cases, may it be yellowish, brown if foul, or pink if painted by Warhole. To the very best of my knowledge there seems to be no easy way in which the default character of common-sense reasoning, though fundamental to pragmatic interpretation as well, can be implemented in an abduction scheme. That is why I will not consider abnormal cases.

The normality assumption should not be confused with the etc-predicate: A fundamental problem occurs for abduction on a Horn-clause knowledge base, because we reason from phenomenon to explanation, from object to compounds or from genus to species (Hobbs et al. 1993). However conceived, it comes down to the problem that abduction is back-ward chaining. In order to license the implication arrow in the wanted direction we have to introduce an additional etc-predicate to collect all the conditions that are not spelled out (5).

(5) apple(x) ← part_of(y,x) & pulp(y) & part_of(z,x) & skin(z) & (...) & etc

Normally, we would infer from the fact that there is an apple that the apple consists of decent parts with certain properties. For instance, we would like to infer that an apple consists of a pulp and a skin among other things. But we can only reason backwards in abduction and therefore the conditions on the right hand side in (5) have to be sufficient conditions. The etc-predicate collects all the unmentioned criteria. I will nevertheless write (...) next to the etc-predicate, because I assume that the knowledge base is sufficiently precise. The notation (...) frees me from listing all the worldly information that is irrelevant for the examples, although it is supposed to be included in the knowledge base. The etc-predicates are therefore not a notational shortcut, but a crucial element to collect all the differentiae.

To sum up, abductive inference is inference to the best explanation. It seems suitable for natural language interpretation, because it has some very convenient properties. Abductive inference is uncertain and non-monotonous. The exact kind of defeasibility is three-fold: Consistency, cost-minimality and normality assumptions can be responsible for the cancellation of abductive inferences. It still has to be explained in sufficient detail how the
abductive proof procedure works and how the proof-costs are computed on the basis of axiom costs and weights. This is done in the following.

**Technical Details and Formal Properties of the Abduction Process**

The input to the knowledge-base is a conjunction of literals $G_0$. Throughout the abductive proof every literal in subsequent goal clauses $G_i$ is marked either *proofed*, *assumed* or *unsolved*. Initially, all literals in $G_0$ are marked unsolved. Contrary to the usual **PROLOG** inference procedure where proofed literals are removed from the goal clauses, literals are marked as proofed or assumed but retained to allow future factoring (see below). An abductive proof is completed when all literals in a goal clause are either proofed or assumed. Hence, for an input $G_0 = Q_1, \ldots, Q_n$ the computed proof on a knowledge base $cg$ ends with what I will call an *enrichment* $[Q_{i(1)}, \ldots, Q_{i(j)}, P_1, \ldots, P_k, Q_{i(j+1)}, \ldots, Q_{i(n)}, P_{k+1}, \ldots, P_m]$ of $G_0$ on $cg$ where $i$ is a permutation of $(1, \ldots, n)$, $P_1, \ldots P_m$ are additionally assumed or proofed literals and. We do not care about the ordering of literals in the goal clauses although it would play a role in the actual implementation, of course. I will write $\text{ENRICH}_{cg}(G_0)$ for an enrichment of $G_0$ on $cg$. Note that there may be several enrichments, because abduction may produce several abductive variants. If it is clear which common ground is meant or if it does not matter, I will omit the index.

Enrichments can be divided in two sets \{Q_{i(1)}, \ldots, Q_{i(j)}, P_1, \ldots, P_k\} of proofed literals and \{Q_{i(j+1)}, \ldots, Q_{i(n)}, P_{k+1}, \ldots, P_m\} of assumed literals. The assumed literals are what we are interested in most, because what had to be assumed is the new information. I will call the set of assumed literals in $\text{ENRICH}_{cg}(G_0)$ an *explanation* of $m$ on $cg$ and write $\text{EXPL}_{cg}(m)$. The obvious relations between an explanation of $G_0$ on $cg$ and $G_0$ are given in (6) and (7).

\[
\begin{align*}
(6) \quad & cg \models \text{EXPL}_{cg}(\text{ENRICH}_{cg}(G_0)) \rightarrow G_0 \\
(7) \quad & cg \cup \text{EXPL}_{cg}(\text{ENRICH}_{cg}(G_0)) \models G_0
\end{align*}
\]

For all enrichments the cost function returns the integer proof-cost as it is computed after the proof. During the proof only the axiom costs are incremented, such that, even if one particular axiom is used several times during the proof, its axiom costs are added up only once. At the end of the proof the assumption costs are computed. If the axiom costs, weights and assumption cost are all non-negative, the axiom costs never overestimate actual costs and may therefore serve as search heuristic in an iterative deepening, depth-first search, so that the abductive variants are computed in cost-minimal order (cf. Stickel 1989).

During an abductive proof four operations are possible. If the current goal clause is $G_k = Q_1, \ldots, Q_n$ and $Q_i$ is the leftmost unsolved literal choose the unique possibility from the following:
(i) **Resolution with a fact**
If $Q_i$ is resolvable with a fact, and $\phi$ is the corresponding most general unifier, the resulting goal clause $G_{k+1}$ has $Q_i$ marked as proofed and all literals unified with $\phi$. Add the axiom cost of the fact.

(ii) **Resolution with a rule**
If $Q_i^w_l$ is resolvable with a rule $Q_i \leftarrow P_1^w l_1, \ldots, P_m^w l_m$, and $\phi$ is the corresponding most general unifier, the resulting goal clause $G_{k+1}$ has $Q_i$ marked as proofed, the additional literals $P_1^w l_1, \ldots, P_m^w l_m$ added and all literals unified with $\phi$. The weights are multiplied. Add the axiom costs of the rule.

(iii) **Making an assumption**
Any unsolved literal can be marked as assumed.

(iv) **Factoring**
If $Q_i$ is a proofed or assumed literal in $G_k$, and $\phi$ is the most general unifier allowing for unification of $Q_i$ and $Q_j$, $Q_i$ is removed in the resulting goal clause $G_{k+1}$ and all literals are unified with $\phi$. The smaller weight is used further.

**How World-knowledge Affects Interpretation: The Example of Red Apples and Pink Grapefruits**

The workings of the abduction mechanism can best be understood with the help of an example. One of the problematic aspects of adjectival polysemy is the distinct interpretation of *red apple*, *pink grapefruit* on the one hand and *red apple* and *sweet apple* on the other. I will show how the most important abductive variants for the interpretation of *red apple* and *pink grapefruit* are computed. The other contrast pair is a case of analogy then. The initial goal clauses are the semantically underspecified formulas (8) and (9) and a successful interpretation on the basis of abduction would include the literals given in (10) and (11).

(8) $\text{sem}(\text{red apple}) = \text{red}(x, \sigma) \& \text{apple}(x)$

(9) $\text{sem}(\text{pink grapefruit}) = \text{pink}(x, \sigma) \& \text{grapefruit}(x)$

(10) $\text{red}(x, \sigma = \text{skin}(y)) \& \text{apple}(x) \& \text{skin}(y) \& \text{part_of}(y, x)$

(11) $\text{pink}(x, \sigma = \text{flesh}(y)) \& \text{grapefruit}(x) \& \text{flesh}(y) \& \text{part_of}(y, x)$

Let’s first have a look at the treatment by Blutner. The gist of Blutner’s suggestion how (10) comes out as an abductive variant of (8) is, briefly put, that the knowledge base contains information about the components of apples (Blutner 1998a). Apples consist of skins and pulps among other things, both of which have a colour. The literal that represents the skin’s colour is cheaper than the literal that represents the pulp’s colour. This corresponds to the intuition that the colour of an apple’s skin is more salient than the colour of the pulp. So, in Blutner’s treatment, the free variable in (8) is instantiated with the salient component.
Such a treatment works fine for apples. Obviously, the skin of apples is more salient than the pulp with respect to colour. But why then is the situation reversed for pink grapefruits? Of course, the inside part of the grapefruit is not the most relevant part visually. As for apples, the skin is visually salient. The reason why pink grapefruit is interpreted to denote a fruit with pink flesh is simply that there are some grapefruits with white and others with pink flesh who are too equal in skin colour to be sensibly discriminated. The same holds, I think, in the case of the apple. The very reason why I usually think of red-skinned apples when I hear red apples is that I know that there are exactly two kinds of apples in the world, namely red-skinned and green-skinned ones both of which are white inside. Consequently, I suggest that the relevant world-knowledge that is responsible for the interpretation of the examples looks approximately like (12) and (13).

\begin{align}
(12) \text{apple}(x) & \leftarrow \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{white}(y) \land \text{part\_of}(z, x) \land \text{skin}(z) \land \\
& \quad \text{green}(z) \land (...) \land \text{etc} \\
\text{apple}(x) & \leftarrow \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{white}(y) \land \text{part\_of}(z, x) \land \\
& \quad \text{skin}(z) \land \text{red}(z) \land (...) \land \text{etc} \\
(13) \text{grapefruit}(x) & \leftarrow \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{inside\_of}(y, x) \land \text{pink}(y) \land \\
& \quad \text{part\_of}(z, x) \land \text{skin}(z) \land \text{yellow}(z) \land (...) \land \text{etc} \\
\text{grapefruit}(x) & \leftarrow \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{inside\_of}(y, x) \land \text{white}(y) \land \\
& \quad \text{part\_of}(z, x) \land \text{skin}(z) \land \text{yellow}(z) \land (...) \land \text{etc}
\end{align}

An abductive proof of (8) would then take the initially unsolved literal \(\text{apple}(x)\) and find at least the two rules given in (12) for suitable unification. (14) shows the result of resolving (8) with the rules in (12). Note that unsolved literals are not stained with any subscript. Only the proven literals are indexed with \(P\).

\begin{align}
(14) \text{red}(x, \sigma) \land \text{apple}(x)^P & \land \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{white}(y) \land \text{part\_of}(z, x) \land \\
& \quad \text{skin}(z) \land \text{green}(z) \land (...) \land \text{etc} \\
\text{red}(x, \sigma) \land \text{apple}(x)^P & \land \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{white}(y) \land \text{part\_of}(z, x) \land \\
& \quad \text{skin}(z) \land \text{red}(z) \land (...) \land \text{etc}
\end{align}

Now we see that \(\text{red}(x, \sigma)\) and \(\text{red}(z)\) in the second clause of (14) can be factorised (cf. Section 1.3). Factoring is obviously not possible for the other clause in (14). Other abduction steps, like further resolutions with suitable rules or assumptions of literals, will occur, before the proof is completed, but the relevant part of the pragmatic interpretation is just the unification of \(\text{red}(x, \sigma)\) and \(\text{red}(z)\), so that we can contend ourselves with a look at the result in (15) and proceed to analyse the implications of the suggested solution.

\begin{align}
(15) \text{red}(x, \sigma = \text{skin}(z)) \land \text{apple}(x)_P \land \text{part\_of}(y, x) \land \text{pulp}(y) \land \text{white}(y) \land \\
& \quad \text{part\_of}(z, x) \land \text{skin}(z) \land \text{red}(z) \land (...) \land \text{etc}
\end{align}
In fact, my proposal might not seem much of a solution at first glance, because the knowledge base just included the fact that the skins of apples are red. Why, the objection goes, is this in any sense better than listing the possible word senses? Where exactly is the systematicity hiding? If we have to write down for every red object where it is red, then this amounts to listing word senses.

Of course, I reject this objection, because the argument falls victim to various oversights. First of all, the problem has indeed been shifted into the conceptual domain. Still, this is not to say that it is solved by enumerating, because what is spelled out in rules (12) and (13) is world-knowledge we certainly have about apples. That means, we are not listing word senses, but we are explicating world-knowledge as it is responsible for the proper interpretation of the phrase red apple. In the present case the relevant knowledge is so banal that it does not seem like a solution to the problem at all. But this view misconceives the problem. The problem of adjectival polysemy was to see how world-knowledge feeds pragmatic interpretation. Despite the apparent simplicity of the example, this is exactly what has been done. The systematicity of interpretation is not threatened at all.

The point of the example is to show what world-knowledge is relevant to abduce the correct interpretation. What is missing is inclusion of the proof-costs. I may have shown how the red-skin interpretation is one abductive variant, but this is only the first step out of three. It remains to be demonstrated how it comes about that a given interpretation scores optimal under the eyes of Q and I. In order to do so, we have to calculate the proof-costs and this presupposes treatment of the weights and axioms. The question to be addressed next therefore is: What is the meaning of the numbers in the abductive database?

**Probabilistic Semantics for Weighted Abduction**

Introducing a numerical measure for proof-costs is pairing symbolic and numeric schemes of representation. This poses difficulties, but can also be very effective. If we have the symbolic representation bigger(John, Mary), we may add the absolute amount that John is, say, 12 cm bigger than Mary. In our abductive database we find not absolute, but relative numeric information. Consider, for example, the component analysis of a hammer: We assume that a hammer consists of a handle, a head and glue, nothing else. Obviously the glue component, though indubitably there, is rather uninteresting. So it makes sense to assign numeric values as in (16) to the component analysis in order to weigh the relevance that the parts have compared to each other.

(16) hammer : handle 0.45 & head 0.45 & glue 0.1

Similarly, we assign weights to the literals in the bodies of clauses according to their relative conceptual contribution to the concept given in the head.

Charniak and Shimony (1990) propose a probabilistic semantics for weighted abduction. As in the hammer example, the weights within one axiom correspond to the conceptual
contribution of the particular literals to the head of the axiom (17). Put in probabilistic terms, that means that the reversed conditional probability that $Q$ given $P_i$ should be proportional to the weights $w_i$ (18).

(17) $Q \leftarrow P_1^{w_1} \& P_2^{w_2} \& \ldots \& P_n^{w_n}$

(18) $w_i \sim \log P(Q \mid P_i)$

The weights are thus, unlike example (17), smaller for conceptually more prominent literals. This makes perfect sense, if we consider that during the abductive proof it should be allowed to assume likely literals, rather than unlikely literals.

The values of weights that relate are not only those of literals within one axiom, but also those that are literals in axioms with the same head (19).

(19) $Q \leftarrow P_{1,1}^{w_{1,1}} \& P_{1,2}^{w_{1,2}} \& \ldots \& P_{1,m(1)}^{w_{1,m(1)}}$

$Q \leftarrow P_{2,1}^{w_{2,1}} \& P_{2,2}^{w_{2,2}} \& \ldots \& P_{2,m(2)}^{w_{2,m(2)}}$

$(\ldots)$

$Q \leftarrow P_{n,1}^{w_{n,1}} \& P_{n,2}^{w_{n,2}} \& \ldots \& P_{n,m(n)}^{w_{n,m(n)}}$

(20) $\Sigma_j P_{ij} \sim \log P(\Lambda_j P_{ij} \mid Q)$

Here: $\Lambda$ denotes conjunction over indexed literals.

The sum of weights of a given clause $i$, viz. the total weight $\Sigma_j P_{ij}$, is thought proportional to the reversed conditional likelihood that these $P_i$ are true given $Q$ (20). Consequently, the total weights rank different axioms with the same head according to the probability that a given instance of $Q$ is substituted with these literals.

The probabilistic interpretation of weights can be made clearer with an example. In (22) two concepts connected with the word lettuce are spelled out in very rough detail.

(21) lettuce(x) ← part_of(y,x)\(^0\) & leaves(y)\(^{0,1}\) & green(y)\(^{0,05}\) &

plant(x)\(^{0,2}\) & (\ldots) & etc\(^x\)

lettuce(x) ← vegetable(x)\(^{0,2}\) & food(x)\(^{0,1}\) & (\ldots) & etc\(^y\)

The weights are supposed to show the relative conceptual contribution along the following lines: The leaves of a lettuce conceived as a plant are much more prominent than its trunk. If we consider lettuce as food, the concept food should be more prominent than the more specific vegetable.

On the basis of the probabilistic interpretation of weights, proof-costs turn out to be relative probabilities, too. A cheaper abductive variant is a more probable conceptual enrichment than an expensive one, because the cheaper proof involved rules that were more likely true given their head (20) and assumed literals that were more characteristic of the concept in question (18). Consequently, minimal proof-costs reflect the likeliest pragmatic interpretation.
The probabilistic interpretation according to Charniak & Shimony, did not mention axiom costs, although it related different axioms with the same head according to their likelihood of affecting the interpretation. In connection with a concrete example I will propose to use axiom costs to include the contextual effects on the interpretation of polysemous adjectives.

**How Context Affects Interpretation: The Example of Healthy Lettuce**

In the following I want to demonstrate how we can account for the interpretation ambiguous example *healthy lettuce*. Let the two possible interpretations be:

\[(22) m_1 = \text{‘healthy organism’} \]
\[m_2 = \text{‘healthy food’} \]

It needs to be shown how in principle both interpretations can come out, so that on rare occasions the underspecification cannot be resolved. Further I want to explain how contextual preference for either alternative can be included.

Let's assume that both $m_1$ and $m_2$ can be computed as abductive variants from a suitable knowledge base. Interpretation preference is solely a matter of proof-costs for $m_1$ and $m_2$. As was shown in section 2.3, both interpretations come out as optimal if the proof-costs are equal and no other interpretation has a smaller proof-cost. Thus it is in principle possible, but admittedly unlikely to have both $m_1$ and $m_2$ as optimal interpretations in the model.

On the other hand, one interpretation will be preferred over the other, if it has a smaller proof-cost. The effect of context on interpretation therefore has to affect proof-costs. One possibility to alter the proof-costs is to add facts to the knowledge base on the basis of which the proof can be computed cheaper than would be possible without these facts. Another, possibility lies in the idea of Stickel (1989, p. 241) to include dynamically adjusted axiom costs to represent the contextual salience of certain facts. This is certainly a neat modification, because we can maintain the probabilistic interpretation of the weights. And it is also a plausible extension. Certain concepts are contextually highlighted, others are in the background. If we are talking about food $m_2$ is supposedly the more likely reading, because the concept of lettuce as food is activated (23). But if we are talking about farming, then $m_1$ is (24).

\[(23) \text{lettuce}(x) \leftarrow ^{0.7} \text{part_of}(y,x) \& \text{leaves}(y) \& \text{green}(y) \& \text{plant}(x) \& (...) \& \text{etc} \]
\[\text{lettuce}(x) \leftarrow ^{0.2} \text{vegetable}(x) \& \text{food}(x) \& (...) \& \text{etc} \]

\[(24) \text{lettuce}(x) \leftarrow ^{0.2} \text{part_of}(y,x) \& \text{leaves}(y) \& \text{green}(y) \& \text{plant}(x) \& (...) \& \text{etc} \]
\[\text{lettuce}(x) \leftarrow ^{0.7} \text{vegetable}(x) \& \text{food}(x) \& (...) \& \text{etc} \]

The question is just, what concepts come into focus when what happens? I will try to make the following proposal plausible. If in a previous utterance a certain concept $C$ is mentioned, then the associated concepts, the concepts that have a conceptual relation to $C$, are more likely
to be preferred in interpretations of following utterances. In order to model the relation between concepts, we could assume that the literals which occur as a head of a rule in the knowledge base are connected with each other in a semantic network. The semantic network implements association relations between concepts such that when a literal $L$ that represents a concept $C$ is proved or assumed, activation spreads over the net starting from $C$. If a concept $C'$ is thus activated, i.e. \textit{semantically primed}, by the occurrence of $C$, all the axiom costs of rules with $L'$, the literal that represents $C'$, as a head are reduced proportional to the level of activation of $C'$.

In summary, I suggest that in addition to the conceptual analyses in the knowledge base, a form of representation for relations of concepts is necessary. One natural candidate is a semantic net and I tried to outline in rough detail how the two forms of representation could be combined in order to incorporate contextual preference on interpretation. The contextual effect can then be modelled by dynamic axiom costs. We have also seen examples for the influence of world-knowledge. Abduction over a common ground computes the interpretation alternatives $m$ for $\alpha$. The optimal pairs $\text{Opt}_{\text{cg}}(\alpha)$ are determined by $Q$ and $I$ with the help of the proof-costs as a numerical measure for the likelihood that $\alpha$ means $m$. So far we have dealt with the abduction procedure and the computation of optimal pairs, $\text{Opt}_{\text{cg}}(\alpha)$, in sufficient detail. What remains to be discussed is the third and last step of PMCE, namely the computation of a feasible update for $\text{cg}$ on the basis of $\text{Opt}_{\text{cg}}(\alpha)$.

3.2 – From Optimal Interpretation to Upgrade

The pragmatic mechanism of contextual enrichment that we are looking for was supposed to return an update for an utterance in a situation. We wrote $\text{PMCE}(\alpha, \text{cg}) = \text{cg'}$. This section is concerned with the step from $\text{Opt}_{\text{cg}}(\alpha)$ to a suitable update $\text{cg'}$. Here, my treatment differs from Bluntner’s. I will first lay out why I find Blutner’s arrangements unsatisfactory. Next, I will provide an alternative account of my own. My treatment also allows to have a subsequent systematic look at cases of uninterpretability.

\textbf{Pragmatically Licensed Updates – Blutner’s Treatment}

Instead of an explicit construction procedure for a suitable update on the basis of optimal form-meaning pairs, the only thing that we find in Blutner (1998a) is the criterion that the update must be \textit{pragmatically licensed}. The definition of this property consists of two conditions, (26) and (27), which are said to be somehow related to Grice’s maxim of Quality. An update $\text{cg}[\alpha]$ is a pragmatically licensed update of $\text{cg}$ with $\alpha$ iff it satisfies (25) and (26) (Blutner 1998a, p.133).

\begin{enumerate}
  \item (25) For each $m \in \text{Opt}(\alpha)$: $m$ is consistent with $\text{cg}[\alpha]$ \label{eq:25}
  \item (26) $\text{Opt}(\alpha)$ is not empty and the disjunction of all $m \in \text{Opt}(\alpha)$ holds in $\text{cg}[\alpha]$ \label{eq:26}
\end{enumerate}
But unfortunately the conditions are ignorant of the actual form and properties of the set \( \text{Opt}(\alpha) \) (cf. Section 2.3). I will briefly explain why the criteria are inappropriate.

Several interpretations may survive \( Q \) and \( I \) at the same time. In other words, \( \text{Opt}(\alpha) \) may contain more than one optimal interpretation. Therefore condition (25) that all \( m \in \text{Opt}(\alpha) \) have to be consistent with the updated common ground has unwanted effects. Consider (27) as an interpretation ambiguous case where one interpretation \( m_1 \) is out due to consistency and thus the other \( m_2 \) is selected.

(27) It will ruin your health, but it’s healthy lettuce.

In this case, there are no pragmatically licensed updates at all, because (25) is wrong for \( m_1 \), even though \( m_2 \) would be a feasible interpretation.

The first part of condition (26) is superfluous, because \( \text{Opt}(\alpha) \) always contains at least one element. The second part of condition (27) allows infinitely many updates as pragmatically licensed, many of which bear all relevance to the utterance \( \alpha \). To make this last point clear, consider the trivial case where the disjunction consists of only one conjunction \( m \) of literals. It would then be a pragmatically licensed update according to (25) and (26) to add the formula \( m \& p \) for any arbitrary consistent formula \( p \) to the common ground.

Consequently, from the given criteria only the very basic idea can be saved. We have to check for consistency, the optimal interpretations may become empty, although \( \text{Opt}(\alpha) \) is never empty in the first place, and we do not need all of the computed enrichment as an update to the common ground. I next try to give an alternative construction procedure which calculates the update, not an infinite set of updates, on the basis of the optimal form-meaning pairs.

**Constructing the Update from Optimal Form-Meaning Pairs**

The construction procedure which I want to put forward consists of three steps:

(i) Get rid of inconsistent interpretations
(ii) Get rid of irrelevant interpretations
(iii) Extract the update from the remainder

Since abductive variants and consequently the optimal interpretations need not be consistent with \( \text{cg} \), we have to kick out all the inconsistent optimal interpretations, since they do not qualify as updates. That is why, as the first step in filtering the update out of \( \text{Opt}_{\text{cg}}(\alpha) \), we compute the set \( \text{Con}_{\text{Opt}_{\text{cg}}}(\alpha) \) which contains all the consistent optimal interpretations, \( \text{Con}_{\text{Opt}_{\text{cg}}}(\alpha) = \{ (\alpha, m) \in \text{Opt}_{\text{cg}}(\alpha) \mid m \text{ is consistent with } \text{cg} \} \).

A consistent optimal interpretation \( (\alpha', m) \in \text{Con}_{\text{Opt}_{\text{cg}}}(\alpha) \) need not be an interpretation of \( \alpha \). It may also be that it is an interpretation of an alternative formulation \( \alpha' \neq \alpha \) and is hence entirely irrelevant for the computation of an update for \( \alpha \). Consequently, we trim the set
Con_Opt_cg(\(\alpha\)) once more to obtain the set Rel_Con_Opt_cg(\(\alpha\)) of relevant interpretations for \(\alpha\). Formally, Rel_Con_Opt_cg(\(\alpha\)) = \(\{(\alpha',m) \in \text{Con_Opt_cg}(\alpha) \mid \alpha' = \alpha\} = \{(\alpha,m) \in \text{Con_Opt_cg}(\alpha)\}.

Finally on the basis of Rel_Con_Opt_cg(\(\alpha\)), we can determine the update such that:

(i) If Rel_Con_Opt_cg(\(\alpha\)) = \emptyset, then \(cg' = \text{undefined}\)

(ii) If Rel_Con_Opt_cg(\(\alpha\)) = \{(\alpha,m)\}, then \(cg' = cg[\text{EXPL}(m)]\)

(iii) If Rel_Con_Opt_cg(\(\alpha\)) = \{(\alpha,m_1), (\alpha,m_2), \ldots, (\alpha,m_n)\}, then \(cg' = cg[\text{CONJOIN}(m_1,m_2, \ldots, m_n)]\)

for any \(n \in N \geq 2\).

I will briefly comment the cases in reversed order:

The motivation underlying the treatment of case (iii) with the additionally introduced CONJOIN-operation is that if several equally probable and consistent interpretations exists, we extract from the alternatives all the information they share. What they do not include in common, may hence not be taken as an update of the expression. Special care has to be taken with respect to adjectives and their free-variables \(\sigma\). If two alternative interpretations contain different specifications for \(\sigma\), then the unspecified representation is chosen as the shared information. The idea is illustrated by example (28).

(28) \(m_1 = \text{healthy}(x,\sigma=\text{food}(x)) \& \text{lettuce}(x) \& \text{food}(x) \& \text{green}(x) \& (\ldots) \& \text{etc}\)

\(m_2 = \text{healthy}(x,\sigma=\text{organism}(x)) \& \text{lettuce}(x) \& \text{organism}(x) \& \text{green}(x) \& (\ldots) \& \text{etc}\)

\(\text{CONJOIN}(m_1,m_2) = \text{healthy}(x,\sigma) \& \text{lettuce}(x) \& \text{green}(x) \& (\ldots) \& \text{etc}\)

The first two representations have different specifications for \(\sigma\), so that the conjoined representation in the last line leaves \(\sigma\) unspecified. The shared information is that lettuce is green and this is preserved, but the diverging conceptual analysis of lettuce as food or as organism is not.

Case (ii) from above is all normal: One candidate interpretation is left to determine the update with. Since \(cg \cup \text{EXPL}(m) \models m\), the explanation \(\text{EXPL}(m)\) is all the update we need. The explanation might in fact be empty, if all that was said was already known. This is different from the case where we have no update though.

If we have no interpretation left which is relevant, consistent and optimal (i), there is no basis for any reasonable update at all. This is then how pragmatic uninterpretability is defined in the system: An utterance \(\alpha\) is pragmatically uninterpretable with respect to a common
ground \( cg \) iff \( \text{PMCE}(\alpha, cg) = \text{undefined} \). Uninterpretability is a central notion for any account of pragmatic interpretation and can also be used for evaluation of the theory.

**Uninterpretability and Pragmatic Anomaly**

Uninterpretability was defined above as the case where \( \text{PMCE}(\alpha, cg) = \text{undefined} \). Consequently, there are several reasons for uninterpretability that arise from the model’s architecture. For any intuitively plausible candidate interpretation \( m \), \( \alpha \) is uninterpretable in \( cg \) if any of the following holds:

1. \( m \) is not consistent with \( cg \)
2. \( m \) is not optimal on \( cg \)
3. \( m \) is not relevant for \( \alpha \) as derived on \( cg \)
4. \( m \) is not an abductive variant of \( \alpha \) on \( cg \)

Some of the reasons for uninterpretability are purely a matter of the design of the knowledge base and are therefore not even interesting from an abstract perspective. For instance, if \( m \) is not optimal (ii), because another interpretation \( m' \) is, then this is a matter of the weights and axiom costs. More so, if \( m \) is not even an abductive variant (iv), then the knowledge base is clearly corrupted. More interesting from a theoretical point of view are hence cases (i) and (iii). What can be distinguished as different causes for uninterpretability in the model, coincides with an intuitive separation between cases like (29) and (30) corresponding to (i) and (iii) respectively.

(29) ? This apple is red, but it’s peel is not.
   \[ \rightarrow \text{Well, what is it then?} \]

(30) ? The tractor is pumped up.
   \[ \rightarrow \text{Well, what do you mean?} \]

Both examples can said to be cases of *pragmatic anomaly* (Blutner 1998a), because we cannot for some reason or another interpret them. But cases are a little distinct as is indicated by the possible follow-up questions beneath the respective examples.

In (29), we have an interpretation, namely that the skin of the apple is red, but this interpretation is ruled out by the explicit statement of its contrary so that we are left wondering what else could be meant. We do not have a close alternative at hand. It seems that the red-skin interpretation is so natural that contradiction to it makes the phrase unintelligible. Picking up this intuition, Blutner (1998a) speaks of *non-cancellable interpretations* in cases where contradictory information leads to uninterpretability. I am not happy with the terminology, because I argued in section 2.2 that the best way to deal with the notion of cancellability with respect to interpretations is to be ignorant of cancellation and instead speak of context-dependency only. The example (29) is rather a case of *uninterpretability due to contradictory information*. 

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In contrast to that a case like (30) is uninterpretable for another reason. The systematic analysis of uninterpretability can make this clear. Blutner’s treatment (1998a, p.150-153) of sentence (30) involves different weights to represent the salience of the motor and the tyres in the component analysis of the concept tractor and also the salience of pressure-states for tyres and motors. Under certain plausible assumptions concerning the relative dimension of these weights, the interpretation that the motor is pumped up can be obtained as optimal. This interpretation suffers from sort conflicts, so Blutner argues, and is therefore filtered out by the consistency check (25) and that is how the pragmatic anomaly of (30) results.

I would like to propose an alternative treatment. I am not happy with Blutner’s analysis, because it rests entirely on the specific design of the knowledge base. We have to assume the right kind of weights and we also have to assume that there is a pressure-state variable for motors, so that the interpretation that the motor is pumped up can be obtained, but at the same time this interpretation is inconsistent with the knowledge base, because having pumped up motors is a sort violation. I think that these are a very implausible assumptions. Instead, I want to propose a more linguistic explanation for the uninterpretability of (30) which is more in line with intuition.

As I see it, (30) is anomalous because it is a strange formulation. That is to say, if there is anything sensible that a speaker wants to convey with (30), he had better said it differently. Let’s assume there are just two abductive variants $m_1$ and $m_2$ as candidate interpretations for $\alpha$ as given in (31).

\[
(31) \quad \alpha = \text{tractor}(x) & \text{pumped-up}(x, \sigma) \\
\quad m_1 = \text{tractor}(x) & \text{pumped-up}(x, \sigma=\text{motor}(y)) \\
\quad m_2 = \text{tractor}(x) & \text{pumped-up}(x, \sigma=\text{tyres}(y))
\]

If we stick to the plausible assumption made by Blutner that the motor of a tractor is somehow more salient than the tyres, we can further assume that cost($\alpha,m_1$) < cost($\alpha,m_2$). So far, the analysis is parallel to Blutner’s. But at this point, I suggest that it is sensible to consider alternative formulations, too. What the speaker could have plausibly said to express $m_1$ and $m_2$ respectively is part of GEN($\alpha$) (32) (cf. Section 2.3).

\[
(32) \quad \alpha_1 = \text{motor}(x) & \text{pumped-up}(x, \sigma) \\
\quad \alpha_2 = \text{tyres}(x) & \text{pumped-up}(x, \sigma)
\]

If the knowledge base does what it is supposed to do, the costs for ($\alpha_1,m_1$) and ($\alpha_2,m_2$) are both smaller than ($\alpha,m_1$). Intuitively, that either the motor or the tyres are pumped up is expressed much more economically by saying the motor or the tyres are pumped up. Hence, the set Opt($\alpha$) contains either ($\alpha_1,m_1$) or ($\alpha_2,m_2$), but certainly not ($\alpha,m_1$) or ($\alpha,m_2$), because of the Q-principle. That is what makes sentence (30) uninterpretable: The optimal interpretations are irrelevant interpretations. In other words, the intuitive reason why (30) is pragmatically anomalous is not because of world-knowledge alone, but crucially because there are far better linguistic alternatives to express what might have been meant.
If my suggestion wants to be a real alternative to Blutner’s proposals, two further points have to be integrated: For one, I have to explain why a phrase like *pumped-up tractor* is interpretable in *special* situations and, for another, I have to explain why a phrase like *pumped-up bicycle* is also interpretable in *normal* situations.

The former is easy. Imagine a situation in which we can sensibly and intelligibly refer to pumped-up tractors. This is for example the case if a garage full of tractors contains some whose tyres are pumped up and others whose tyres are not. But even then the use of the phrase *pumped-up tractor* is only feasible, if both speaker and hearer know that the set of tractors under consideration can be split by the property of having pumped-up tyres. This amounts to saying that it is shared knowledge that there are tractors whose tyres are pumped up and others whose tyres are not. But if this knowledge is a salient part of the common ground due to perceptual or discourse context, then it is plausible to assume that the proof costs of the interpretation $m^2$ of (31) are much lower than under normal circumstances. Thus, if we are in a special situation where we can reasonably talk about pumped-up tractors, then this is reflected in the common ground and the interpretation becomes possible because of the additional facts or the shifting of weights in the common ground.

It is more difficult to see why *pumped-up bicycle* is interpretable in normal situations. As for the tractor-case, an alternative formulation which refers directly to the tyres should be proof-cost cheaper and therefore optimal. Intuitively, however, it is indeed a prominent property of bicycles to have pumped-up tyres or not, because it happens rather frequently that bicycles have a flat tyre, foremost when we depend on them early Monday morning. Thus, it is certainly part of our world-knowledge that bikes rely on pumped-up tires to be useful. The difference between bicycles and tractors is this: Pumped-up tyres are a critical precondition for the use of bicycles, but not as critical for the use of tractors. This is what intuitively licenses the use of the phrase *pumped-up bicycle*, but not the use of *pumped-up tractors*. However, the crucial problem is that the disposition of having pumped-up tyres and the knowledge that the tyres of bicycles are sometimes flat cannot be modelled easily in Horn-clause knowledge bases with abduction as inference mechanism. We need more than just the component analysis of concepts. We also need reasoning about dispositions and the likelihood that certain preconditions for proper use are fulfilled. As I see it, this is a basic shortcoming of the abduction scheme and a good point to motivate the general discussion and evaluation of PMCE exercised in the next section.

### 3.3 – Summary of Section

Weighted abduction produces interpretation alternatives and thus serves as the generator in PMCE. The abductive variants are derived from a knowledge base that contains basic conceptual knowledge that speaker and hearer share. On top of that, abduction provides the
numeric measure that we need for application of Q and I, namely the proof costs of the abductive variants. The proof costs are computed on the basis of axiom costs and weights which in turn have been given a probabilistic semantics in relation to their conceptual contribution within a component analysis of the concepts represented in the knowledge base. It was shown how the interpretation of red apple rests on world-knowledge. I suggested that the context-dependence of healthy lettuce can be explained, if we assume that the concepts represented in the knowledge base are also part of a semantic net so that concepts can be made salient by the occurrence of others and this leads to different axiom costs. This was done in Section 3.1.

Section 3.2. was concerned with the computation of a suitable update for the common ground on the basis of the set of optimal form-meaning pairs. I argued why Blutner’s original treatment is erroneous and elaborated an algorithmic procedure for the determination of an update. If no update surfaces after inconsistent and irrelevant interpretations have been removed from Opt(α), the utterance is not interpretable. I distinguished two kinds of uninterpretability: (i) due to contradictory information and (ii) due to strange formulation. The latter is linguistically most interesting, but also revealed a certain weakness of the abductive reasoning scheme which will be picked up in the subsequent evaluation in Section 4.2.
Section 4: Towards a Theory of Interpretation

Speech is a highly conventionalised, special kind of behaviour that presumably reaches the very core of human existence – a species which is often referred to as the linguistic species. It may be hypothesised that our linguistic competence is deeply intertwined with a theory of mind, i.e. the recognition of other peoples’ mental states and integration of these into our representation of and reasoning about the outside world. An aspect where the relationship between our theory of mind and our communicative abilities comes clearly into the foreground is in natural language understanding. If speech is behaviour, then comprehending speech is understanding human behaviour. It is thus not surprising that some of the factors that play a role in natural language understanding are partly the same as those for understanding human behaviour, like ascribing complex patterns of beliefs and desires as motivations for rational action.

The aim of this last section is therefore to take a step back from the theoretical details and have a distanced look at:

(i) The implications for a theory of understanding that arise from the concrete pragmatic theory. In particular, I want to discuss the implications of our theoretical starting point, namely two-level semantics and radical underspecification, with respect to the semantics-pragmatics interface in Section 3.1.

(ii) The limits of the pragmatic mechanism of contextual enrichment. In particular, I will discuss some of the shortcomings of our pragmatic interpretation approach with respect to some of Davidson’s ideas on understanding and interpretation and evaluate PMCE from this general perspective in Section 3.2.

4.1 – Pragmatic Enrichment and the Semantics-Pragmatics Interface

I want to motivate the following discussion by starting with a certain conceptual problem, namely the Gricean Circle, so that it can be made clear why it is profitable to consider the implications of PMCE for the semantics-pragmatics interface. It will transpire that the view we laid out in Section 1.3 as the theoretical foundation of PMCE circumvents the Gricean Circle. To make this clear I will argue for a clear distinction between strict semantic content and pragmatically enriched content. I will further differentiate between pragmatic enrichment and conversational implicatures in order to support the three-layer view of the semantics-pragmatics interface that I will introduce here. Finally, the consequences of the three-layer view for lexical semantics and truth-conditions of the involved representations are discussed.

The Gricean Circle

Grice proposed that a conversational implicature is calculated on the basis of what is said and the assumption that the speaker co-operates. Levinson (2000) discusses the following problem
that arises from Grice’s conception: It is circular to assume that, for one, what is said acts as the input to the pragmatics module and, for another, what is said is also affected by the very same mechanism of pragmatic interpretation. To see that this is so, Levinson argues that what is said by an utterance \( \alpha \) is the proposition expressed by \( \alpha \), but conversational implicatures affect the truth-conditions of utterances. The so-called *Gricean circle* (Levinson 2000, p.170ff) is indeed a fundamental problem to a pragmatic theory of conversational implicature so conceived.

As I see it, the problem rests on three assumptions:

(i) Conversational implicatures contribute to the content of what is said.

(ii) What is said is the input to compute conversational implicatures with.

(iii) There is only one mechanism to compute conversational implicatures.

I think that (ii) and (iii) are rather harmless claims which can be maintained easily and do not need much justification by plausibility arguments. One of the cases in favour of claim (i) which Levinson discusses at length (Levinson 2000 p. 174-236) is particularly interesting, because polysemous adjectives are part of this class. Levinson subsumes various phenomena under the heading *generality narrowing*. All the examples have in common that what we intuitively conceive of as truth-conditional meaning of a sentence is already pragmatically enriched in various respects. (1) is naturally not taken to mean that everybody in the whole world came and (2) is not totally uninformative, even if uttered by a middle-aged person, who has obviously eaten *at some time* in her life before.

(1) Everybody came.

(2) I have already eaten.

In both (1) and (2) the scope of the quantification seems to be pragmatically restricted to a relative reference set. The important point is, then, that according to plain intuition the readings with wide scope are not considered the truth-conditions of the sentences. Similar points can be made with respect to adjectival polysemy (3), genitive locutions (4), or compounding (5).

(3) I own a fast car.

(4) Bob bought John’s new book.

(5) I bought a new bread knife.

Again, the argument from intuition is that the naively perceived truth conditions of (3) do not really take note of the far-fetched possibility that the car I own might drive pretty slow, but was produced very fast. Similarly for (4) or (5) where the possibility that a knife made of bread would certainly not even occur in the analysis of a working semanticist.
However, no such problem as a Gricean circle occurred in PMCE. The input to the mechanism were semantically underspecified representations. The first pragmatic enrichment that took place was under PMCE. So it appears that what we really computed as pragmatically interpreted representations were what is said rather than what is meant. If we look at things from this perspective, a solution to the circularity problem pops up. Instead of the assumption that there are just the two levels of what is said and what is meant, it makes sense to stipulate, as we did, a further level of pure semantic representation.

**Three Levels of Meaning Representation**

Gibbs (2002, p.475-479) gives psycholinguistic evidence for the claim that the intuitive content of an expression is pragmatically enriched content. In his experiment, participants were asked to give paraphrases for what is said in certain test sentences. The result showed that significantly more participants chose paraphrases that corresponded to the pragmatically enriched content of the presented test sentences. The pragmatic enrichment in question included various kinds of pragmatic inference such as in (6) where we have scope restriction or (7) where we have the classical I-implicature of temporal enrichment (Gibbs 2002, p.475-6).

(6) Everybody went to San Francisco.

(7) Amy bought a new dress and she went out dancing.

The same intuition is independently picked up by Récanati (1989) as a starting point of his argument for three different types of meaning representations in linguistic theory. Récanati equates the intuitively conceived content with what is said. As a more abstract and presumably sub-doxastic level, as Récanati puts it, linguistic theory should additionally assume a level of strictly literal sentence meaning devoid of all pragmatic enrichments. Beyond what is said pragmatic theory contributes by the calculation of conversational implicatures to add up to what is communicated as in standard Gricean theory. In sum, the strictly literal meaning of a sentence is first pragmatically *enriched*. The pragmatically enriched meaning is equated with what is said from Grice’s theory of implicature. From this pragmatically enriched representation the calculation of conversational implicatures departs as usual. Figure 1 shows how the *three-layer view of the semantic-pragmatics interface* relates to Bierwisch’s two-level semantics which we took as a theoretical starting in Section 1.3. It should be clear that two-level semantics and the three-layer view basically express the same idea. We can in fact use the terms interchangeably. The only difference is that the three-layer additionally includes conversational implicatures in the sense intended by Grice (see below).
To make sense of the three-layer view it has to be shown that each of the different levels are justified as independent levels of meaning representation. On top of that, it has to be made clear how the abstract processes that lead from one level to the next can be theoretically distinguished, because we want to avoid the Gricean circle. In other words, the mechanism of pragmatic enrichment has to be different from the computation of conversational implicatures! In the following I first argue for the representation of strict semantic content and then delineate conversational implicature from pragmatic enrichment.

**Arguments for the Representation of Pure Semantic Content**

One of the basic realizations of Section 1 where we discussed the problem of semantic underspecification at length was that far more linguistic constructions are actually underspecified than is perceived. Poesio therefore maintains the so-called *underspecification hypothesis*:

**Underspecification Hypothesis:**

Human beings represent semantic ambiguity implicitly by means of *underspecified representations* that leave some aspects of interpretation unresolved. (Poesio 1996, p.169)

The main motivation for Poesio to propose his underspecification hypothesis is that it seems unlikely that humans entertain the set of all possible specifications of an underspecified expression at the same time, a problem called *combinatorial explosion* which is best illustrated by an example of scope ambiguities (8).

(8) Some of the girls from three of the volleyball teams had a date with some boys from the four football teams also residing in the two hotels.

The underspecification hypothesis states that it makes sense to assume a level of strictly underspecified representation. However, it does not exclude the possibility that actual underspecification is not perceived. Some of the theoretically possible readings may be so far-
fetched that they do not naturally come to mind. Consider for instance the absurdity of reading (9) as if the complement of *bowl* specified the bowl’s material as it does in (10).

(9) I put the tomatoes in the salad bowl.

(10) I put the tomatoes in the metal bowl.

Nevertheless, Poesio points out that there are situations in which the fact that we have a distinct representation of the underspecified representation *as well* becomes critical. This is the case, for example, in jokes, puns and for rhetoric effects. (11) is Poesio’s illustrating example with respect to scope ambiguity (Poesio 1996, p. 165)

(11) Statistics show that every 11 seconds a man is mugged here in New York City.

We are here today to interview him.

Taken together, Poesio’s arguments implicitly support the proposed view that there is a distinct level of potentially underspecified, strict semantic content in addition to a level of pragmatically enriched content. Furthermore, the examples also seem to support Récanati’s proposal that what is said is consciously available while the proper semantic content might be not. A similar point of view with respect to natural language engineering can be found in Egg et al. (2001).

Further support for the advocated position can be found in Berg (2002). Berg distinguishes two forms of semantics: *loose* and *strict semantics*. The difference is that strict semantics is concerned with meaning representations that are (i) disambiguated, (ii) relative to indexicals and (iii) abstracted from pragmatic enrichments. Strict semantics corresponds to what I called strict semantic content while loose semantic content can be equated with what is said. The gist of Berg’s paper is that most, if not all, of the pessimistic attitudes towards the possibility of a theory of meaning stem from a confusion of strict and loose semantics. According to Berg, a pursuit of a theory of meaning is licensed only as a strict semantics. His arguments once again show that the distinction between pure literal meaning and contextually enriched meaning makes sense and is important, because fundamental problems arise if we mix up what is distinct in nature and function. So after all, we have justified our theoretical starting point: A two-level semantics, comprised of a layer of semantic underspecified meaning and another of pragmatically enriched meaning. It needs to be made clear that conversational implicatures are something over and above pragmatic enrichment.

**Pragmatic Enrichment and Conversational Implicatures**

I want to contrast the process of pragmatic enrichment with the calculation of conversational implicatures. We now profit from PMCE, because we now have a spelled-out proposal for a theory of pragmatic enrichment. Foremost with respect to PMCE, I do not think that it is justified to call the pragmatic enrichments conversational implicatures. In other words, I propose to restrict the notion of conversational implicature to pragmatic inferences of a
discernibly *distinct kind* than pragmatic enrichments. This opposes the view of Levinson (2000) and Blutner (1998a) and I will try to justify my position against theirs.

Blutner (1998a, p. 148) refers to the pragmatic enrichment in (13) as a conversational implicature of the sentence in (12).

(12) The apple is red.

(13) The apple’s skin is red.

Blutner does so, because according to his definition “a proposition $\phi$ is a conversational implicature of $\alpha$ iff $cg[\alpha]$ models $\phi$ for each pragmatically licensed update.” (Blutner 1998a p. 133). If this definition is right, many things turn out to be conversational implicatures that should not be conversational implicatures at all: All common world-knowledge in cg is an implicature of every sentence, the literal content of an utterance $\alpha$ is a conversational implicature, and previous statements in a discourse are, no matter how unrelated, conversational implicatures of every later statement. Hence, the formal definition of conversational implicatures in Blutner’s framework is of little help and we have to look for other evidence for or against the claim that (13) is a conversational implicature of (12). I propose to have a look at the workings of PMCE where (13) was obtained as a pragmatic enrichment of (12) and compare that to Grice’s original ideas on conversational implicatures.

The operation of the pragmatic mechanism for the interpretation of polysemous adjectives can best be summarised as follows: We compute the most probable interpretation with respect to shared conceptual knowledge and contextual salience, but we also keep an eye on alternative formulations. We did not mention concepts such as relevance or informativeness explicitly - at least not in the particular examples. It is certainly true, on the other hand, that the pragmatic principles that we used are derivations from Gricean maxims and that conversational implicatures are those inferences that rely on Gricean maxims. Despite this fact, the view I want to put forward is that although we used formal versions of the Q and I principle, this is not to say that we calculated conversational implicatures *in the Gricean sense*. As I see it, the problem is that the formulations of the original maxims are so broad that we can explain quite a lot with them. But we have to bear in mind what was originally intended to be inferred on the basis of the maxims of conversation.

There are at least two critical points in Grice’s treatment of conversational implicatures that support my view. One stems from the *calculability* of conversational implicatures, the other can be read off the examples that are given as examples of conversational implicatures. Grice thought that an essential feature of conversational implicatures was their calculability along the lines of a formal reasoning scheme (Grice 1989, p.30f.). This is not to say that conversational implicatures are *actually* derived this way. This is to say that, if something is a conversational implicature, it can be reconstructed with this reasoning scheme. It is apparent that any reference to the speaker’s believes or the cooperative principle are not only superfluous, but also extraordinarily strange, if we interpret a phrase such as *pink grapefruit*.
Moreover, if we have a look at the examples given (Grice 1989, 31-37, cf. Scholz 2001, p.166-180 for a reconstruction), it becomes clear that Grice had more complex, more sophisticated inferences in mind - inferences that relate to the conversational impact of statements on a higher level, e.g. the relevance of a whole utterance to what was previously said (14) (Grice 1989, p.32):

(14) Smith doesn’t seem to have a girlfriend these days.  
He has been paying a lot of visits to New York lately.

This view runs counter to Levinson’s (2000) conviction that the Gricean circle is a real problem for pragmatic theory. As I argued above, one of the assumptions of his conviction is that conversational implicatures contribute to what is said. Levinson holds this premise true, because he is convinced that it is the exact same kind of mechanism, namely Q, I and M-implicatures, which has truth-conditional impact.

I think that Levinson’s position is wrong in several respects. To begin with, as I argued above, it makes sense to assume a distinct level of strictly literal sentence meaning as the input to a pragmatic mechanism of contextual enrichment. With three different levels of representation, the circularity problem vanishes, if we can make clear that the pragmatic enrichment is not dependent on pragmatically enriched content as its input. The exemplary treatment of polysemous adjectives did exactly that. Furthermore, Levinson’s premise that it is conversational implicatures that do the pragmatic enrichment is questionable. The pragmatic principles are, though well elaborated, still not precise, so that it is possible, but insubstantial to say that, e.g., (15) are examples for inferences to stereotype, hence I-implicatures, hence conversational implicatures which can by definition only be computed on the basis of what is said.

(15) a. I bought a new bread knife.
   ? I→ The knife is for slicing bread, not made of bread.

b. I like pink grapefruits.
   ? I→ The grapefruits that I like have pink flesh.

Contrary to Levinson’s position, the treatment of PMCE made clear that it is possible to keep apart two different levels of pragmatic interpretation. One criterion for distinction can be that they operate on clearly distinct inputs: Semantically underspecified representations and pragmatically enriched representations. Another criterion can be derived from the concrete case of PMCE and supports Récanati’s view (Récanati, 1989), called scope-principle there: The pragmatic enrichments have truth-conditional impact, conversational implicatures have not.

In sum, I think that the distinction between pragmatic enrichments and conversational implicatures is justified, because conversational implicatures have a discernibly different function. The function of conversational implicatures is to explain the conversational impact
of utterances. On the other hand, pragmatic enrichments are, intuitively speaking, less sophisticated processes and influence truth-conditions. Pragmatic enrichments do not involve, or cannot be sensibly supported by, reasoning processes over speaker intentions or assumptions that conversational maxims are obeyed or exploited. Hence, it is plausible to assume the three-layer view of the semantics-pragmatics interface. Accordingly, we should spend some thought on the implications of this view. I therefore want to discuss the consequences of the three-layer view with respect to (i) lexical meaning and (ii) truth-conditions.

**Underspecified Lexical Meaning and Pragmatic Enrichment**

If we abstract over contextually enriched meaning, what remains as lexical meaning of semantically underspecified adjectives is not much. In section 1.3, we assumed that the meaning of an expression like *fast* is best represented as in (16).

(16) fast(x, σ)

\[ x \text{ is fast in some not (yet) specified sense} \]

There are plenty of examples for the various ways in which such an adjective can be specified (17).

(17) fast runner → runs pretty fast
    fast runner → stops running pretty fast
    fast runner → one from the team of runners is always fast asleep
    fast dancer → dances to fast songs
    fast dancer → dances fast to slow songs as well
    fast dancer → starts dancing as soon as he enters the room

If we continue the list started in (17) in our heads, it might seem as if there is nothing really in common to all those things that can be fast in some not (yet) specified sense. That is to say, if we consider just the lexical meaning, the extension of the predicate *fast* seems to be nearly the complete universe of objects. If that were true, the lexical meaning of *fast* were hollow and quite useless. Let me call this the *problem of vacuous words* for the moment.

Certainly, I do not think that the problem of vacuous words is an actual problem, but it affects the view we should reasonably hold of the semantics-pragmatics interface. It is hardly necessary to give a reason why lexical meaning is an indispensable concept for linguistic theory. But what it actually is cannot be decided without a proper look at pragmatic enrichment. In other words, I am convinced that the pragmatic mechanism we dealt with in the previous sections contributes essentially to the notion of lexical meaning. To spell this out, when I introduced the Q-principle as the hearer economy principle in Section 3.2, it was meant to be a balancing force to the I-principle as the speaker economy principle. I argued
that it is obviously impossible in most situations to infer what a speaker wants to convey if he does not say anything. The latent view on lexical meaning is that words are clues for interpretation! The necessity to interpret persists even for simple and non-deviant speech. Words do not have a meaning in the sense that they have a fixed and unshakeable denotation. Words have a meaning only in the sense that they contribute to an interpretation process. What a word means can only be reached, if we abstract over pragmatic enrichments and subtract that which has been added by certain principles of interpretation. Further counterintuitive implications arise for the truth-conditions of sentences.

**Truth, Consistency and the Maxim of Quality**

If we assume an intuitive difference between literal content and actually perceived utterance content and differentiate between semantic and pragmatically enriched content, then we can also distinguish their truth-conditions. The question to be addressed is, what are the truth-conditions of sentences with semantically underspecified lexical items, both on the level of pure semantic content and pragmatically enriched content.

Intuitively, the pragmatically enriched content is more specific than the semantic content. Since the semantic content is thought to be the basis for the pragmatic specification, it makes sense to assume that the semantic representation is true under all circumstances in which there is a conceivable true pragmatic specification. In other words, we can stipulate that the semantic meaning is the disjunction of all conceivable contextually enriched meanings. The resulting view on truth-conditions for underspecified semantic content is that the semantic content is true in far more contexts and worldly affairs than the intuitively accessed pragmatically enriched content. Semantic content is thus the disjunction of all possible pragmatically enriched contents. This is the analysis I suggest and I want to call it version 1, because:

There is another possibility to think of the truth-conditions of pure semantic content which I will call version 2. We could stipulate that the semantic content $\text{sem}(\alpha)$ of an utterance $\alpha$ has truth-conditions equal to exactly one pragmatically enriched, contextually specified sense. This seems less plausible at the beginning, because it is not clear which specified sense this should be, but we should not discard the idea so quickly, because it might turn out theoretically beneficial after all. In fact, if we equate the pure semantic content of a phrase which contains a semantically underspecified lexical item with one particular contextually specified sense, then we can parallel this case with a large group of other examples where something similar happens. To make it precise, the semantic content so conceived, would be false in the majority of cases. Hence, we could say that we have to reinterpret, because this violates Grice’s maxim of Quality.

Such a treatment can be found in Lasersohn (1999). Lasersohn notes that some expressions are literally very precise, but the intuitive verifications of sentences that contain such expressions allow for a certain, yet contextually fixed amount of imprecision. Consider the
examples in (23) taken from Lasersohn (1999) with my added paraphrases of the pure semantic content.

(18) a. Mary arrived at three o’clock.
Mary arrived at exactly 3:00 o’clock, and not a second after or before.

b. The townspeople are asleep.
All the townspeople are asleep.

Lasersohn accounts for this kind of pragmatic looseness by computing pragmatic halos. Pragmatic halos are context-dependent measures of deviation from the literal truth. By using pragmatic halos Lasersohn is able to formalise the notion of closeness to truth, so that he can make sense of the intuition that “people accept utterances that deviate in minor ways from the truth” (Lasersohn 1999 p:525). The particular benefit of Lasersohn’s theory is that he gives a formal account of what it means to be sufficiently or relevantly close to the literal truth in a given context. The most interesting point for us though is the suggested relation to Gricean interpretation principles. Since Lasersohn explicitly focuses on deviations from truth, he can reasonably call upon Grice’s maxim of Quality to reason as follows: Some precise formulations are so obviously false that we may interpret loosely.

The question is, can we apply the same reasoning to semantically underspecified sentences? Is version 2 to be preferred? – My answer is obviously negative for two reasons. First, there are further examples besides semantically underspecified sentences which are not so obviously false, but still undergo some sort of pragmatic enrichment. Just consider (2) repeated from above.

(2) I have already eaten.

Second, I not only find it implausible to assume that there is a default reading for every phrase with a semantically underspecified item, but I also think that a theory of pragmatic enrichment should get by without falsity as a starting trigger. It seems more elegant to proceed as we did in PMCE: Take the underspecification of the input for real, represent it and specify the meaning if possible. Consequently, I prefer version 1 with disjunctive truth-conditions over ubiquitous falsity. However, the engagement with version 2 revealed that a word has to be said about the status of the maxim of Quality in our pragmatic interpretation theory.

Consistency and the Maxim of Quality
In PMCE, the consistency check appeared in Section 3.2 as a system-intrinsic requirement due to the fact that abduction produces non-consistent variants. According to Blutner (1998a, p.132f.), the criteria with which to check for consistency are related to Grice’s maxim of Quality. This may or may not be true for the kind of common ground that Blutner has in mind, but since I referred to a more restricted version of a common ground (Section 3.1) it will turn
out that the consistency check made in PMCE is related to the maxim of Quality in a
*restricted sense only*. I will make this statement intelligible below.

Grice acknowledged the special status of the maxim of Quality, but refused to separate it
from the other maxims for good reason, for the way he intended the maxim of Quality to
contribute to the computation of conversational implicatures is in no ways different from the
other maxims.

Indeed, it might be felt that the importance of at least the maxim of Quality is such that it should
not be included in a scheme of the kind I am constructing; other maxims come into operation only
on the assumption that this maxim of Quality is satisfied. While this may be correct, so far as the
generation of implicatures in concerned it seems to play a role not totally different from the other
maxims, and it will be convenient, for the present at least, to treat it as a member of the list of
maxims. (Grice 1989, p.27)

In effect, the maxim of Quality is usually cited for the explanation of tropes, like metaphor

Since the Q- and I-principles are derived from the maxim of Quantity, the next best place
to look for the maxim of Quality in PMCE is the consistency check. In PMCE, we considered
only interpretations that were consistent with the common ground. So the question boils down
to what it means if an optimal interpretation m is consistent with a given common ground cg.
If m ∪ cg is inconsistent, m is incompatible with shared world-knowledge, a previous
discourse statement or a combination thereof. Since m therefore is incompatible with a belief
ascribed to the speaker, the maxim of Quality, more concretely Quality 1, can be brought to
cover this case. Hence, the consistency check in the system is not a presumption of *truth*, but
a presumption of *consistency* (Künne 1990, see below). We are not assuming that the speaker
says something that is preferably *true*, but we only assume that what he says is not in conflict
with what he believes. In summary, the aspect of the maxim of Quality that relates to the
consistency check is Quality 1, not the other half of it or the supermaxim. But this also means
that we included only part of what was recognised by Grice and others to be a very important
part of interpretation.

It becomes clear now that we have only dealt with a restricted fraction of human
interpretation competence. The general perspective suggested in the opening of this section
now brings to attention how delicate a matter understanding human speech really is. There are
certainly far more aspects to pragmatic interpretation that were not covered than aspects that
were included. Especially, with respect to belief ascriptions and reasoning based on world-
knowledge, many things have not even been mentioned along the way. I will attend to some
of these issues and evaluate PMCE from a very general perspective: What we really try to
account for is the human capability to understand the literal content of utterances.
4.2 – Evaluation of the Pragmatic Mechanism of Contextual Enrichment

The questions to be addressed in the final section are:

(i) Which crucial aspects of human competence for language comprehension were not included in PMCE?

(ii) Did PMCE cope with the included aspects in a satisfactory way?

I intend to give an answer to these in the following. In order to deal with the first question (i) I rely crucially on Davidson’s ideas on radical interpretation. The answer to the second question will be my personal critical evaluation of the whole enterprise of pragmatic enrichment, in so far as it has not already been covered in the previous sections.

Davidson’s Perspective on Interpretation

To ask for the competence needed for interpretation is certainly a Davidsonian perspective. Davidson stressed that belief ascription and interpretation are hard, in not impossible to separate:

A speaker who holds a sentence to be true on an occasion does so in part because of what he means, or would mean, by an utterance of that sentence, and in part because of what he believes. If all we have to go on is the fact of honest utterance, we cannot infer the belief without knowing the meaning, and have no chance of inferring the meaning without the belief. (Davidson 2001, p.142).

In order to loosen the tight connection between beliefs and meanings, Davidson proposed a principle of charity to guide the interpretation. The principle of charity comprises two aspects. We can assume that (i) the speaker is, by uttering $\alpha$, saying something true. Alternatively, we can assume that (ii) the speaker’s beliefs are in themselves consistent (Künne 1990, p.217). Obviously, assumption (i) is a stronger assumption, because a set of true beliefs is also a set of consistent beliefs, but not vice versa. However, both aspects of the charity principle play a role in the interpretation of polysemous adjectives.

Let me start with consistency. I have already noted that the consistency check in the system is not an implementation of a truth presumption, but of a consistency presumption. To make it even more precise, two things happen in PMCE. For one, we check whether a candidate interpretation contradicts the speaker’s belief system. But since the common ground contains shared knowledge, we also check for consistency between speaker and hearer. That is to say, we cover both aspects of the reconstruction of the consistency assumption given in Glüer at the same time (Glüer 1993, p.67ff.): With each update we assure consistency of the speaker’s beliefs and agreement between speaker and hearer. It might thus well be the case that an alleged interpretation $m$ is perfectly sound with the speaker’s actual and ascribed beliefs, but that $m$ is not consistent with shared belief. If the $m$ is discarded in this case, it is falsely discarded. It follows that the use of shared knowledge, of common beliefs as a basis for pragmatic interpretation, is by and large licensed, because we focused on uncritical world-
knowledge only, but, in order to be precise, we would have to account for asymmetries between speaker and hearer beliefs in interpretation.

What is more, if an interpretation \( m \) is not consistent with the common ground, it is strictly speaking not justified to discard \( m \) right away. In fact, it might as well be another earlier interpretation which is responsible for the present inconsistency. In the case of inconsistency of a belief system, what is called upon is a very complex and by no means uncritical procedure of belief revision (Gärdenfors & Rott 1995).

There are occasions at which a false belief has to be attributed. That means, sometimes the consistency assumption (ii) has to be preferred over the assumption that the speaker says something true (i), if there are reasons to do so. And reasons to do so are bountiful, if we also take the epistemic and perceptual states of the speaker into account. Bluntly speaking, if someone speaks of red apples when it is absolutely sure that he can only perceive green apples and there is no red brand sticker at hand either, then we have to attribute a false belief.

It is plain to see then that interpretation therefore also rests critically on perceptual similarity between speaker and hearer (Levinson 2000, p. 29). A verbal exchange is a triangular setting: Someone is talking to someone else about something (Davidson 1991, Blume & Demmerling 1998, p.210ff.). The basis for correct understanding of what is being talked about is that hearer and speaker have sufficiently similar standards in representing their environment. We already silently included this fundamental prerequisite when we defined our common ground. The common ground as we had it came with the uncritical, but non-trivial assumption that humans have by and large comparable conceptual representations. So conceived, we can also make sense of Davidson’s idea that we need a large background of shared beliefs on the basis of which diverging beliefs can only be diverging beliefs about the very same objects (cf. Künne 1990, p.224 and the quotation given therein). For example, to think that you falsely believe that the apples are green, I have to make sure that you have roughly the same ideas about apples and colours that I do.

All in all we see that a complete theory of interpretation has to take into account that there is an interpreter with his beliefs about and representations of the world who tries to integrate the linguistic signal of a speaker into a complete picture of the speaker’s beliefs, former statements and perceptual and epistemic state. As a basis for interpretation we have a rock-solid common ground of shared world-knowledge which secures that we talk about the same things and acts as the basis for disagreement. Along with the world-knowledge comes a similarity assumption about the speakers conceptual representations and perceptual states. Finally, we find our pragmatic mechanism of enrichment right at the core of understanding. It can now be conveniently located in the overall picture of interpretative competence: We showed in a very restricted setting how indispensable, mutually shared beliefs about the ways the world is provide conceptual specifications for semantically underspecified expressions.
Finally, I would like to conclude this thesis with a look back at all that we have been doing so far. I will start with a number of shortcomings and flaws of PMCE and end with a few personal remarks that critically evaluate what has been achieved in this thesis.

The Davidsonian perspective on interpretation revealed that some kind or another of epistemic reasoning is involved in understanding utterances. Epistemic reasoning has not been treated in PMCE though. If we would include epistemic predicates explicitly in the knowledge base, as Blutner seems to suggest (Blutner 1998a, p. 132), we would get into trouble with the abductive inference procedure, because we would have to extent the abductive proof to cover epistemic predicates. Moreover, there are other features of logical reasoning that were not included in our framework either. Take for instance negation, modal, spatial or temporal reasoning and a treatment of eventualites or the inclusion of contingent properties and dispositions. So, we note that one basic flaw of the abduction scheme is that it does not cover all necessary logical reasoning.

A further drawback of PMCE is that there is no room to explain certain regularities of conventional meaning. Recall that Pustejovsky & Boguraev (1993) generalised a meaning aspect of the adjective *fast* (Section 1.2). They claimed that *fast* modifies the telic role of the accompanying noun. We objected that there are cases of nouns and contexts where it is not the telic role and that therefore the generalisation may not hold. We left it completely open which aspect of the noun is modified by an adjective, but it is plausible to assume that there are linguistic default interpretations. In this sense, Pustejovsky and Boguraev referred to such a default interpretation with respect to *fast*, the defect of the theory being that the default status of the interpretation was not acknowledged and dealt with. That is to say, an alternative amendment of the shortcomings of the type coercion approach is to stipulate linguistic defaults and then explain how interpretations are defeated by certain contexts or aspects of nouns.

Lascarides & Copestake (1998) therefore propose to include lexically preference on interpretation which may be defeated by pragmatic reasoning. Their criticism against a purely pragmatic interpretation approach as we have it is substantial. We neither have a chance to account for certain regularities on a lexical level, nor can we make any sense of the notion of a linguistic default. Of course, we can include the idea of a preferred interpretation with respect to world-knowledge in the abductive proof-costs, but “One would have to impose prioritisations on world-knowledge that weren’t independently motivated.” (Lascarides & Copestake 1998, p.394). The first main point of criticism is that the so conceived defaults are not treated as defaults in the system. In other words, no literal in the update is especially marked as defeasible to be possibly retracted at a later point in time. The other main point of criticism is even more fundamental: Unlike in Lascarides & Copestake’s characterisation of pragmatic interpretation, what might count as a default interpretation in PMCE, namely an optimal interpretation derived from a normal, contextually unmodified common ground, is not
conventional linguistic meaning, because it is derived only with respect to world-knowledge. That is why I consider the omission of defaults a real conceptual deficit of our PMCE.

There are further minor problems which should not go unmentioned: The abduction process is, if taken seriously and contra Blutner (1998a, p.147), all but efficient. In order to apply Q- and I-principles a huge set of alternative formulations have to be compared all of which have to be dragged through the abduction routine. With respect to the psycholinguistic results of Gibbs (2002), it seems more plausible to use the pragmatic principles as search heuristics during the computation of enrichments.

What is even more troublesome is that there is no suggestion in Blutner’s papers how linguistic alternatives for a given interpretation could be computed as the application of the Q principle requires. Again, this is a fundamental problem, because the task is all but trivial. When the Q-principle refers to alternative formulations, what is originally meant in the work of the neo-Griceans are certainly not other logical representations, but other utterances that the speaker could have made instead. I cannot see how these could be computed easily, be it with a reversed abduction procedure or other mechanisms. So, I really think that the lack of a possibility to compute alternative formulations is a heavy pun in the formal treatment of pragmatic enrichment. The problem is simply that once we make explicit how the interpretations are computed, there is no good reason to rely on a mythical generator or oracle-on-demand for the reversed direction.

On the other hand, pragmatic interpretation principles are certainly essential for the interpretation of semantic underspecification, and, to my mind, the course taken along the lines of neo-Gricean speaker and hearer economy principles seems to be on the right track. The integration of the consistency check and the kind of common ground that we used can be counted as a realisation of the fact that a certain commonality between participants in conversation is fundamentally indispensable in order to converse reasonably and have also diverging opinions about the same things. One could improve here and I see it as a promising loose end to further investigate the interaction of common-sense ascriptions of beliefs and motivations on the one hand and pragmatic enrichment by pragmatic interpretation principles on the other.

In contrast to that, the issues relating to the abductive proof procedure are less satisfying. Not only that there are crucial elements of common-sense reasoning left out, the ignorance towards conventional linguistic meaning is mortifying. However, this is not an irredeemable problem for sure, but another interesting topic for further investigation. Alternatives for the abduction method are bountiful (cf. Levinson 2000, p. 42ff., Blutner 1998b, p. 156). Personally, I think that default logic approaches are appealing, because they provide a more flexible and more extendible formal mechanism than abduction and are on top of that more suitable for the intuitive representation of world-knowledge for obvious reasons. Taken
together, I think that the suggestion of the abduction method for the computation of interpretation alternatives is by far the weakest spot in the architecture of PMCE.

Still, I am overall satisfied with the treatment of the problem of adjectival polysemy by PMCE, because all the exemplary problem cases which were worked out in Section 1.2 have been convincingly accounted for in Section 3. On top of that, the extended precise treatment of neo-Gricean interpretation principles in Section 2 is a very welcomed step towards a formalisation of pragmatic theory. Finally, I count it as a basic success of PMCE that it gave concrete support for a particular view of the semantics-pragmatics interface in Section 4. So, the treatment of the problem of polyseous adjectives has substantially contributed to the overall picture of the human comprehension competence.

4.3 – Summary of Section

In the final section, the theoretical foundations of PMCE were critically reconsidered. I argued for a three-layer view of the semantics-pragmatics interface (Récanati 1989). This view covers two-level semantics and radical underspecification, i.e. our theoretical point of departure from Section 1.3 and furthermore integrates conversational implicatures as pragmatic inferences of a different kind than pragmatic enrichment. Consequences of the three-layer view for lexical meaning, truth-conditions and the Gricean Circle were discussed. Finally, we took a step back and considered pragmatic enrichment of polyseous adjectives as a part of the general capacity of natural language understanding. It became apparent that PMCE covered only a very small fraction of human comprehension competence when we additionally considered some of Davidson’s views on interpretation and understanding of natural language. My personal view of the achievements of PMCE can be rephrased as such: I think that the formal treatment of pragmatic interpretation principles is very promising. However, the abduction scheme is the Achilles’ heel of the theory: Essential logical reasoning methods cannot be included and, worst of all, the notion of linguistic defaults has not been integrated.
References


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