The Asymmetry of Optimality Theoretic Syntax and Semantics

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1   OT Semantics and Syntax

Optimality theoretic syntax (OT syntax) is the proposal to think of the knowledge of language as an ordered sequence of constraints that decide which are the best candidate sentences for expressing some given content[1] (the input). Optimal candidates are the ones that do better on the ordered constraints than all the competing candidates. S_1 is a better candidate than S_2 if there is a strongest constraint C such that S_1 and S_2 do equally well on the constraints that are stronger than C but S_1 does better on C itself. Moreover, we make the following assumptions. First the set of constraints is the same for all languages, but languages differ in the ordering of the constraints. Second, constraint satisfaction is scored discretely. Both of these assumptions can in principle be giving up without changing the essence of the theory as a descriptive device for a particular language, but they have an important methodological value since the first assumption militates against language particular constraints and the second keeps the theory formally simpler. Though there is as yet no consensus about a particular set of constraints for syntax, there is a lot of promising work going on in the area, like e.g. *Grimshaw, Choi* and *Bresnan*.

OT syntax suffers from a problem. The prediction —which arises from the formal conception itself— is that for any input there is a set of optimal candidates. This prediction is easily refuted by showing that some sentences are untranslatable. For example (1)

(1)   Who ate what?

is a proper English sentence but does not have an Italian translation, like (2).

(2)   *Chi ha mangiato che cosa?

Yet, it is a natural assumption that the input for the English sentence is also available for the Italian language users. But there does not seem to be a form (except complicated paraphrases) that expresses the input. The same point has been made by *Pesetsky* using ungrammatical sentences that are not repairable.

Optimality Theoretic Semantics (OT semantics) is a more recent enterprise in which traditional methods of conceiving natural language interpretation are replaced by systems of ordered constraints. Given the problems that natural language semanticists face, this is both a natural and a wise move and has led to interesting approaches to when-sentences (*De Hoop & De Swart*) and to presupposition (*Blutner*). But there is a natural question to ask here. If there is an OT semantics, how is it related to OT syntax? It is clear that we do not want a conflict: the OT semantics should not assign an optimal interpretation to a sentence for which the sentence is not optimal according to OT syntax. And also we do not want the OT syntax to assign a sentence to the input that does not have the input as an optimal interpretation. The problem is that both OT syntax and OT semantics are theories about the relation between form and content and so it would seem that they cannot be independent of each other.

Blutner has pioneered a first version of bidirectional OT which overcomes these problems. In his conception of superoptimality there is a single ordered set of constraints that regulates the relation between form and content. But the constraints are used twice: a pair $< Form, Content >$ is superoptimal iff there is no better pair $< Form_1, Content >$ and no better pair $< Form, Content_1 >$. In weak superoptimality —the notion he really favours— we find also some recursion: A pair $< Form, Content >$ is weakly superoptimal iff there are no weakly superoptimal better pairs $< Form_1, Content >$ or $< Form, Content_1 >$.

Both of these notions are highly interesting and allow important results, like a treatment of the ineffability problem and treatments of presupposition and lexical semantics. But they labour from their essentially symmetric character. One prediction that can be derived that is both synonymy and ambiguity are dying phenomena in natural languages: there is a tendency for them to disappear. Now it is true that synonymy is not a stable phenomenon as is almost a linguistic commonplace (in the form: real synonymy does not exist). But ambiguity seems ever on the increase as any computational linguist can tell you: it is a remarkably robust phenomenon and increases whenever the language loses phonological, morphological or configurational properties.

The OT literature also contains a formal case against the symmetric view: the rat/rad problem. The Dutch word *rat* (meaning rat) is homophonous with the Dutch word *rad* (meaning wheel) in its singular form. The pronunciation of *rad* (but not *rat*) is derived by a faithfulness violation: the underlying feature +*voiced* is lost at the end of Dutch words. In a treatment like Blutner's, this has consequences for the interpretation of the sound $/rat/$. If it is interpreted as *wheel* there is a better form content pair, namely $< /rat/, rat >$. According to both notions of superoptimality, this means that $< /rat/, wheel >$ is thrown out of the competition.

This is a simple phonological problem, but it would arise in any ambiguity where in one of pairs $< Form, Content_1 >$, $< Form, Content_2 >$, $Form$ is in one case derived by more serious constraint violations than the other. A simple case is perhaps[2] (3)assuming that (b) involves 2 violations a the constraint **STAY** enforcing constituents to stay in their canonical position rather than (at most) one as in (a).

(3)   a. Wie slaat Hans?
              a'. Who beats Hans?
              b. Wie slaat Hans?
              b'. Whom does Hans beat?

Superoptimality would predict not just that reading (a') is preferred but that it is the only reading, of course under the assumption of the analysis in terms of **STAY**. But it would be easy to find such examples at will, given a particular syntactic analysis.

This paper is an attempt to develop a competing theory of the combination of syntax and semantics in optimality theory. The theory is asymmetrical and naturalistic and precisely so conservative to the views of Blutner as the facts seem to allow.

It has been my view for a long time that the asymmetry between speaking and hearing should be taken more seriously than many theorists have done. Completely different parts of the body are involved and there is no identity between what people can say and what they can understand. Moreover hearing and speaking differ in the very nature of the activity: speaking is an active process in which the speaker has control, hearing is essentially passive, where the hearer tries to make the most of the signal she receives. Equally important is the naturalistic character of an optimality theoretic account of speaking or understanding. OT started from a consideration of processes in the brain and still derives much of its plausibility from its interpretation as a theory about brain processes. A theory of the relation between form and content should therefore primarily be a theory of speaking and understanding, as these are the processes in which the brain uses the constraints. Following *Smolensky*, the naturalistic interpretation still does not give a theory of the actual processes in performance (which would involve other mechanisms as well) but only a description of the grammatical norm. Naturalism here only means that we can think of the theory as a part of an overall account of the actual production and understanding mechanisms.

2   Chicken or Egg

What did evolution achieve when it created language? The right answer is I think the creation of a system of forms in which contents can be coded. Though the creation of the forms doubtlessly helped in extending the richness of the

contents that can be expressed by them, there is nothing to suggest that the everyday thoughts we have and that we transmit to our fellow humans are that different from the thoughts of somebody who lacks language or even from our closer biological cousins. Our basic drives are the same and so is the information we gather in order to satisfy them.

The wrong answer is surely that evolution created a stronger power of understanding that allows us to make sense of the complex forms found in natural language. It is the wrong answer if we assume that the new power of understanding is prior or independent of the creation of the system of forms. I do not think the system of understanding needed to be adapted very much. Before language it was already possible to interpret the behaviour of other humans and of animals and to interpret the environments. These are the hard problems, not language understanding. Understanding limits the diversification of the production of acoustic signals: if a differentiation is not picked up by the understanding it is not functional and will not last. The development of language use can therefore not be understood in isolation from the process of decoding the language tokens. But the biological achievement is the differentiation of the production of acoustic signals, which in combination with the recognitional and understanding capacities of the producing organisms make the differentiation lead to a biological advantage.

This can be underpinned to some extent by physiological considerations. Whereas the ear is largely what it was before language as we know it, there are physiological changes in the larynx and in the way it is used.

The point of this remarks is that —as linguistis interested in the nature of language— we should be primarily concerned with the production of language and develop theories of the production process. Producing language would not make sense without understanding, but it is not clear that the understanding needed to develop that much.

3   Conflict in Production and Understanding

Following *Boersma*, we can make the following observations. As in the production of speech, the production of a sequence of words stands under two opposing principles. The first principle is that the receiver of the string should be able to take out the message that the speaker has coded into his string of words: that is the purpose of language use. This goal is served by marking every semantically relevant property of the input by some syntactic feature, such as morphology, word order, lexical items etc.

At the same time, the speaker stands under a principle of minimal effort. There is no point in marking a feature that is in fact inferable and often the available means of marking will be conflicting. So both requirements are in conflict and the optimal realisation is a particular way of solving the conflict.

It is not clear that in interpretation there is the same conflict between different

interests of the interpreter. If the interpreter wants to minimise his effort, she runs the risk of not finding the speaker's intention. Of course, it does not pay off to put in more effort than is needed to recognise the speaker's intention, but economising on effort cannot go below the effort required, on the pain of disfunctioning.

There is of course the same principle of expressiveness: everything that is in the signal must be interpreted. But it does not seem there is conflict between doing that to the maximal extent and the principle of not doing more than is required to find the speaker's intention.

I want to conclude from this that whereas there is a naturalistic interpretation of conflicting constraints in language production, there is no such naturalistic interpretation for conflicting constraints in interpretation. If there are conflicting constraints in language interpretation they must really derive from constraints about language production.

The situation can be fruitfully compared to the habit of hiding easter eggs for one's children. The parents engaged in hiding the eggs balance the amount of effort with the desired amount of difficulty in finding the egg. (They also picture the child looking for it and try to keep it possible for the child of finding the egg, without spoiling the fun.) For the child it is another matter. They just have to throw in the effort required for finding the eggs. Not more of course, but definitely not less. It is not a complicated balancing act.

This would be the argument that shows that the process of language production has to find a balance between conflicting constraints. Languages are an inventory and a conventionalised way of establishing the balance: the language particular ordering of the constraints. A similar argument for underpinning the same balance in understanding cannot be given.

To avoid confusion, this is not the same asymmetry as the one discussed in *Smolensky*, which discusses the empirical differences between comprehension and production. We are discussing a conceptual difference: that between active, creative processes and passive processes.

4   Proper Optimality Theoretic Semantics

The previous sections may be read as an argument against assuming a OT semantics. My prejudice has always been that there should not be so such thing. The proposed constraints of OT semantics and their ordering are really generation constraints and the ordering of the generation constraints in disguise. I tried to show the plausibility of this view by reconstructing the analysis of *De Hoop & de Swart* in *Zeevat1999* within OT syntax. But my plan of showing this has run up against the following problem: there are some interpretation constraints that do important work, but do not allow a reformulation in terms of generation constraints.

These are the ones I know about: ***ACCOMMODATION, *INVENT, STRENGTH, ANCHOR, CONSISTENCY** and **FAITH-INT**. I would not expect there to be many others and also these ones seem to form a interesting natural class as I will try to show at the end of this section. But I may be wrong here. I should also point out that my argument does not at all depend on the question of which semantic constraints must be assumed or on the formulation of the constraints. There should be some, otherwise the theory collapses into optimality theoretic syntax. But I believe my outline here has some independent merit.

The first constraint is ***ACCOMMODATION**. It (fallibly) prohibits accommodation of the antecedents of presupposition triggers. A presupposition trigger such as *regret* requires that its complement is already true in the context in which it is used. If that is not true, the content of the complement needs to be added to the context, a process called accommodation. Now, nothing should be added if the context (the local context) already has the material and ***ACCOMMODATION** does just that.

There is nothing in generation that corresponds to ***ACCOMMODATION**. It is not a prohibition against using the trigger in a context that does not have the antecedent: that occurs frequently and appropriately. If one wants, ***ACCOMMODATION** can be taken as a special case of a principle that forbids us to add to the context of the utterance or to the content of the utterance without a proper reason (like external evidence or the material supplied by the sentence). ***INVENT** seems a good name for such a constraint. It is of course completely unclear how the speaker can rule this bad behaviour of the hearer out by some feature of the sentence.

STRENGTH expresses the preference for informationally stronger readings of the sentence. It is a bit of an odd man out here, because it does not seem to allow a discrete evaluation and also makes a couple of wrong predictions, as *Geurts* has pointed out. Nevertheless, a version of **STRENGTH** is needed for the interpretation of presupposition triggers and as *Peters et al.* have argued for the interpretation of reciprocals. It is obvious that there is no generation principle that can capture the effect of **STRENGTH**.

ANCHOR is the principle that interpretations should be anchored. This in essence means that all the pronouns, ellipses, tenses should find proper antecedents and that a discourse relation must be constructed to the appropriate earlier element of the discourse or dialogue. Also, topics must be regulated appropriately. Accommodation occurs because of the needs of **ANCHOR**. Here, there is something in generation that corresponds: the principles that select the proforms, ellipsed versions, the presupposition triggers, sentence types with or without a topic or a connective based on the speaker's estimate of the context. **ANCHOR** can be taken to be the corresponding principle that prevents choosing the reduced forms when this is not appropriate. In principle, we could have a generation principle ***REDUCE** that prevents reductions when the context does not licence them, i.e. ***REDUCE** would have to be ordered below the

constraints that force the reductions. But as will become clear, it suffices to have **ANCHOR** to get this effect and that is the more natural choice.

CONSISTENCY prefers interpretations that do not conflict with the context and **FAITH-INT** forces us to interpret all that the speaker has said. Like **ANCHOR**. **FAITH-INT** could in principle[3] be a generation constraint but it is more naturally placed with the interpretation constraints.

The ordering between the constraints is also fairly obvious. Readings can be inconsistent with the context if they are faithful, you can accommodate because you have to anchor. Accommodation is restricted by consistency and so is strength.

This gives us the following picture of what —if I am right — is nearly the whole of OT semantics.

FAITH-INT > CONSISTENCY = ANCHOR > *INVENT, *ACCOMMODATION > STRENGTH

It should be clear that, without support from OT syntax, the semantics is unable to interpret any sentence whatsoever. But OT syntax exists and how this support is regulated is the subject of the next sections.

But there is a further aspect of the system that should be pointed out. It is in fact not very much more than an OT reformulation of the essence of the received interpretation theory from the '70s of the last century. There we had the compositional semantics of *Lewis* and *Montague*, supplemented with *Karttunen* and *Stalnaker*'s ideas about presuppositions and assertions. In the '80s these have been supplemented by establishing that anaphoric processes and discourse relations can be best thought of as special cases of presupposition.

Now **FAITH-INT** and ***INVENT** in combination restore important aspects of compositional semantics (not the whole thing, but essential parts). The combination of **CONSISTENCY** and **STRENGTH** are (a strengthening of) Stalnaker's principles of assertion and **ANCHOR** and ***ACCOMMODATION** together give a reconstruction of the field of discourse, including insights from discourse representation theory (e.g. *Kamp* and *Heim*) and the analysis of presupposition (*Heim*, *Van der Sandt* and *Blutner*). The set of constraints itself is almost nothing more than the received theory. My proposal adds to the received theory by ordering the constraints and by allowing exceptions. It is extremely unlikely that there would be reasons for changing the constraints and their ordering if one moves from language to language.

The above presents the case for maintaining OT semantics in the face of the criticism that OT semantics is just OT syntax in disguise. For the rest of the paper I will assume that OT semantics is just a small body of universal constraints that help us in deciding between different readings allowed by OT syntax. In the next sections I will refer to the system defined here as the interpretation constraints.

5 The Basic Connection

Given what we have done so far, we can define the optimal interpretation of a sentence S in two steps. First we take our OT syntax system and determine the set $\{Content : Form$ is an optimal form for the content $Content\}$. In a second step, we determine which of the elements of that set optimally satisfy the interpretation constraints. Those are the best interpretations.

This can be understood as the evaluation of pairs $< Content, Form >$ over two systems of constraints: the syntax constraints $G = CG_1, \ldots, CG_n$ and the interpretation constraints $I = CI_1, \ldots, CI_m$. The fact that we first take the set $\{Content : Form$ is an optimal form for the content $Content\}$ order the interpretation constraints after the generation constraints, if we take both constraints as constraints on pairs.

In the table below, the evaluation starts with all pairs in which $Form$ is the input. The optimal pairs are found before the evaluation by the semantic constraints begins and form the set GEN for semantic evaluation. The optimal pairs at the end of the process give the possible interpretations of $Form$.

$$CG_1, \ldots, CG_n \qquad CI_1, \ldots, CI_m$$

$< Content_1, Form >$

.

.

$< Content_j, Form >$

.

.

$< Content_m, Form >$

Since the generation and interpretation constraints form disjunct sets we have no problem with the harmony between the interpretation and the generation process. It is also asymmetric: interpretation only applies after generation.

We can assume that an interpreter proceeds in this way (in an efficient implementation of it). But it is not all a wild idea that the speaker does the same. Why say something knowing that it will be understood in the wrong way? A simple check on the interpretability is normally assumed in natural language generation systems. You can even wonder whether a natural language speaker who —after all— is also a natural language understander can avoid interpreting her own words. The only difference is the set of candidate pairs. Content is fixed, form varies.

This basic system already suffices for an explanation of the ineffability problem: ineffable contents are those whose optimal realisation is misinterpreted by the interpretation constraints. I will give a more subtle account of ineffability later on.

6 Cooperativity

An important aspect of pragmatics that we did not incorporate so far is *Grice*'s principle of cooperation[4]. Language use is cooperative behaviour and the speaker has a task in speaking. Especially, the speaker has a responsibility for what the hearer will make of his sentence. That makes it plausible to assume that the speaker goes through the interpreter's part of the process and makes sure that at least she would get the interpretation she intends. But there is something more: the speaker can make sure that interpretation is as painless as possible by avoiding violations of the interpretation constraints[5]. This gives us the following picture ($G + I$ is the system of generation constraints followed by the system of interpretation constraints):

Form is an optimal generation for *Content* iff

a. $< Content, Form >$ is optimal for $G + I$ in the set $\{< Content, Form_i >$: $Form_i$ an arbitrary form$\}$

b. there is no pair $< Content_j, Form >$ that is better by I than $< Content, Form >$ is. ($Content_j$ must come from the set of optimal inverses of the set of forms obtained in (a), but this is not essential)

And the definition of an optimal interpretation must be independent, but similar.

Content is an optimal interpretation for *Form* iff

a. $< Content, Form >$ is optimal for $G + I$ in the set $\{< Content_i, Form >$: $Content_j$ is an arbitrary form$\}$

b. there is no pair $< Content, Form_i >$ that is better by I than $< Content, Form >$ is. ($Form_i$ must come from the set of optimal inverses of the set of contents obtained in (a), but this is not essential)

In generation, we carry out the basic combination first and then survey as interpreters the range of other interpretations of the form we found. In interpretation, we carry out the basic combination first and then survey as generators the range of other forms for the thought we found.

That is what people seem to do when they literally carry out this task of generating from a fixed content, like e.g. in translation. Real generation seems more like starting from a partially specified content and be happy or not with the result consisting of a full content and a form.

A succinct formulation of the system is to say that we first do normal OT syntax and —after that— superoptimality over the interpretation constraints. The cooperativity of the speaker gives us superoptimality in the semantics.

The advantage of cooperativity is that we keep some of the effects of Blutner's

bidirectionality. In particular, we keep Blutner's theorem which offers revolutionary insights in the analysis of presupposition triggers, at least if you want to believe *Zeevat2000* or *Zeevat1999*.

And we get a diagnosis for what is wrong with superoptimality. In superoptimality, it is not just the speaker that is cooperative, but also the hearer. The hearer too selects a reading taking into account the effort of the speaker: the reading is deselected if the speaker has to violate a stronger constraint or the same constraint more severely for it than for another reading. This does not do: the speaker will spend the effort if it is the optimal way to express the content in question. The hearer is just not in a position to reduce the speaker effort.

7   Rat and Rad

The last point of the last section is the solution to the rad/rat problem.

From the interpretation point of view *rad* (wheel) and *rat* (rat) are equally good interpretations for /rat/. Neither incurs a mark by any of the interpretation constraints. The mark occurred in the generation component is unimportant once /rat/ has become the optimal realisation of *rad* and *rat*.

The same applies to my syntactic version of the rad-rat problem. After *Wie slaat Hans?* has become the optimal realisation of both $?x\ beat(x, Hans)$ and $?x\ beat(Hans, x)$ the **STAY** violations become irrelevant.

8   Italian WH-phrases

Let us assume that Italian wants it WH-phrases fronted, i.e. in the first position. Let us also assume that it wants to mark semantical WH-phrases but not as much as it wants to front them.

It then follows that the optimal candidate for $?xy\ at(e, r) \wedge eat(e, x, y))$ is something like (4)(assuming *qualcosa* is Italian's default NP)

(4)   Chi ha mangiato qualcosa?

The WH-constituent is fronted and the subject, but not the object is WH-marked. The object violates **PARSE-WH**, but the damage is smaller than marking it and violating **FRONT-WH**. The generation competition gives — as always— an optimal candidate.

But in interpretation, by ***INVENT** the semantical realisation of the WH-feature cannot be recovered. That means that the optimal generation is in fact not a good expression of the input.

9 Kill and Cause to Die

We lose the ability to predict the semantic difference between *kill* and *cause to die* in this framework. Reinhard Blutner[7] can with weak superoptimality, just by the way of putting generation and interpretation together.

That is a pity, but there is no reason to despair as a simple explanation is available. Let us assume that there is an **ECONOMY** constraint active in the generation system. Now this constraint militates against long and unfrequent ways of expression. If the sheriff killed Bill in a normal way, **ECONOMY** will prevent the selection of *cause to die*. For the interpreter, that means that the interpretation *kill* is not available: it is not a survivor. Suppose that we also have a (stronger) constraint **PARSE-MARKED** which requires a marked way of expression when an input item has the feature $MARKED$. Assume moreover that the use of long and/or infrequent expressions are marked ways of expression. The interpreter can then only interpret *cause to die* as the expression of a marked way of killing.

Though I appreciate the beauty of the explanation by weak superoptimality, I am worried by the fact that the interpreter actually overinterprets *cause to die*. As I see it, the interpreter violates ***INVENT**. I would like to supply the generator in her input with the features to distinguish the two readings.

10 Reflexives

Grice remarks that if you say (5), you imply that the woman is not his wife, his mother or his sister.

(5)   I saw John in town yesterday with a woman.

We might add that she is also not the speaker or the hearer or any other high salience item in the discourse situation. A natural explanation for this within OT is the assumption of a sequence of parsing constraints that force us to indicate in the output that the referent of an NP is the speaker or the hearer, c-commanded, currently in the discourse topic, in the visible surrounding of the utterance, has been mentioned before, is related to a highly salient discourse item by a relation expressed by the common noun of the NP, is uniquely described by the common noun of the NP etc. We further have to assume that first and second person pronouns express the person, reflexives c-commanding (or —in English— perspective), personal pronouns membership of the discourse topic, demonstratives the presence in the visible surroundings, the definite article either previous mention or a relation to an object in the discourse topic or uniqueness. The use of default rules for NP-selection is the standard technique in natural language generation and the only reason they have not found their way into linguistics is that grammatical formalisms before OT syntax cannot accommodate them naturally[6].

In combination with *INVENT* and **ANCHOR** the hierarchy of parse constraints give us precisely the effects that Grice predicts: that we can rule out all the properties higher up in the hierarchy.

11 Morals

In this paper, I have shown that a theory of semantic interpretation on the basis of OT syntax is feasible, though it has to be supplemented with some quite general semantic and pragmatic principles. The place of the Gricean maxims within this scheme has so far not been explored properly. E.g. relevance and quantity must play a role. Superoptimality (or weak superoptimality) and the speaker and hearer games developed by (Dekker & Van Rooy) continue to be relevant, but do not penetrate syntax as such.

There are perspectives for the further development of the field of semantics. If I am right, compositionality does not need to be as much a straightjacket as it was in the heydays of the rule-to-rule hypothesis. A traditional problem is that of idiomatic expression. The rule-to-rule hypothesis predicts that both sentences in (6)mean the same, i.e. that the speaker wants to know the time.

(6)   What time is it?
         How late is it?

Now the fact of the matter is that in English the second expression, though grammatical, is merely a source of wonder, while only the first actually expresses it. (The Dutch equivalents are reversed.) Now, it should be easy to configure the English OT syntax so that only the first is an optimal expression of the input. The second sentence is then rightly predicted to be uninterpretable.

An important feature of OT syntax is that is can easily underspecify the full content of the semantic input. It is reasonable to assume that the representations in (7)are both optimally generated by: *Every man likes a woman.*

(7) $\forall x(man(x) \rightarrow \exists y(woman(y) \land like(x,y)))$
         $\exists y(woman(y) \land \forall x(man(x) \rightarrow like(x,y)))$

The syntax parses the grammatical function of the two quantifiers and their quantificational force, but not their relative scope. The function of polarity sensitive items is now clear: they parse a semantic feature of the environment of the semantic NP. The assumption by Bittner1997 of seven abstract semantic combinators with a whole range of concrete logical interpretations makes sense from the current perspective: natural languages can choose to mark certain abstract relations between the semantic counterparts of the component expressions of a sentence, but need not fully specify the logical relations between these parts.

What we need is a weaker interpretation of the principle of compositionality. Frege does not say much more than that the meaning of a complex expression is a function of the meaning of its parts. All that we need are slightly more liberal formulations. Parts must be taken to be the smallest meaningful part, which can include fixed combinations of words. And though we must admit that the meaning of a complex expression is determined by applying a function to the meaning of its parts, it does not follow that natural languages make it clearer what the precise logical content of that function is on a particular occasion than they make it clear what shade of blue is involved in my daughter's new dress. Though we can go for more precision in both cases, such precision is not required or desirable for everyday communication.

References

Bittner, M. Cross Linguistic Semantics. In: *Linguistics and Philosophy*, **17**1994, p. 57-108..

Blutner, R. Some Aspects of Optimality Theory in Interpretation. (this volume).

Boersma, P. Functional Phonology. PhD. Amsterdam 1998.

Bresnan, J. Optimal Syntax. MS. Stanford.

Choi, Hye-Won. Optimizing Structure in Communication: Scrambling and Information Structure. PhD Stanford 1998.

Dekker, P. & R. van Rooy. (this volume)

Geurts, B. Strength. (this volume)

Grice, H.P. Logic and Conversation. In: Studies in the Way of Words.

Grimshaw, J. Projection, Heads and Optimality. In: Linguistic Inquiry, 28.3, p. 373-422.

Heim, I. *On the projection problem for presuppositions*, *WCCFL* **2** (1983). p. 114-26.

Heim, I. The Semantics of Definite and Indefinite Noun Phrases. PhD University of Massachusetts, Amherst 1982.

Hendriks,P. & H. de Hoop. Optimality Theoretic Semantics. (to appear)

De Hoop, H. & H. de Swart. (this volume)

Kamp, H. A Theory of Truth and Semantic Representation. In: Groenendijk, Janssen & Stokhof (eds). *Formal Methods in the Study of Language.* Mathematical Centre, Amsterdam 1981.

Karttunen, L. Presupposition and linguistic context.*Theoretical Linguistics* **1**,1974, p.181-94.

Karttunen, L. Presuppositions of Compound Sentences. Linguistic Inquiry 1973, p. 167-193.

Lewis, D. General Semantics.

Montague, R. The Proper Treatment of Quantification in Ordinary English.

Pesetsky, D. Optimality in Syntax. In: D. Archangeli & T. Langendoen (eds.) Optimality Theory. Blackwell 1997.

Peters, S et. al. Reciprocals.

Van der Sandt, R. Presupposition projection as anaphora resolution. In: Journal of Semantics **9** (1992), p. 333-377.

Smolensky, P. On the Comprehension/Production Dilemma in Child Language.

In *Linguistic Inquiry* **27** (1996).

Smolensky, P. Handout OTS Conference. Utrecht 3-1-2000.

Stalnaker, R. Assertion. In: Cole &Morgan (eds.) *Syntax and Semantics 9: Pragamtics*, Academic Press, New York, 315-332.

Zeevat, H. 2000. Optimal Semantics. In H. de Hoop & H. de Swart (eds.)OTS^2. OTS, Utrecht 2000.

Zeevat, H. 1999. Explaining Presupposition Triggers. In: P.Dekker(ed). AC 99 Proceedings. University of Amsterdam 1999.

Footnotes

1. Though this plays only a minor role in the argument, I wish to make clear my assumption that I take the notion of content here to one of a semantic representation in some suitable logical formalism against the background of discourse context representing the common ground and the current discourse situation. The semantic features referred to by the constraints can therefore equally well be properties that the object identifiers have in virtue of their role within the discourse context. This goes against some proposals for the input, that favour underspecified representations or even quasi-syntactic inputs.

2. I want to remain strictly uncommitted to any syntactic analysis in this paper. Not in life.

3. As Bresnan does as part of the faithfulness constraint in Optimal Syntax.

4. Charity of the interpreter is coded in the interpretation principle of consistency with the context and in the principle of going for the most informative reading. But this is only an aspect of cooperativity.

5. I am not sure of my equation of pain and constraint violation, but it is a natural idea. At least in syntax, it is testable whether there is a relation between understanding times and the amount of constraint violation that goes on in sentences. Certainly the violations of the interpretation constraints bristling in the presupposition literature are not easy to understand.

6. An exception should be made here for Panini, who by his general architecture and elsewhere principle is clearly a precursor of OT.

7. As Blutner points out, there is another problem. If there are not two possibilities, the prediction is that only the simple reading remains. That would predict that *make laugh* only has the direct interpretation, or that in Frisian, which has no reflexives, normal pronouns only have reflexive meanings.