

Commentary on Hubert Truckenbrodt's 'On the semantic motivation of syntactic verb movement to C in German, for *Theoretical Linguistics*.

## How far can pragmatic mechanisms take us?\*

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### 1 Truckenbrodt's challenge

Hubert Truckenbrodt issues a substantive challenge near the start of his contribution:

The variation we observe in the connection between syntactic sentence types and their possibilities of use, while showing some flexibility, is not arbitrary or unrestricted. Narrow restrictions on this relation exist, which cannot plausibly stem from general purpose pragmatic mechanisms.

This is a bold statement. The field is only just now beginning to understand what general pragmatic mechanisms are like once we dig deeper than intuitive statements. One wonders: to what extent could a precise set of pragmatic mechanisms (maxims), interacting with semantic denotations, produce the "narrow restrictions" that Truckenbrodt carefully documents?

The present commentary explores this question. I outline a general pragmatic theory in which versions of the Gricean maxims act as pressures on the space of felicitous utterances. Relevance is defined in terms of the immediate question under discussion (Roberts 1996, 2004; van Rooy 2003a), so there is special emphasis on question meanings and the pragmatic expectations that they generate when uttered. This emphasis carries over into the second main part of the commentary, in which I review Truckenbrodt's question-related data from the point of view of this theory and show in addition that the system makes correct predictions about where partial answers are preferred answers.

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## 2 Pragmatic pressures

For Truckenbrodt, a sentence's *context index* encodes much of what it does or can do when uttered. For instance, a standard matrix interrogative (with the verb in second position in German) is keyed into the following kind of index:

- (1)  $\langle \text{Deont}_S, A, \text{Epist} \rangle$  'speaker *S* wants addressee *A* to make it common ground ...'

So an interrogative like *Regnet es?* ('Is it raining?') encodes the information that the speaker wants the addressee to tell him whether it is raining (and thereby make this information part of the common ground). Standard interrogatives contrast minimally with verb-final matrix clauses like *Ob es regnet* ('(I wonder) whether it is raining'), which make no mention of the addressee:

- (2)  $\langle \text{Deont}_S, \text{Epist} \rangle$  'speaker *S* wants it to be common ground ...'

The lack of *A* in (2) is meant to capture the fact that verb-final matrix interrogatives place no demands on the addressee.

In the pragmatic theory articulated below, we need not encode the speaker's desires into question meanings, nor is it necessary to mention the addressee. Rather, we can rely on general pragmatic pressures to shape the discourse and produce, as side effects, the speaker's voiced desires and the concomitant demands placed on the addressee. The pressures I rely on are essentially Gricean; they are summarized in (3).

- (3) a. Quality: Be truthful!  
b. Quantity: Be informative!  
c. Relevance: Be relevant!

I do without a maxim of manner (the injunction to be clear and concise), to emphasize that we can go a long way with just the above information-based conditions. I refer the reader to Blutner 1998, 2000 and van Rooy 2003b for conceptually related pragmatic theories that incorporate manner, and to Horn 1989 and Levinson 2000 for frameworks in which manner is subsumed by other maxims.

The next few subsections develop the theory of pragmatic pressures that I call upon to reanalyze the important question data from Truckenbrodt's paper.<sup>1</sup>

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<sup>1</sup>The calculations involved in the theory below can be tedious and involved. For this reason, I have developed an implementation, which is available at <http://semanticsarchive.net/Archive/jViODAyZ/>. It is a useful tool for quickly working through examples to see what the theory predicts about them. There is also an interface for using the theory to calculate clausal conversational implicatures (Potts 2006).

## 2.1 From propositions to probabilities

The starting point for my theoretical implementation is the insight that there is an easy translation from propositions into probability distributions. This idea was exploited in linguistics early on by Merin (1997), and van Rooy (2003b, 2004b) has recently employed it successfully in a variety of settings.

A probability distribution is, in the present linguistic context, a function from (countable) propositions into real numbers in  $[0, 1]$ , as defined in (4).

- (4) For countable  $W$ , a function  $P : \wp(W) \mapsto [0, 1]$  is a probability distribution iff:
- a.  $P(W) = 1$
  - b. If  $p$  and  $q$  are disjoint subsets of  $W$ , then  $P(p \cup q) = P(p) + P(q)$ .

The first condition relates the tautology to the (maximal) probability, 1. The second defines probabilities as additive: we can get the probability of a proposition by adding up the probabilities for its disjoint subsets.

We want to use probability distributions to mimic propositions. For this, we need to impose two additional constraints:

- (5) The probability distribution  $P$  mimics the proposition  $q$  (a subset of  $W$ ) iff:
- a.  $P(\{w\}) = 0$  iff  $w \notin q$
  - b.  $P(\{w\}) = P(\{w'\})$  for all  $w, w' \in q$

The first clause equates nonmembership in  $q$  with 0 probability according to  $P$ . The second clause smooths out the probabilities for all the singleton subsets in  $q$ . Propositions treat their members equally. Probability distributions do not do this inherently, so we impose the added condition with (5b).

Propositions are employed in intensional semantics not just for declarative-sentence denotations, but also for modal spaces, individuals' belief states, and so forth. This unifying theme translates to the probabilistic view. For instance, if Lisa's belief state is modeled by  $\{w_1, w_2\}$ , then it is also modeled by the function  $P_{\llbracket Lisa \rrbracket}$  such that  $P_{\llbracket Lisa \rrbracket}(\{w_1\}) = P_{\llbracket Lisa \rrbracket}(\{w_2\}) = .5$  and  $P_{\llbracket Lisa \rrbracket}(\{w_i\}) = 0$  for all other worlds  $w_i$ .

The next few sections show that there is a conceptual advantage to thinking in terms of these numerical values.

## 2.2 Quality

Grice's maxim of quality exerts pressures for truthfulness and reliability. The original statement is complex; a full treatment would demand that we explore the theory of knowledge ascriptions. Here, to keep the paper short and focussed, I simplify: with Groenendijk (1999), I treat quality as the pressure to say only those things that are entailments of our beliefs. If we were to import this idea, unmodified, into the realm of probabilities, then quality would say that a speaker  $S$  should utter a sentence  $U$  only if  $S$  assigns  $\llbracket U \rrbracket$ , the propositional content of  $U$ , the probability 1.

But are we this strict? We are not. It is easy to find cases in which our standards for utterance are lower than perfect belief. We brainstorm new ideas. We bullshit (Frankfurt 1986). We speak a little loosely (Lasersohn 1999). And some of us express extreme skepticism in general (Putnam 1981).

Thus, in the present theory of pragmatics, quality is both more forgiving and more context-dependent than the rigid view suggested initially by Grice. I propose that each context  $C$  comes with a *quality threshold*. A quality threshold is just a real number in  $[0, 1]$ . Quality is the demand that we limit ourselves to things that we assign a probability higher than the threshold:

(6) **Quality ratings**

The *quality rating* of an utterance  $U$  by speaker  $S$  in context  $C$  is  $P_{S,C}(\llbracket U \rrbracket)$ .

(7) **Quality with thresholds**

An utterance  $U$  by speaker  $S$  in context  $C$  satisfies quality iff its quality rating is above the quality threshold  $C_\tau$  for  $C$ .

Here,  $P_{S,C}$  is a probability distribution representing the speaker's belief state. In what follows, I drop the subscript  $C$  wherever it is clear which context the belief state is drawn from.

Normal quality thresholds are above .9. Contexts with lower thresholds favor informativeness over reliability. In the terms of Frankfurt (1986), they are full of bullshit.

The quality threshold imposes an initial, absolute cut-off. Imagine that we begin with the full power-set of possible worlds as the class of things whose content we could offer. Quality, as defined in (7), eliminates all utterances with content at or below the threshold. In practice, the more refined the speaker's beliefs, the greater this elimination. And we can think of this elimination as providing a hearer strategy: the hearer is licensed by the Gricean maxims to infer that the speaker will not say something that is at or below the quality threshold.

## 2.3 Quantity

Grice's (1975) statement of the quantity maxim has two parts. The first is an injunction to be as informative as is required. The second counsels against saying more than is required. The "required" portions of this maxim are, I believe, fully duplicated by the relevance maxim, discussed in detail below. So I regard quantity as a call for speakers to maximize information content, expecting this injunction to be mitigated by quality as well as relevance (Horn 1984, 1996).

So we need a measure of information content. There are many such measures on the market (van Rooy 2004a; Benz et al. 2005). To keep things simple, I adopt a version of Blutner's (1998) proposal to derive information content from probabilities using a logarithmic function. Here is the basic measure:

(8) **Information value of  $p$  for individual  $a$**

$$\text{inf}_a(p) = -\log_2 P_a(p)$$

By this measure, informativity values rise as probabilities fall (with the probability of 0 assigned the pathological value  $\infty$ ). The more likely something is to be false, the higher its inf value is.

We want to assign utterances *quantity ratings*. However, it won't do to identify these with the inf values for propositions relative to the speaker's probability distribution. On that approach, the more strongly a speaker believed a proposition  $p$ , the lower  $p$ 's information content would be. This indicates that the speaker's belief state is not the one we want to use to model quantity.

We should instead use the *addressee's* probability function in calculating the inf values relevant for pragmatics, as in (9).

(9) **Quantity rating**

The *quantity rating* of an utterance  $U$  by speaker  $S$  to addressee  $A$  in context  $C$  is

$$\text{Quantity}_C U = \text{inf}_A(\llbracket U \rrbracket)$$

It might seem strange at first that the quantity rating of the speaker's utterances are determined by the probability distribution of the addressee. But it matches well our intuitions about pragmatic values. I might accidentally tell you something you already know, on the mistaken assumption that it is new to you. In such cases, the information value of what I said is indeed very low. More generally, as a speaker, I must guess about what your probability distribution is like. If I guess wrong, my utterance is infelicitous. (You might also be insulted by my supposition about your belief state.)

## 2.4 Relevance

Grice's maxim of relevance says simply that one should make one's utterances relevant to the current aims of the discourse. I follow Roberts (1996, 2004) and van Rooy (2003a) in taking the primary notion of relevance to be *relevance to a question*. I assume a partition semantics for questions (Groenendijk and Stokhof 1982, 1989). Answering a question means selecting part or whole of one or more of the partitions in the question. The more complete an answer is, the closer it comes to picking out exactly one of the question's cells. The following definitions, due to van Rooy (2003a), get at this notion:

- (10) a.  $p_Q = \{q \in Q \mid q \cap p \neq \emptyset\}$  (for  $p$  an answer to question  $Q$ )  
b.  $\text{Ans}_Q p = |p_Q|$

The set  $p_Q$  is the set of propositions in the question  $Q$  that are consistent with the proposition  $p$  (our answer).  $\text{Ans}_Q p$  is simply the cardinality of the set  $p_Q$ . A complete answer to  $Q$  has cardinality 1 by this measure. Partial answers have cardinalities greater than 1. (Only the empty-set answer has a cardinality of 0, so we ignore that case.)

Ans values do not totally order the set of propositions. To see this, consider a question with just one cell, say,  $\{\{w_i, w_j\}\}$ . All of  $\{w_i, w_j\}$ ,  $\{w_i\}$ , and  $\{w_j\}$  have nonempty intersections with the lone cell, and thus all have identical Ans values for this question. But it is easy to imagine such answers contrasting in terms of their discourse properties.

We resolve the ties by taking advantage of the observation that *too much* information can lead to a decrease in relevance (Sperber and Wilson 1995; van Rooy 2003b). If two propositions have identical Ans values, then we want to get rid of one of them. Following van Rooy (2003a), I resolve these ties by eliminating all but the *least* informative members from the sets of equivalence classes that we can extract from the Ans numbers. The definition is (11).

(11) **Relevance-ranking**

- i. Sort the space of utterances with quality ratings above the threshold into equivalence classes based on Ans-values.
- ii. For each Ans-equivalence class, get the utterances with the lowest quantity ratings in that class. Keep them, and throw out the rest.
- iii. The Ans ordering of the remaining set is the relevance ranking.

## 2.5 Felicitous utterances

The above considerations of quality, quantity, and relevance define a procedure for arriving at a set of felicitous utterances for each stage in a discourse:

(12) **Felicitous utterances**

The set of felicitous utterances in a context  $C$  is obtained as follows:

- i. From the set of all propositions, eliminate those that have quality ratings at or below the quality threshold for  $C$ .
- ii. With the resulting set, determine relevance rankings and throw out all utterances without such rankings. (That is, throw out every utterance that is not among the least informative members of its Ans-equivalence class.)
- iii. From the resulting set of relevance-ranked utterances, extract the utterances with the lowest Ans values.
- iv. From the resulting set, select the utterances with the highest quantity ratings. These are the felicitous utterances for  $C$ .

The steps are necessarily ordered. Just as Grice (1975) imagined, quality has primacy (Horn 1996; Chapman 2005): it determines the first elimination. Relevance makes a second elimination. Finally, quantity enters the picture directly: we maximize on information content (confined by the quality threshold and relevance ranking).

### 3 Standard interrogatives

In the present system, every utterance is measured by the algorithm described in (12). For standard (V-in-C) interrogatives, this is all we need to derive the information encoded in Truckenbrodt's context indices.

#### 3.1 *S wants...*

As noted above, Truckenbrodt argues that a standard interrogative directly encodes the information that the speaker wants its true answer to become a part of the common ground. This is the  $\text{Deont}_S$  term in the context index  $\langle \text{Deont}_S, A, \text{Epist} \rangle$  for such clauses, as in (1).

In the present system, we need not encode the speaker's desires in our meanings for questions. Their deontic flavor derives from the general pragmatic mechanisms. The central observation is (13).

- (13) If the speaker already knows the answer to his question, then the quantity rating of any felicitous answer, as defined in (12), will be disastrously low.

Recall that the quantity rating, (9), is determined by the addressee's belief state: an utterance has a high quantity rating iff it has a low probability for the addressee. Thus, if Bart

asks Lisa a question with true answer  $p$ , and it holds also that  $P_{\llbracket \text{Bart} \rrbracket}(p) = 1$ , then all of Lisa’s felicitous replies — those that are relevance-ranked and above the quality threshold, as per (12) — will have 0 quantity ratings.

So the speaker, in asking a question, must have an unfulfilled desire to have his question answered, else the best answer one can give him will be uninformative. This is not a fact about questions, but rather an entailment of the system.

Truckenbrodt (2004) explores cases in which the questioner is already able to answer his question: academic tests, for example. Presumably, such discourses are nonpathological in virtue of the fact that every utterance is keyed into a higher-level question relative to which true answers have high quantity values. In the academic-test setting, the higher-level question could be something like “What does the student know?”, with everything he puts on the test supplying a piece of the overall answer. I think Roberts (1996) has it exactly right with her tiered system of questions under discussion; only space considerations prevent me from systematically drawing this distinction.

### 3.2 ...from A

Truckenbrodt’s context indices for standard interrogatives also encode their addressee-orientation, as the second member of the context tuple  $\langle \text{Deont}_S, A, \text{Epist} \rangle$ , which conveys that an answer is requested ‘from A’.

Just as it is unnecessary to encode the speaker’s desires, it is likewise unnecessary to hard-wire demands on the addressee into our question meanings. If the speaker  $S$  asks a question that succeeds in becoming the context’s immediate question under discussion, then any immediately following utterance will be measured with respect to that question, via (12).

For example, suppose Bart and Lisa are the discourse participants. Bart says, “Is it raining?” If Lisa is engaged in the normal conversational turn-taking, she will speak next. Whatever she says will be measured relative to Bart’s question. If she is playing by the rules of the game, i.e., (12), what she says will obey quality and relevance, and, within that space, it will be as informative as possible. In this way, the ‘from A’ nature of questions is derived as an environmental effect.

The automatic nature of this addressee-orientation helps us understand the ill-formed discourse in (14), Truckenbrodt’s (28).

- (14) a. Stefan: Ich hab seit Jahren nichts mehr von Peter gehört.  
 I have since years nothing more from Peter heard  
 ‘I haven’t heard from Peter in years.’



- b. Heiner: Ich auch nicht.  
I also not  
'Me neither.'
- c. Stefan: #Mag er immer noch kubanische Zigarren?  
likes he always still Cuban cigars  
'Does he still like Cuban cigars?'

Let's suppose that Heiner's utterance, which asserts that Heiner has not seen Peter in years, carries with it the implication that Heiner does not know any particular facts about Peter and, in turn, that Heiner does not know whether Peter still smokes Cuban cigars.<sup>2</sup> Then Stefan places Heiner in a difficult spot with his question: all of Heiner's permitted moves bring with them very low information content. (The ones that are informative are ruled out due to low quality or lack of relevance.) To make this concrete, let's assume that Stefan's polarity question divides the world space into two cells — the cell  $W_s$  containing the worlds where Peter still smokes Cuban cigars and the cell  $W_{ns}$  containing the worlds where he doesn't. Then we have the following context settings:

- (15) a. QUD:  $\{W_s, W_{ns}\}$   
 b.  $P_{\llbracket \text{Heiner} \rrbracket}(W_s) = P_{\llbracket \text{Heiner} \rrbracket}(W_{ns}) = .5$

Assuming the quality threshold is .5 or above, the only thing Heiner can say in reply to Stefan's question is "Yes or no" ("I don't know"), which rates a disastrous 0 on quantity.

(16)

utterance	quality	relevance	quantity
$\llbracket \text{Yes or no} \rrbracket = W_s \cup W_{ns}$	1	2	0
$\llbracket \text{Yes} \rrbracket = W_s$	.5	1	1
$\llbracket \text{No} \rrbracket = W_{ns}$	.5	1	1

Only the highly uninformative equivocation is a potential utterance. The others are eliminated by quality.

We achieve this result without encoding anywhere the demand that the questioner want something from the addressee. The result follows entirely from the fact that the addressee's utterance has a value that is set partly by the speaker's question.

<sup>2</sup>These are non-necessary, extra-linguistic inferences. If it is clear that Heiner is an expert on Peter's habits despite their long separation, then Stefan's question might be perfectly felicitous (because Heiner might be able to answer it to some significant degree).

## 4 Matrix verb-final interrogatives

Truckenbrodt sets up a minimal contrast between (14c) above and (17) (his (29)) in the context created by (14a)–(14b).

- (17) Stefan: Ob er immer noch kubanische Zigarren likes.  
          whether he always still Cuban cigars mag  
          ‘I wonder whether he still likes Cuban cigars’

This discourse differs minimally from (14): here, Stefan’s second (final) utterance has verb-final form, with a corresponding interpretation that is at least somewhat like an English “I wonder” predication.

We know a few things about the semantics of matrix verb-final sentences like Stefan’s *Ob*-clause. The most important is that, as Truckenbrodt puts it, they do not expect an answer from the addressee. In his terms, this means that they do not encode the information that the speaker wants some information from the addressee. This is their point of contrast, discourse-wise, with regular matrix interrogatives.

In the present terms, this simply means that a verb-final matrix interrogative does not shift the question under discussion to the one expressed by its verb-second counterpart. This follows directly if they have a non-interrogative semantics, i.e., if they have meanings that correspond (even if only approximately) to the declarative “I wonder” paraphrase given in (17). They seem to function instead to point the listener to a higher-level question under discussion.

## 5 Partial answers

Truckenbrodt claims, in his (23), that a speaker who asks a question presupposes that his addressee knows its answer. But he qualifies this in a complex way: “this presupposition can normally be accommodated, and if in fact you don’t know the answer, you can say so and thus contradict my presupposition”.

The present system achieves the requisite results without any reference to presuppositions. Rather, the context itself shapes the answer directly, ensuring that speakers will do the best they can to provide complete answers. This often results in (very) partial answers, ones that are entirely felicitous despite their not satisfying the presupposition that Truckenbrodt specifies.

Consider, for instance, the logical space in (18).

$$(18) \quad W = \{w_1 \dots w_4\}$$

$$\begin{aligned} \llbracket \textit{Barbara lives in Russia} \rrbracket &= \{w_1, w_2\} \\ \llbracket \textit{Barbara lives in Moscow} \rrbracket &= \{w_1\} \\ \llbracket \textit{Barbara lives in Petersburg} \rrbracket &= \{w_2\} \\ \llbracket \textit{Barbara lives in Germany} \rrbracket &= \{w_3, w_4\} \\ \llbracket \textit{Barbara lives in Berlin} \rrbracket &= \{w_3\} \\ \llbracket \textit{Barbara lives in Cologne} \rrbracket &= \{w_4\} \end{aligned}$$

Assume that Lisa knows that Barbara lives in Russia, but she doesn't know anything more specific than this. Her belief state is given by  $\{w_1, w_2\}$ . If Bart asks, "Which city does Barbara live in?", Lisa will give the partial answer, "She lives in Russia". This will be the most felicitous move for her to make, and the present system can articulate why: naming a specific city would fall below even extremely lenient quality thresholds, and anything more general would fail to maximize on quantity:

(19)

utterance	quality	relevance	quantity
$\llbracket \textit{In Russia} \rrbracket = \{w_1, w_2\}$	1	2	1
$\llbracket \textit{In Russia or Berlin} \rrbracket = \{w_1, w_2, w_3\}$	1	3	.415
$\llbracket \textit{In Russia or Germany} \rrbracket = \{w_1 \dots w_4\}$	1	4	0
$\llbracket \textit{In Moscow} \rrbracket = \{w_1\}$	.5	1	2
$\llbracket \textit{In Berlin} \rrbracket = \{w_2\}$	0	1	2

Only the first three are admissible in contexts with reasonable quality thresholds (i.e., above .9). Given this set, the choice is clear: maximize on information content. Thus, her partial answer ("In Russia") is favored.

## 6 Extensions and future directions

This commentary sought to show that a set of general pragmatic mechanisms is sufficient to shape discourses consisting of questions and their answers. There was no need to talk about presuppositions, sentence-type meanings, or the like. As we gain a deeper and more comprehensive understanding of the pragmatic pressures brought to bear on all our utterances, we should be able to expand the coverage to include the other imperative and declarative data that Truckenbrodt explores in his paper. This might be a long way off. But I hope this commentary has shown that general pragmatic mechanisms, when made sufficiently precise, can impose quite specific and intricate limitations on where and how sentences are uttered.

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