TOPIC-FOCUS ARTICULATION AS GENERALIZED QUANTIFICATION

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Abstract

Recent results of Partee, Rooth, Krifka and other formal semanticians confirm that topic-focus articulation (TFA) of sentence is relevant for its semantics. The essential import of TFA, which is more apparent in case of a language with relatively free word order such as Czech than in case of English, has been traditionally intensively studied by Czech linguists. In this paper we would like to indicate the possibility of the account for TFA in terms of the theory of generalized quantifiers, drawing on the results of both these groups of theoreticians. The basic intuition which we accept as our point of departure is the intuition of topic as the "semantic subject" and focus as the "semantic predicate"; we point out that the role of topic is to specify the entity the sentence is "about" (thereby triggering a presupposition), while that of the focus is to reveal a characterization of this entity, and usually a characterization that is in some sense exhaustive. Then we show that it may be plausible to consider topic and focus as arguments to an implicit generalized quantifier, which may get overridden by an explicit focalizer.

0. A preliminary remark: symbols in semantics

There are two principal ways to employ formal or symbolic means to semantically analyze a sentence (more generally an expression or an utterance). The first of the ways consists in using symbols to picture some aspects of the sentence to emphasize or to point out those aspects of its syntactic structure which we consider relevant for its semantics. We may, for example, depict the statement *John loves Mary* as **JOHN** $\xrightarrow{\text{loves}}$ **MARY** to emphasize that John is the agent of the action expressed by *loves* and Mary its objective; or we may indicate the same by writing $[John]_{Ag}$ *loves* $[Mary]_{Ob}$. It is the graphical shape of such a representation that is important: it is just the graphics that does the job of explication. We are free to employ symbols of any kind, the only point is to emphasise the relevant, and to suppress the irrelevant, features of the sentence analyzed.

The other way to use formal means is to do logical analysis, and its nature is essentially different. Its primary aim is not to depict features of the sentence's structure, but rather to point out the proposition which is to explicate the meaning of the sentence (and to point out this proposition means – in effect – to point out the truth conditions of the sentence, or the contribution the sentence brings to truth conditions of suprasentential wholes, i.e. the "context-change potential" of the sentence). We again use symbolic means: we may, for example use the formula LOVES(JOHN,MARY) of the first-order predicate calculus to schematize John loves Mary. However, now it is not the graphical shape of the symbols which is relevant – we know that the formula we have used is equivalent to many other formulas and it would have been the same if we have used any of them – the proposition pointed out would be the same.

The basic difference between the two approaches is that the latter works with closed systems of symbols with strictly defined equivalence – in their case, it is not the formula itself that does the explication, but rather the proposition pointed out by it. And it is also only this approach that facilitates semantic analysis in the strict sense (cf. Lewis, 1972).

1. Topic and Focus within the Prague Tradition

Contemporary semantic theories are inclined to view focus as something extraordinary, as something which a sentence may, or may not, have, and which becomes semantically relevant only when it gets combined with a focus-sensitive operator. The Praguian approach, on the other hand, considers TFA as the universal basis of semantic structuring of sentence. Let us briefly recapitulate its basic tenets – for a more detailed exposition see Sgall, Hajičová and Panevová (1986) and also Sgall (1995) and Hajičová (1995).

The syntactic characterization of sentence underlying this approach works with the concept of *dependency*. The default order of items depending on a verb (i.e. the order of thematic roles and adverbials) is considered to be fixed for a given language; it is called the *systemic ordering*. However, this order together with the order of other items not depending directly on the main verb is modified in a concrete utterance, so that the resulting "deep" order is that of the *communicative dynamism* (*CD*). The CD order of contextually bound items dependent on the same head is determined by the speaker's discourse strategy rather than by grammar; on the other hand, the CD of the unbound items dependent on the same head is in accordance with the systemic ordering. An item is less dynamic than its head iff the dependent item is bound.

The least dynamic element of the sentence constitutes the *topic proper*. All the contextually bound items depending on the main verb together with all that depends on them and together with the main verb if this is contextually bound, constitute the *topic* of the sentence; the rest of the

sentence constitutes the *focus*. Hence the topic/focus classification is exhaustive: every element of the sentence belongs either to the topic or to the focus.

2. Topic & Focus as "Subject" & "Predicate"

The basic idea is that the topic-focus articulation has to do with the dynamism of discourse. A linguistic utterance says – in the prototypical case – something new about something old. There is a subject which the sentence is about, and there is a predicate which is ascribed to the subject. The utterer first points out an element of the common ground shared by the participants of the discourse and then reveals something which he proposed to be added to the common ground. If his utterance is successful, then the new item is added and it can become the starting point of a following utterance.

In the prototypical case, this semantic notion of subject and predicate coincides with the syntactic notion – the grammatical subject refers to what the sentence is about, and the grammatical predicate expresses what is said about it. However, in general almost any syntactic part of sentence can act as the semantic subject, leaving the rest of the sentence for the role of semantic predicate. Thus, while under normal condition the sentence (1) expresses the ascription of the property of walking to the individual John, its variant (2) (with the stress on *John*) seems rather to express something like the ascription of the property "being instantiated by John" to the "entity" walking.

John walks (1)

JOHN walks (2)

An instructive way to see topic and focus is to see them just as "semantic subject" and "semantic predicate". Topic is that which the sentence is about, by which it gets anchored to the common ground, and focus brings about the very information the sentence was assembled to convey.

What does this mean for logical analysis? The straightforward way to analyze (1) is (1'); and it seems that to account for the fact that in (2) the roles of *John* and *Walks* get exchanged it is enough to employ the mechanism of lambda-abstraction and to use the well-known Montagovian trick of type-raising. (2) thus seems to be analyzable as (2').

Walk(**John**) (1')

λf.f(**John**)(**Walks**) (2')

However, this idea is misguided, because it disregards the very sense of logical analysis. The point is that (1') and (2') are equivalent formulas ((2') is straightforwardly lambda-reducible to (1')), and hence (2') fosters precisely the same analysis as (1'). To analyze something as a "semantic subject" it is not enough to provide a formula in which it corresponds to the subject – because we can always provide another, equivalent formula in which it would correspond to the predicate.

This means that if we want to speak about "semantic subject" and "semantic predicate", we must understand these terms as expressing two different ways of contributing to truth conditions. We cannot simply say that the contribution of the predicate differs from that of the subject in that the truth conditions of the whole sentence result from applying the former to the latter; because we saw it is easy to provide an alternative analysisŘeknu-li někomu například ".

The real semantic difference can be seen as stemming from the fact that the subject purports to point out something known. If it fails to do so, the sentence is not false, but rather infelicitous, because it makes the listener wonder what the speaker is talking about. On the other hand, if the subject succeeds in pointing out a known anchor and the predicate fails to be true, the sentence is simply false. In other words, the subject is the matter of presupposing, whereas the predicate is the matter of stating.

What kind of logic do we need to account for this?. First, we need a logic that is partial: its formulas can posses not only the values T and F, but can also have no truth value at all (i.e. they can be not only true or false, but also "infelicitous"). Then we can associate define what can be called the "propositional content" of an expression (a propositional content of a statement is the statement itself, that of a term is the proposition claiming the existence of the corresponding individual and that of a predicate is the proposition claiming the non-emptiness of the corresponding class); and we can define *"presuppositional" predication* as predication posing the presupposition associated with the subject. Let us do it – for the sake of simplicity – on the level of extension (everything can be straightforwardly relativized to possible worlds); thus, $\|X\|$ will denote the extension of X (i.e a truth value if X is a sentence).

Definition 1. ("propositional content" of X)

$|X| = \|X\|$ if X is a sentence

$= \|\exists y.y=X\|$ if X is a term

$= \|\exists y.X(y)\|$ if X is an unary predicate

= T otherwise

Definition 2. ("presuppositional" predication)

$\|P\{S\}\| = T$ iff $(|S|=T \ \& \ \|P(S)\|=T)$

$= F$ iff $(|S|=T \ \& \ \|P(S)\|=F)$

$= 0$ iff $|S|=F$

Only now we can give the analyses of (1) and (2) in spirit of the above considerations – viz (1") and (2").

Walk{**John**} (1")

λf.f(**John**){**Walk**} (2")

These two formulas now express different propositions: although there are no circumstances under which one of them would be true and the other false, there are circumstances under which one is false and the other lacks a truth value altogether (if there is no John, then (2") yields F while (1") yields 0; if nobody walks then it is the other way round).

If we take the sentence *John loves Mary*, there are formally nine straightforward ways to draw the boundary between topic and focus; they lead to the analyzes (3a) through (3h) (where x, y are variables for individuals, p for properties of individuals, r for binary relations among individuals, f for properties of propositions and g for properties of properties of propositions)[1].

John loves Mary (3)

λy.**love**(y,**Mary**){**John**} (3a)

λx.**love**(**John**,x){**Mary**} (3b)

λp.p(**Mary**){λy.**love**(**John**,y)} (3c)

λp.p(**John**){λx.**love**(x,**Mary**)} (3d)

(λf.f){**love**(**John**,**Mary**)} (3e)

λg.g(**love**(**John**,**Mary**)){λf.f} (3f)

λr.r(**John**,**Mary**){**love**} (3g)

λx,y.**love**(x,y){**John**,**Mary**} (3h)

Out of these, (3e), in which the whole sentence is contained in the topic, appears to be ruled out – a sentence seems to have to bring in something new. All the other ways of TFA are acceptable. Moreover, there are other possibilities to draw the boundary, non-aligned to the boundary of words. Thus, to respond to the statement *John loved Mary* by stating *John LOVES Mary* means to make only the present tense grammateme of the verb into the focus[2].

What is important is that in case of sentences with a generic noun phrase the subject-predicate structuring that is yielded by the TFA determines the scope and thus can mean differences not only regarding felicity conditions, but also regarding truth conditions proper, like in case of (4).

Every man loves one woman (4)

$\lambda P.P(\lambda x.\exists!y.(\mathbf{woman}(y)\&\mathbf{love}(x,y)))\{\lambda p.\forall x.(\mathbf{man}(x)\rightarrow p(x))\}$ (4a)

$\lambda P.P(\lambda y.\forall x.(\mathbf{man}(x)\rightarrow\mathbf{love}(x,y)))\{\lambda p.\exists!y.(\mathbf{woman}(y)\&p(y))\}$ (4b)

$\lambda p.\exists!y.(\mathbf{woman}(y)\&p(y))\{\lambda y.\forall x.(\mathbf{man}(x)\rightarrow\mathbf{love}(x,y))\}$ (4c)

$\lambda p.\forall x.(\mathbf{man}(x)\rightarrow p(x))\{\lambda x.\exists!y.(\mathbf{woman}(y)\&\mathbf{love}(x,y))\}$ (4d)

Besides this, there is another semantically relevant feature of TFA. The focus not only predicates something of the topic; it appears to tend to *exhaust* all what there is to be predicated about the topic. Uttering (2), we not only state that walking is instantiated by John, but also that John is the only (or at least "the principal") walker. (2) would be inappropriate in the situation where John would be only one of a plenty of those who walk around.

To be able to account for the phenomenon of exhaustiveness, we have to introduce the concept of *alternative*.[3] We assume that for every entity there is a class of alternatives (of the same type), which count as its alternatives. We can introduce a functor ALT such that if e is an entity of the type t, then ALT(e) is a set of entities of type t (containing e). The trivial version of ALT would be such that ALT(e) would be the set of *all* the entities of the type t. In fact, it is clear that the nature of ALT is pragmatic – what counts as an alternative to a given item and what not is given by the context; and from this point of view it seems to be reasonable to see ALT as something which gets changed by ongoing utterances. This means that a logic which incorporates an adequate version of ALT would have to be dynamic – changing ALT in the way dynamic logic of Groenendijk and Stokhof (1991) changes valuation of discourse markers.

Anyway, once we have ALT, we can define the *"exhaustive" predication* as predication such that the predicate has no alternative which would also hold of the subject, i.e. as follows (where $\|X\|_I$ means the extension of X under the interpretation I and $I[y\rightarrow Y]$ denotes the interpretation which is just like I save for the single exception that I(Y)=y.

Definition 3. ("exhaustive" predication)

$\|P!(S)\|_I=T$ iff $\|P(S)\|_I=T$ & $\forall p.[p\in ALT(\|P\|_I)\&\|P(S)\|_{I[p\rightarrow P]}=T\rightarrow\|P\|_I=p]$

Combining definitions 2 and 3 we arrive at the concept of *"exhaustive presuppositional" predication*.

Definition 4. ("exhaustive presuppositional" predication)

$\|P!\{S\}\|_I$

$= T$ iff $|S|_I = T$ & $\|P(S)\|_I = T$ & $\forall p.[(p \in ALT(\|P\|_I) \& \|P(S)\|_{I[p \to P]} = T) \to \|P\|_I = p]$

$= F$ iff $|S|_I = T$ & $(\|P(S)\|_I = F$ v $\exists p.[p \in ALT(\|P\|_I) \& \|P(S)\|_{I[p \to P]} = T \& \|P\|_I \neq p]))$

$= 0$ iff $|S|_I = F$

Now we can analyze (3) as (3a') through (3h').

$\lambda y.$**love**$(y,$**Mary**$)!\{$**John**$\}$ (3a')

$\lambda x.$**love**$($**John**$,x)!\{$**Mary**$\}$ (3b')

$\lambda p.p($**Mary**$)!\{\lambda y.$**love**$($**John**$,y)\}$ (3c')

$\lambda p.p($**John**$)!\{\lambda x.$**love**$(x,$**Mary**$)\}$ (3d')

$(\lambda f.f)!\{$**love**$($**John**$,$**Mary**$)\}$ (3e')

$\lambda g.g($**love**$($**John**$,$**Mary**$))!\{\lambda f.f\}$ (3f')

$\lambda r.r($**John**$,$**Mary**$)!\{$**love**$\}$ (3g')

$\lambda x,y.$**love**$(x,y)!\{$**John**$,$**Mary**$\}$ (3h')

(3a') through (3h') differ not only in their felicity conditions, but they may also differ in truth conditions (this depends on how we interpret the operator ALT). If both John and Tom love Mary and if Tom counts as an alternative to John, then (3d') is false, whereas (3c') may well be true (in the case when Mary is the only person loved by John).

However, it seems not to be adequate to take TFA to always amount to this exhaustive version of predication. The extent to which the focus of a given utterance really purports to exhaust all what there is to be said about the topic (relative to context) seems to vary (the heavy stress on focus usually strongly facilitating exhaustiveness), and thus the TFA should be considered to be somewhere in between simple presuppositional and exhaustive presuppositional predication.

3. Introducing the generalized quantifier PRED

The linguistic significance of the theory of generalized quantifiers, as elaborated by van Benthem and others, bears on the idea that the truth value of a sentence can be seen as the matter of a pair of sets being in certain relation.[4] This theory seems to be in accordance with certain intuitions regarding topic and focus, namely with the intuition that "topic specifies a class and focus lists the

elements of the class". This is in fact an idea underlying the first attempts of semantic capturing of the Prague notion of topic and focus within the framework of intensional logic (Materna and Sgall, 1980, Materna, Hajičová and Sgall, 1987). This approach is also closely allied to that based on the concept of *tripartite structure* as proposed by Partee (1995).

There is a straightforward way from the analysis by means of strong presuppositional predication given above to the analysis by means of a generalized quantifier. Let us introduce the (type-polymorphic) generalized quantifier PRED in the following way. Let us assume that we have a sentence analyzed as P!{S}; we shall show how to turn this analysis into the new one. We shall distinguish two cases. If P is P = λp.p(T) for some T (i.e. if P is a "type-raised T"), like in case (3c'), then we turn P!{S} into PRED(S,λx.x=T); thus we turn (3c') into (3c").

PRED(λy.**love**(**John**,y),λx.x=**Mary**) (3c")

In the other case (when P is not a λp.p(T), e.g. (3a')), we turn P!{S} into PRED(λp.p(S),P); thus we turn (3a') into (3a").

PRED(λp.p(**John**),λy.**love**(y,**Mary**)) (3a")

However, in this new way we can account also for cases which are not so easily analyzable in the old one. Thus, we can straightforwardly analyze (5) as (5') and (6) as (6').

John loves MARY, MINIE and HILLARY (5)

PRED(λx.**loves**(**John**,x),λx.(x=**Mary**∨x=**Minie**∨x=**Hillary**) (5')

John loves those who BILL loves (6)

PRED(λx.**loves**(**John**,x),λx.**loves**(**Bill**,x)) (6')

What is the character of the generalized quantifier PRED introduced in this way? It can be characterized by three points. (1) PRED(A,B) implies that all Bs are As, hence B⊆A; which accounts for the intuition that "focus lists only members of the topic-class". (2) PRED(A,B) presupposes nonempty A (if A is empty, then PRED(A,B) is 'undefined'); which is the formal counterpart of the intuition that "topic assumes knowledge shared by communicants". Then there is the most controversial point: (3) PRED(A,B) holds only if B exhausts, or 'almost exhausts', A ("focus lists all, or the most important, members of the topic-class"). If we took (3) as stating that PRED(A,B) implies that B⊇A, then PRED would turn out to be very close to ONLY. But it would

be probably necessary to distinguish at least two versions of PRED: the basic version defined only by means of (1)+(2), and the exhaustive version, $PRED_{exhaust}$, defined by (1)+(2)+(3).

The idea is that PRED is the default, implicit generalized quantifier which can be overridden by an overt focalizer. Thus, (7) is analyzed as (7'), whereas (8) as (8').[5]

John loves only Mary (7)

ONLY(λx.**loves**(**John**,x),λx.x=**Mary**) (7')

John loves only those who BILL loves (8)

ONLY(λx.**loves**(**John**,x),λx.**loves**(**Bill**,x)) (8')

However, this does not mean that a word like *only* would automatically assume the place of PRED – in cases with the so called "free focus" the quantifier expressed by the focalizer stays embedded within the topic – viz (9').

JOHN loves only Mary (9)

PRED(λx.ONLY(λx.**loves**(y,x),λx.x=**Mary**),λx.x=**John**) (9')

The problem of focalization can thus be seen as the problem of overriding PRED. In some cases, like (7) and (8), it is overriden, in other cases it is not. Partee (1995) points out, that "adverbial" quantifiers are usually focalizers, whereas "determiner quantifiers" are usually not. Negation can be considered as a principal focalizer – as the primary aim of negation seems to be to deny that "the focus holds of the topic" (see Hajičová, 1995), it can be seen as changing PRED into another, complementary quantifier. And possibly also the relationship between PRED and $PRED_{exhaust}$ can be understood in this way: we might see $PRED_{exhaust}$ as a non-default quantifier which may in some cases (especially in cases with the heavy stress on focus) override the default PRED.

However, let us once more stress that if what we are after is semantics proper, i.e. truth conditions, then we must be careful about claims to the effect of presence of quantifiers or other similar items within that which the sentence expresses, means or denotes. Quantifiers are constituents of formulas, and logical formulas are, as we have stressed, only ways to point out propositions. The same propositions can be pointed out in various ways, some of them employing a quantifier, others not.

Let us consider the sentence (10).

Every man walks (10)

In fact, it is sentences of this kind, which oil the wheels of linguist's embracing the theory of generalized quantifiers. We have seen that the intuition behind generalized quantifiers in linguistics stems from the fact that the truth of the sentence of the shape Det N V can be computed by comparing the extensions of N and V in the way prescribed by Det. Thus, (10) is true if and only if the extension of *man* is included in the extension of *walk*.

The TFA-based approach proposed in this paper now might seem to detach the tools of the theory of generalized quantifiers from this powerful intuition. However, this is not exactly true, because the analysis we proposed need not contradict the traditional one. Let us, for the sake of illustration, assume the standard TFA of (10), with *every man* being in the topic and *walks* in the focus. If we disregard presupposition and the requirement of exhaustiveness, then our analysis becomes equivalent to the standard one. To see this, let us consider the analysis (10') of (10) yielded by our approach. It is easy to see that (10') is – under the given conditions – equivalent to (11), which can be straightforwardly reduced to (12). And if we define the generalized quantifier EVERY in the usual way (i.e. EVERY(A,B) iff $\|A\| \subseteq \|B\|$), then (12) is further equivalent to (13).

$$\mathrm{PRED}(\lambda p.\forall x.\mathbf{man}(x) \rightarrow p(x), \lambda p.p = \mathbf{walk}) \quad (10')$$

$$(p = \mathbf{walk}) \rightarrow (\forall x.\mathbf{man}(x) \rightarrow p(x)) \quad (11)$$

$$\forall x.\mathbf{man}(x) \rightarrow \mathbf{walk}(x) \quad (12)$$

$$\mathrm{EVERY}(\mathbf{man}, \mathbf{walk}) \quad (13)$$

Thus it does not always make sense to ask whether the semantic analysis of a sentence contains this or that quantifier. What does make sense is to ask whether if we decide to employ a quantifier, its operands coincide with topic and focus (i.e. whether the quantifier can be seen as overriding PRED).

4. Conclusion

The aim of this paper was to survey the "logic" of topic and focus and to indicate how this "logic" can be done justice to by means of the currently popular formal approaches to semantics. We have claimed that it is the theory of generalized quantifiers, which could provide for a simple and adequate framework to capture TFA.

Contemporary semantic theories are inclined to view TFA as something that is relevant only for the scope of focus-sensitive operators. The Praguian approach, on the other hand, considers TFA as the universal basis of semantic structuring of sentence. The approach proposed here can be – I believe – seen as compatible with the approach of Rooth and Krifka – the cases of focus-sensitive

operators are considered only special cases of the general pattern. Moreover, the approach can be seen as a step towards an elaboration of Partee's insight regarding the tripartite structuring of sentence.[6]

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Notes

[1] If S is a sentence with the focus F, then the general way to analyze it would be as $\lambda x.S^{[x \rightarrow F]}\{F\}$ (where $S^{[x \rightarrow F]}$ stands for S in which x is substituted for F; x being the variable of the appropriate type).

[2] This shows that we need semantic representation fine-grained enough to allow for capturing all possible TFAs; everything that can by itself constitute the focus must obtain its own counterpart within semantic representation. We see that the tense grammateme constitutes such an item. This might seem an obstacle, but is it not rather a test of what are the ultimate constituents of semantic representation?

[3] Employed for the first time – at least to my knowledge – by Rooth.

[4] And it can thus be seen as a sort of vindication of the Aristotelian, syllogistic approach to logic.

[5] We can – in a sense – say hat also negation behaves as a focalizer, because in the typical case it can be seen as replacing PRED by the complementary generalized quantifier NPRED. This is to say that in the typical case it is the TFA that determines the scope of negation – the scope being the focus. See Hajičová (1995) and also Peregrin (1996).