Focus negation in formal grammar

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In this paper, we introduce a proposal towards a formal grammatical model that captures different types of negation uniformly, in terms of communicative functions and pragmatic structuring. The central objective of the work presented here is the analysis and formal modeling of the relation between focusing and negation, where next to the logico-semantic understanding of negation, the information structural interpretation plays a crucial role. The grammatical model proposed here is modular, with separate but interrelated representations for syntax, semantics and information structure, where the latter two together determine the (discourse) context-based interpretation of the sentence. We argue for an analysis of negation that targets the newly conveyed information (i.e., its communicative function) determined by the focus structure of the sentence, hereby accounting for the focus sensitivity of negation. The semantic representation of the sentence is given as a decompositional frame, which reflects a mental representation / description of the event expressed in the given sentence.

1 Types of negation

Dating back to the earliest discussions on negation (Aristotle; the Stoic School; Jespersen, 1917; Klima, 1964), there are different types distinguished, which lead to related, but still different notions. For example, Aristotle distinguished 'predicate denial' and 'term negation', philosophers of the Stoic School talk about 'external negation' and 'internal negation', Jespersen (1917) distinguishes 'nexal negation' and 'special negation', and Klima (1964) distinguishes 'sentence negation' and 'constituent negation'. Regardless of the differences between these notions (see, e. g., De Clercq, 2020), a crucial aspect of distinguishing these 'negation types' is the domain that the negation operates on. Despite the recognition of the different types of negation, formal syntactic/semantic accounts capture negation in the locigo-semantic terms and mostly investigate sentential (or propositional) negation, and related phenomena that are crucial at the syntax-semantics interface (e.g., the relation of sentential negation and quantification, the interpretation of negative indefinites, the analysis of negative polarity items and negative concord). The work presented here is inspired by the other type, which is generally underrepresented in current formal grammars and semantic/pragmatic approaches. This negation type is often referred to as 'focus negation', reflecting its tight relation with narrow focus structure. While in the locigo-semantic understanding of negation the two types can be captured uniformly in terms of a propositional operator, the two differ in their information structural interpretation. We argue for an analysis and introduce a proposal of a formal grammatical model, where the interpretational differences of the two negation types are captured within the information structure of the sentence, where negation scopes over the given focus domain. Hence, in information structural terms the different focus types reflect broad versus narrow scope negation. This basic assumption is in line with the analysis of (Vallduví, 1990).

2 Focus sensitivity of negation

Information structure, and hence focusing, manifests itself in different layers of natural language: in interpretation and in structure building. In interpretation, focusing can be treated semantically: as introducing alternatives (Rooth, 1992) or structuring semantic content (Krifka, 2001), and pragmatically: relating to the QUD (Roberts, 2012) or in terms of pragmatic structuring (Lambrecht, 1994). Structure building effects of focusing manifest itself in various languages (e.g., Hungarian, Basque) in terms of triggering dedicated syntactic operations and configurations (e.g., É. Kiss, 1995).

It is widely accepted that the interpretation of a range of linguistic expressions is dependent on

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the information structure of the utterances in which they occur (König, 1991; Krifka, 2001; Beaver and Clark, 2008). This holds for focus sensitive particles (e.g., *only, also*), as well as for negation. This observation holds across languages and the phenomenon is referred to as *focus sensitivity*. See, e. g., (1), where the interpretation of the exclusive operator (*only*) depends on the placement of focus, hence the focus structure of the sentence.

(1) a. Pim only saw [MIA]^{F} at the party.
⇝ Pim saw Mia, and noone else, at the party
b. Pim only saw Mia at the [PARTY]^{F}.
⇝ Pim saw Mia at the party, and nowhere else

Current approaches to focus sensitivity are rather restricted to the field of formal semantics/pragmatics, however, despite their fairly uniform semantics, focus sensitive elements vary across languages with respect to their structural behaviour, which in turn strongly affects their modeling in formal grammar. Leading grammar theories and formalisms that capture information structural phenomena (CCG, LFG, HPSG)[1] do not systematically address focus sensitivity. These accounts generally acknowledge both aspects of information structure (i.e., interpretation and structure building), but they often concentrate on only one of them, or lack the formal means in their architecture to equally address both aspects.

In information structural terms, the two major types of negation differ in their focus domain they operate on. *Focus negation* takes a narrow scope, while *sentential/propositional* negation takes a broad scope. As we will discuss later in more detail, these domains correspond to narrow and broad focus respectively. Under narrow scope negation, also affixal negation (e.g., *unhappy*), inherent negation (e.g., *deny*) and negative quantification (e.g., *no girls*) are often understood. Although they share the property of having a narrow scope, we argue that these represent different types. Under the type of 'focus negation', we understand the type, where the negative particle, which also expresses sentential negation, operates on a single constituent instead of the whole proposition. In the examples below, square brackets indicate the domain the negation operates on, and capitals indicate where the main stress falls.

[1] See, for example, Steedman (2000, 2019), Dalrymple and Nikolaeva (2011), Engdahl and Vallduví (1996).

(2) [Pim did not introduce Sam to MIA].

(3) a. Pim did not introduce [SAM] to Mia.
b. Pim did not introduce Sam to [MIA].

In (2), the negation takes a broad scope, and operates on the whole proposition. The negation in (3-a) and (3-b), however, takes a narrow scope: it only operates on the constituent that is marked as the narrow focus of the sentence. Similarly to the examples in (1), the interpretational difference between (3-a) and (3-b) is due to the different focus structures, hence sensitive to focusing. The focus sensitivity of negation is explicitly addressed by Beaver and Clark (2008), who claim that negation is 'quasi focus sensitive', which is best analyzed as a pragmatic implicature. We argue that the relation between negation and focusing is more tight, and should be part of the grammatical system. This is supported by the fact that in certain languages, the two negation types are structurally different, with a direct relation to the default focus marking. For example, in Hungarian, the negative particle *nem* 'not' can appear right before the predicate (4-a) or right before the preverbal narrow focus (4-b), directly reflecting the above negation types.

(4) a. Alex nem csókolta meg Samu-t.
Alex not kissed VPRT Sam-ACC
'Alex did not kiss Sam.'
b. Alex nem Samu-t csókolta meg.
Alex not Sam-ACC kissed VPRT
'It is not SAM whom Alex kissed.'

In a compositional analysis, the scope of the operator is the semantic content of the expression that stands in a given structural relation with it. For sentential negation this leads to the insertion of the logical operator above the predicate, which provides the intended interpretation. The reading of 'sentential negation' in (2) is straightforwardly captured by the formula $\neg introduce'(pim', sam', mia')$, where the logico-semantic operator of negation is applied to the whole proposition. In focus negation, however, a structural relation where only the given constituent is in the scope of the negative particle is not sufficient to give the right interpretation. In (3-a), we cannot simply apply negation to the content of the focal object. That is not meaningful, it does not even provide a well-formed formula. In (3-a), semantically (or truth-conditionally) it also holds that 'Pim did not introduce Sam to Mia', but it has an additional contribution: the *identification* expressed by focusing is targeted as well. The

sentence in (3-a) expresses that 'the one Pim introduced to Mia is not Sam'. To capture the correct contribution of focus negation, we need a formal grammar that accesses the focus structure and its communicative function: e.g., identification in case of narrow argument focus. We introduce our proposal towards such a model, beginning with its application to focus negation and then extending it to sentential negation in a uniform way.

3 Proposal

The formal analysis of any linguistic phenomenon requires a two-sided approach: theoretical claims need to be verified by empirically valid and formally exact models, and formal models must be built on solid theoretical grounds. Therefore, in our proposal, we build upon the formalized version of Role and Reference Grammar (Kallmeyer et al., 2013; Osswald and Kallmeyer, 2018), which facilitates such an approach. This formal grammar is based on a solid theoretical framework, Role and Reference Grammar (RRG; Van Valin and LaPolla, 1997; Van Valin, 2005), with a strong typological and cross-linguistic perspective. The formal specification of this grammar is defined in terms of Tree-Wrapping Grammar (Kallmeyer et al., 2013; Osswald and Kallmeyer, 2018), strongly inspired by Tree-Adjoining Grammar (Joshi and Schabes, 1997). The current developments of this grammar lack a formal specification and modeling of information structure, which asks for an extension.

3.1 Theoretical base

We argue for the cross-linguistic validity of the claim that negation generally has a direct access to the focus structure of the utterance (Van Valin, 2005), and next to its logico-semantic contribution, it operates on the contribution by focusing, i.e., on the information conveyed. In this paper, we discuss this latter, information structural aspect of negation. To capture our proposal, we first need to specify what exactly the contribution of focus is to the interpretation of the sentence. We argue for a context-sensitive perspective on the matter, and follow the theory of information structure by Lambrecht (1994), who claims that beyond the semantic content of the sentence, focusing leads to its *pragmatic structuring*. This structuring reflects the communicative functions: what information is conveyed and how this information is transferred between the discourse participants. The core aspect is the transfer of information and its relation to the Common Ground, the set of propositions shared by the interlocutors.

The 'pragmatic presupposition' of the sentence is the information content that is part of the discourse context shared by the discourse participants, and the 'pragmatic assertion' is the newly provided information, in relation to the pragmatic presupposition. Both concepts are lexico-grammatically defined, hence they are determined by the grammatical organization of the sentence. In the following, we systematically use the notions 'presupposition' and 'assertion' in the above sense, thus regarding 'pragmatic presupposition' (e.g., Stalnaker, 1974; Lambrecht, 1994) as opposed to 'conventional/semantic presupposition'.

Lambrecht (1994) defines focus structure as "*the conventional association of a focus meaning with a sentence form*" (Lambrecht, 1994, p. 22). He distinguishes three different focus structures based on the domain (i.e., scope) of the focus in the given sentence, and presents the systematic ways natural languages encode these structures in their morphosyntax. The core distinction is given on basis of whether a single constituent or multiple constituents are included in the focus domain. In this respect, we distinguish narrow focus and broad focus respectively. Broad focus is further divided into 'predicate focus', where the focus domain includes all parts except the topic and 'sentence focus', where the focus domain is the entire utterance. The predicate focus construction correlates with the topic-comment distinction, and is referred to as the unmarked focus type.

(5) a. [Pim saw MIA]^{F} (sentence focus)
b. Pim [saw MIA]^{F} (predicate focus)
c. [PIM]^{F} saw Mia. (narrow focus)
Pim saw [MIA]^{F}

The communicative functions of these focus structures are different: introducing an event or a referent (sentence focus), providing information of a topic (predicate focus) and idenitification of an entity with respect to an open proposition (narrow focus). All these functions correspond to the relation between presupposition and assertion, which is determined as the newly conveyed information. In the sentence *Pim saw* $[MIA]^{F}$ in (5-c), the focus is the semantic content of the object noun phrase, while the new information (i.e., the pragmatic assertion) is not this content itself, but the identification

relation between the entity represented by the focal noun phrase and the open proposition 'pim saw x' given as the pragmatic presupposition (6). In the predicate focus construction, the pragmatic presupposition is the availability of a referent as the topic and the pragmatic assertion is the content predicated of this topic. Finally, in sentence focus constructions, the pragmatic assertion is the proposition, introducing an event.

(6) Pim saw [MIA]^{F}
$\rightsquigarrow$ presupposition: 'pim saw x'
(= open proposition)
$\rightsquigarrow$ assertion: 'x = mia'
(= identification)

In focus negation, the negation operator targets the identification, i.e., the pragmatic assertion, and not merely the content of the focal constituent. According to this view, at the level of the interpretation of the sentence, the semantic content and the information structural interpretation are represented at distinct, but yet related levels. To model the major types of negation, 'sentential negation' and 'focus negation', a grammatical model is required that provides access to these levels and that explains the relation between syntactic structure, semantic content and information structural interpretation. Role and Reference Grammar (RRG; Van Valin and LaPolla, 1997; Van Valin, 2005) is a linguistic theory that offers the sufficient means to satisfy these above requirements.

RRG is a surface oriented grammar theory, developed from a strong typological and theoretical perspective. One of the theory's main aim is to capture both the universal characteristics of natural languages and the given language specific features. The general architecture of RRG is modular, with different levels of representation called 'Projections' and well-defined linking relations between them to model the interfaces. The syntactic representation (the layered structure of the clause, Figure 2) captures universal notions in terms of predicate-argument relations, as well as language-specific aspects in terms of special syntactic positions. The syntactic representation is given in two closely related projections, the 'Constituent Projection' and the 'Operator Projection'. The semantic representation is based on the classification of predicates by (Vendler, 1967) and adapted from the decompositional system of (Dowty, 1979). The center of the grammatical model of RRG is the bi-directional *linking algorithm* between the syntactic and the semantic representations, capturing both language production and comprehension.

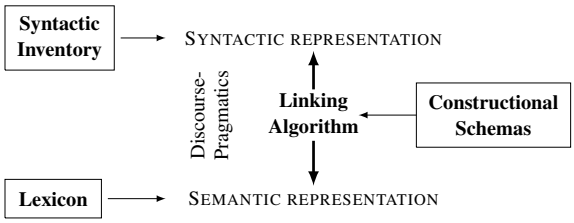

Figure 1: The general architecture of RRG

The universal properties of the clause structure are represented in the *layered structure of the clause* (see Figure 2), where the elements render semantically motivated universal characteristics of an utterance.

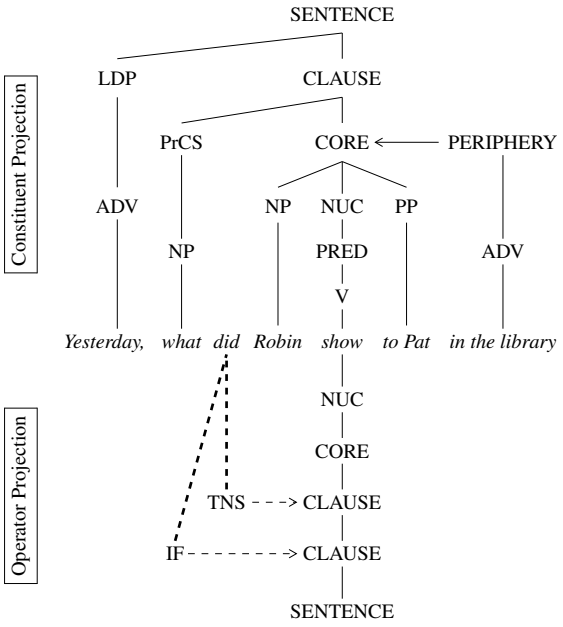

Figure 2: The layered structure of the clause in RRG

The basic elements of the layered clause structure are the NUCLEUS, containing the predicate, the CORE, containing the predicate and its core-arguments (both direct and oblique arguments), the PERIPHERIES, housing adjunct modifiers and adverbs and finally the CLAUSE, that contains the Core and the Peripheries. Next to these semantically motivated universal properties, there are also language-specific aspects represented in the syntactic structure. The presence of corresponding syntactic positions is language specific. Operators such as tense, aspect, modality and illocutionary force are not given in the constituent projection of the clause

but are represented in the separate 'Operator Projection'. The main layers can each be modified by one or more operators. The layered clause structure in RRG is motivated by theoretical and typological considerations, and as such it applies to different types of languages equally: to languages with fixed word order (e. g., English), to languages with free word order (e. g., Dyribal), to head-marking languages (e. g., Lakhota), to dependent-marking languages (e. g., Japanese), and so on.

In the general architecture of RRG, as part of the discourse pragmatics of the sentence, the focus structure is represented in a separate projection, called 'Focus Structure Projection'. Within this projection, RRG distinguishes the *actual focus domain* (AFD), the syntactic domain that corresponds to the *focus (domain)* in Lambrecht's terms, and the *potential focus domain* (PFD), where the focus can occur. Both syntactic domains include one or more *information units* (IU), which are the minimal phrasal units in the syntactic representation. The distinction between the PFD and the AFD is cross-linguistically relevant. Although in English, the PFD is always the entire clause, this is not generally the case in other languages. See, for example, Italian, where the PFD excludes any prenuclear elements (see Van Valin and LaPolla, 1997), or Hungarian, where the structural topic position is clause-internal, but external to the PFD. The information units are linked to syntactic domains in the constituents structure, and the focus domains include one or more information units. Hereby, it can represent the various focus structures. Figure 3 illustrates the RRG representation of narrow object focus and predicate focus respectively.

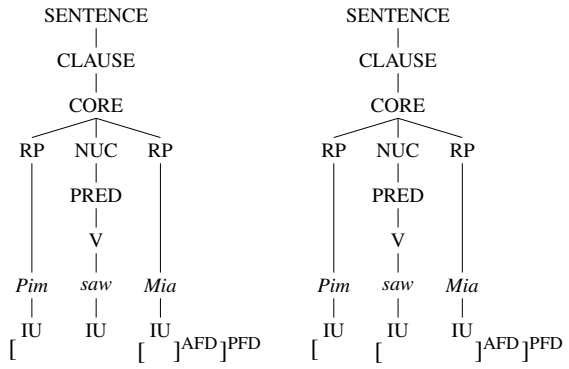

Figure 3: RRG's Focus Structure Projection

This representation shows the IUs, which are linked to syntactic domains in the constituent structure, and the focus domains, that each include one or more IUs. Hereby, it represents the various focus structures, as proposed by Lambrecht (1994). What is missing from this approach is the modeling of the interpretational effects of the different focus structures in terms of pragmatic structuring, which is crucial in the analysis of negation. We propose this extension in a formalized version of RRG (see Section 3.2). The extension requires a specification of the nature and role of information units, the ways of determining the presupposition-assertion distinction on basis of the focus structure, and its relation to the pieces of semantic information.

3.2 Modeling focusing and negation

In our proposal, we argue that negation operates on the pragmatic assertion, which is determined by the focus structure of the sentence. To capture this, pragmatic structuring needs to be derived, based on the given focus domains. This asks for an extension of the Focus Structure Projection. The information contained in the elements of the pragmatic structuring is derived on basis of the pieces of semantic information contributed by the constituents. This is essentially captured by the notion of 'information unit', which represents a given syntactic domain and its semantic content.

Our analysis is based on the theoretical developments of (classical) RRG and Lambrecht's theory of information structure, which both lack a precies formal definition. For the formal modeling and further extensions we use the formalized version of RRG (fRRG) as proposed by Kallmeyer et al. (2013) and Osswald and Kallmeyer (2018). fRRG has important advantages, of which a major one is that semantic composition is on a par with syntactic composition, i.e., semantic construction can be carried out compositionally. Syntactic templates come with (pieces of) semantic representations, given as *decompositional frames* (Petersen, 2015; Löbner, 2017), formally defined as *base-labelled typed feature structures* (Kallmeyer and Osswald, 2013). The nodes in the syntactic trees are provided with feature structures, containing interface features, which establish the link between syntax and semantics: they mediate between syntactic and semantic composition. The syntactic operations trigger the composition of the semantic representations, thereby deriving the meaning representation of the sentence. The semantic composition proceeds by *unification*. Figure 4 below illustrates the tree templates for deriving *Pim saw Mia* before

composition. By combining the trees templates (via substitution here), the feature structures are unified and the meta-variables are identified (e.g., $\boxed{1} = x$). The semantic representation of the final tree is calculated by unification of the semantic content of the participating trees.

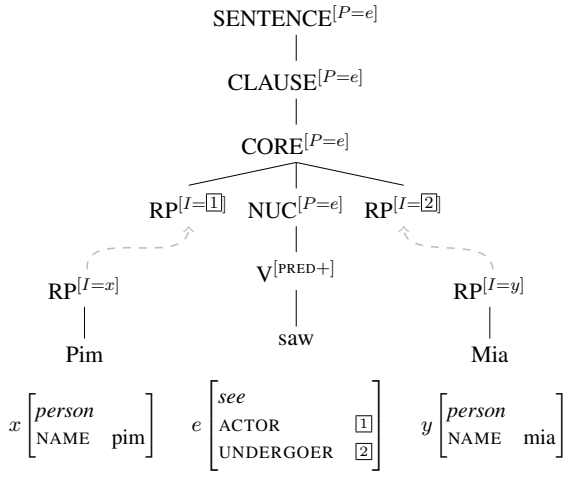

Figure 4: Syntax-semantics interface in fRRG

Recall that within the syntactic structure, operators (e.g., negation, tense) are represented in the separate 'Operator Projection'. In the linearization *Pim did not see Mia*, negation is analyzed as a core-operator. In the semantics, this leads to an operator that is applied to the content of the domain in the CORE, i.e., the whole proposition.[2]

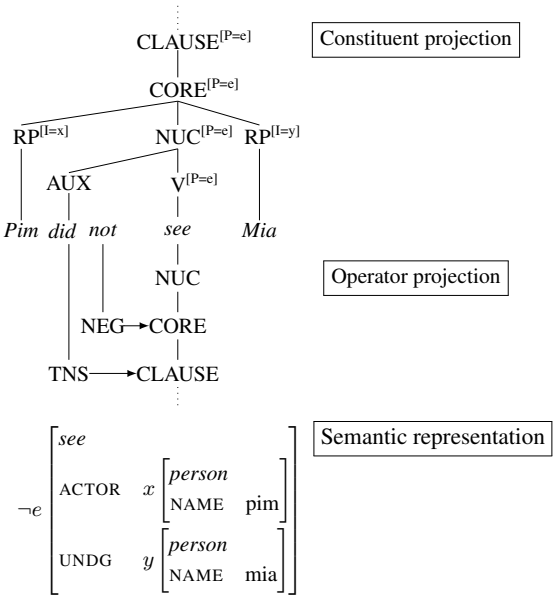

Figure 5: Syntactic and semantic projections

[2]The proper definition of negation in frame semantics is beyond the scope of this paper. The representation by ¬ here is simplified.

The difference between the 'focus negation' and the 'sentence negation' interpretation lies in the respective information structures of the sentences. Their semantic representation is the same. To capture this, we argue that the contribution of negation to the interpretation of the sentence also enters information structure. Hence, for the full analysis, we must extend Figure 5 with the representation of the information structure of the resepective utterance, where negation also plays a crucial role. We argue that negation operates on the pragmatic assertion, i.e., on the newly conveyed information, not on the semantic representation of the focused constituent. It is represented within the 'Information Structure Projection',[3] which contributes the context-dependent meaning component of the sentence. The pragmatic assertion is determined by the focus structure of the sentence, that contains the information units and the different focus domains. Following Van Valin (2005), we distinguish the actual focus domain (AFD) and the potential focus domain (PDF). Additionally, we also represent the non-focus domain (NFD), that can be straightforwardly derived based on the AFD/PFD structure. The information units have a central role establishing the link between the syntactic domains and the corresponding semantic content. The IUs are linked to the syntactic structure by features on the respective nodes, and to the pieces of semantic content of these syntactic domains. The focus structure is a triple of the focus domains: AFD, PFD and NFD. These focus domains are represented as sets of information units, and provide the focus-background division: the focus is the unification of the semantic content of the IUs in the AFD, while the background is the unification of the semantic content of the IUs in the NFD.[4] The communicative function, i.e., the newly conveyed information is dependent on the focus structure, and defined as a special relation between the focus and the back-

[3]The 'Information Structure Projection' is an extension of RRG's 'Focus Structure Projection' proposed by Balogh (2021), which not only represents the focus structure, but also the topic-comment division. This is necessary for a comprehensive representation of the information structure of the sentence, and also for capturing various linguistic phenomena where focus structure and topic structure interact, e.g., the linearization constraints of *also*. In order to simplify the representations here, we only give the focus structure, that is directly relevant to our discussion regarding negation. However, keeping in mind that the projection contains more, we keep referring to it as 'Information Structure Projection'.

[4]Preserving the specifications of the meta-variables as determined by the syntax-semantics interface; see Figure 4.

ground. In case of a narrow focus construction, this relation is the 'identification' between the focus and the missing information in the background, the open proposition. This equals the 'pragmatic assertion' in Lambrecht's (1994) terms, while the 'pragmatic presupposition' is the same as the background in the focus-background division. Figure 6 below illustrates the extended 'Information Structure Projection' for the sentence in (7) with narrow (object) focus structure above its syntactic and semantic representations given in Figure 5.

(7) Pim did not see [MIA]^{F}

Information Structure Projection (for (7))

information units: $\{IU^x, IU^y, IU^e\}$

focus structure:

$\langle AFD, PFD, NFD\rangle = \langle\{IU^y\}, \{IU^x, IU^y, IU^e\}, \{IU^x, IU^e\}\rangle$

focus-background division:

$$\left\langle\ y\begin{bmatrix} person & \\ \text{NAME} & \text{mia}\end{bmatrix},\ e\begin{bmatrix} see & \\ \text{ACTOR} & x\begin{bmatrix} person & \\ \text{NAME} & \text{pim}\end{bmatrix} \\ \text{UNDG} & \boxed{2}\end{bmatrix}\ \right\rangle$$

pragmatic assertion: $\text{NEG}(\boxed{2} = y)$

Figure 6: Information structure projection of (7)

Modeling of narrow subject focus (8) is straightforward. Note that the syntactic and semantic structures, as well as the information units are equivalent in example (7) and example (8). The difference is in the focus-background division, which derives the different content of the identification. Straightforwardly, the relation between focus and background is of the same nature for both (i.e., identification).

(8) [PIM]^{F} did not see Mia

Information Structure Projection (for (8))

information units: $\{IU^x, IU^y, IU^e\}$

focus structure:

$\langle AFD, PFD, NFD\rangle = \langle\{IU^x\}, \{IU^x, IU^y, IU^e\}, \{IU^y, IU^e\}\rangle$

focus-background division:

$$\left\langle\ x\begin{bmatrix} person & \\ \text{NAME} & \text{pim}\end{bmatrix},\ e\begin{bmatrix} see & \\ \text{ACTOR} & \boxed{1} \\ \text{UNDG} & y\begin{bmatrix} person & \\ \text{NAME} & \text{mia}\end{bmatrix}\end{bmatrix}\ \right\rangle$$

pragmatic assertion: $\text{NEG}(\boxed{1} = x)$

Figure 7: Information structure projection of (8)

The above approach correctly captures the meaning contribution of 'focus negation', where the negation operator takes narrow scope, and in the interpretation it applies to the identification evoked by narrow focus. As such, it is represented within the Information Structure Projection as well, rather than merely in the semantic representation of the sentence. Based on this analysis, an important question arises, how to capture 'sentential negation', which is standardly analyzed as the negation operator directly applies to the semantic content of the predication. We argue that in sentential negation, negation also applies within the information structure projection, targeting the communicative function. In *Pim did not see Mia*, without narrow focus, the negation operates on the predication. The underlying sentence has a broad (predicate or sentence) focus structure. In both, the AFD contains the predicate, the difference is in the topic-comment distinction. For our concerns here, the determinant aspect is whether the predicate is part of the AFD, so regarding space limitations, the precise characterization of the effects of the topic structure is left for further discussion. In broad focus structures, the pragmatic assertion of the sentence is the statement that the event described by the frame as the semantic representation exists, and must be added to the common ground. When negation applies to broad focus, it targets this pragmatic assertion, stating that the event represented by the frame does not exist. For *Pim did not see Mia* with a broad focus structure, the syntactic structure, the semantic representation and the IUs are the same as before. The interpretational difference is due to the different focus structure and the corresponding communicative function.

Compared to the narrow focus structures in Figure 6 and 7, the information units are the same, but the focus structure is different, as the information unit corresponding to the predicate is part of the focus. This in turn leads to a different pragmatic structuring, and a different communicative function, where the relation between focus and background is not of an 'identification', but stating the existence of the event. As before, this contribution is targeted by negation. In the focus-background division, the actual focus domain contains the whole proposition, and the background is either empty, or rather contains a contextual restriction ('Restr' above) to some time-/space-frame or alike, relative to which the (non-)existence of such an event is pragmatically asserted.

(9) [Pim did not see MIA]^{F}

Information structure ($\Rightarrow$ broad focus)
information units: $\{IU^x, IU^y, IU^e\}$
focus structure:
$\langle AFD, PFD, NFD\rangle = \langle\{IU^x, IU^y, IU^e\}, \{IU^x, IU^y, IU^e\}, \{\}\rangle$
focus-background division:

$$\left\langle \begin{bmatrix} e & \begin{bmatrix} see & & \\ \text{ACTOR} & x & \begin{bmatrix} person & \\ \text{NAME} & \text{pim} \end{bmatrix} \\ \text{UNDG} & y & \begin{bmatrix} person & \\ \text{NAME} & \text{mia} \end{bmatrix} \end{bmatrix} \end{bmatrix}, \text{(Restr)} \right\rangle$$

pragmatic assertion: $\text{NEG}(\exists.e)_{\text{Restr}}$

Figure 8: Information structure projection (broad F)

4 Conclusion and further issues

The paper addressed a surprisingly underrepresented linguistic phenomenon, 'focus negation', where the crucial issue is how to link the logical semantic understanding of negation as a unary propositional operator and the meaning contribution of negation operating on a single (non-propositional) constituent. Although this type of negation is generally acknowledged, an analysis and formal modeling of it is still missing. The issue is not straightforward, as it goes beyond the mere semantics of the sentence, and asks for an approach where information structure, in particular the focus structure, of the sentence interacts with negation at the syntax-semantics interface.

In this paper, we introduced a proposal towards a grammatical model that captures 'focus negation' and 'sentential negation' uniformly, in an information structure based perspective. The meaning component of the sentence is an interplay between the semantic representation, a mental representation/description of an event, and the information structural interpretation given in terms of pragmatic structuring. We proposed a two-level approach, where negation has access to and operates on the pragmatic assertion, rather than it merely enters the semantic representation. The proposal offers a way to capture 'sentential negation' and 'focus negation' in a uniform way, correctly dealing with the interpretation of the latter type as well. In the proposed grammatical model, semantic representations are given as decompositional frames, which are descriptions/minimal models of events.

The grammatical model we proposed is based on solid theoretical grounds as given by Role and Reference Grammar (Van Valin and LaPolla, 1997; Van Valin, 2005), formally defined using Tree-Wrapping Grammar (Kallmeyer et al., 2013; Osswald and Kallmeyer, 2018) and decompositional frames (Petersen, 2015; Löbner, 2017; Kallmeyer and Osswald, 2013). For the analysis we proposed the necessary extensions to the framework, regarding both the theoretical and the modeling side.

We proposed here the basic ideas of a uniform analysis and formal modeling of the two types of negation. Nevertheless, there are still several issues to resolve for a comprehensive analysis of natural language negation and the interface between syntax, semantics and information structure (i.e., discourse pragmatics). From the theoretic point of view the most urgent issue is how to analyze the relation between the contribution of negation in semantics and in information structure. Furthermore, we must extend the analysis for further constructions, in particular for constructions where the focus falls on the verb (i.e., narrow verb focus), where it falls on a constituent within a complex noun phrase (e.g., determiner, adjective, preposition and so on), constructions with multiple foci, and the relation between focus, negation and other scope taking elements. From a more structural perspective, we must extend the analysis to languages where the two types are distinguished in the morphosyntactic structure (e.g., Hungarian). These issues and further theoretical considerations are left for further investigation and development of the current proposal.

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