

Focus Domains and Information-Structure

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Proceedings of the LFG97 Conference

University of California, San Diego

Miriam Butt and Tracy Holloway King (Editors)

1997

CSLI Publications

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1 Introduction

Configurational languages like English and non-configurational languages like Russian use both syntax and prosody to encode discourse functions. This crucial interaction of syntax, phonology, and discourse functions has been recently brought to the forefront of linguistic research (É. Kiss 1995 and references therein).

The division of constituent-structure from functional-structure, as well as the possibility of an information (discourse function)-structure, makes Lexical Functional Grammar well suited for capturing these interactions (King 1993/1995, Choi 1996). This paper explores a problem posed by these interactions, in particular by the association of discourse functions with particular c-structure positions and their f-structure counterparts. In LFG, discourse function information has traditionally been encoded in the f-structure via annotations on the c-structure. In the case of structurally encoded topic and focus of arguments, this approach as worked adequately, especially for syntacticized discourse functions. However, in certain cases involving f-structure heads, the standard annotations result in the incorrect scoping of the discourse functions in that more material is focused or topicalised than intended. As such, I propose that discourse function information be captured in an independent projection, i(nformation)-structure, which is a projection off the c-structure and which is accessible to the s(ematic)-structure, and that the information relevant to the i-structure is the core predicate value without its associated argument structure.

2 Structurally Encoded Discourse Functions

It has long been noticed that discourse functions can be encoded configurationally, usually accompanied by a particular intonation pattern.¹ In LFG, this can be captured by annotations on the c-structure which provide both a discourse function and a grammatical function to the constituent. This is shown in (1) which states that YP has the discourse function DF (e.g., TOPIC or FOCUS) and that this DF is identical to some grammatical function indicated by the uncertainty equation BODY BOTTOM (Kaplan and Zaenen 1988 and 1989). That is, there is exact sharing of information between the discourse function and the grammatical function.

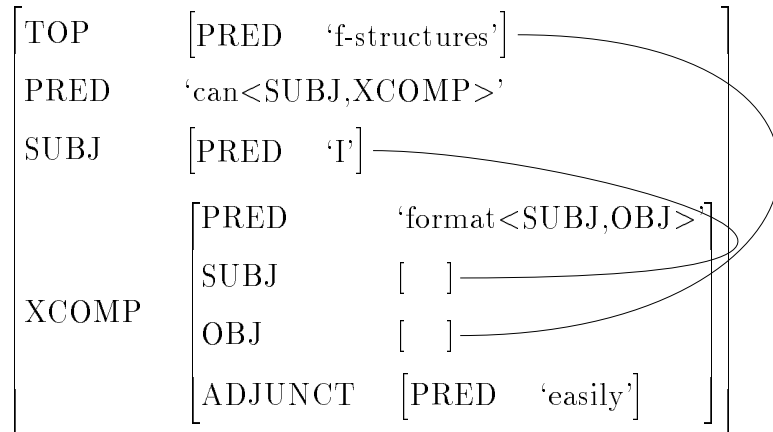
$$(1) \quad XP \longrightarrow \begin{array}{c} YP \\ (\uparrow DF)=\downarrow \\ (\uparrow DF)=(\uparrow \text{BODY BOTTOM}) \end{array} \quad X$$

For example, Huang 1992 proposes the equations in (2) for topicalization in English. The left dislocated XP is assigned the TOP discourse function. The TOP is then equated with any grammatical function other than COMP (i.e., GR-COMP) at any level of COMP or XCOMP (i.e., {COMP|XCOMP}*). So, in a sentence like (3), the TOP is also the XCOMP's OBJ, as seen by the f-structure in (3).

¹In this paper I do not examine how best to implement the phonology interface in LFG. Since the phonology is sensitive to the surface string, the c-structure should serve as the interface between the i-structure and the phonology.

$$(2) \quad S' \longrightarrow \begin{array}{ccc} & \text{XP} & \text{S} \\ & (\uparrow\text{TOP})=\downarrow & \uparrow=\downarrow \\ (\uparrow\text{TOP})=(\uparrow\{\text{COMP}|\text{XCOMP}\}^* (\text{GF}-\text{COMP})) & & \end{array}$$

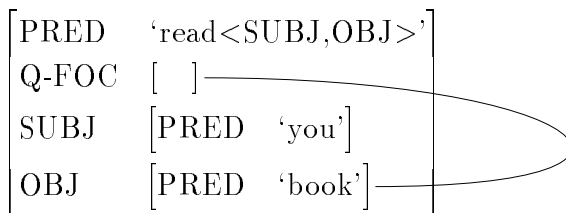
(3) F-structures I can format easily



In King 1995 I proposed a similar account for Russian *li* questions in which the constituent preceding the complementizer *li* is the focus of a yes-no question. The c-structure rule in (4) places the fronted constituent in Q-FOC² and equates it with a grammatical function from any number of XCOMPs (COMPs do not allow extraction in Russian). So, in a question like (5), the fronted NP, *knigu* 'book', is the Q-FOC and the OBJ of the top level f-structure.

$$(4) \quad CP \longrightarrow \begin{array}{ccc} & \text{XP} & \text{C}' \\ & \downarrow = (\uparrow\text{Q-FOC}) & \uparrow = \downarrow \\ (\uparrow\text{XCOMP}^* \text{GF}) = \downarrow & & \end{array}$$

(5) Knigu li ty pročitala?
 book Q you read
 Was it a book that you read?



Thus, the encoding of discourse functions via annotations on the c-structure tree works relatively well for simple arguments and adjuncts, assigning them both a grammatical function and a discourse function in the f-structure.

²The discourse functions associated with questions are not fully understood. The term Q(uestion)-FOC(us) is used to indicate the role which corresponds to the focus in the answer to the question.

3 Focusing F-structure Heads

Difficulty with this approach arises when f-structure heads are assigned discourse functions. When these heads are assigned a discourse function role, everything within the sub-f-structure containing the head is also contained within the discourse function. Although this sometimes gives the correct scope of the discourse function, it usually results in wider scope than desired. That is, more material is topicalised or focused than was intended.

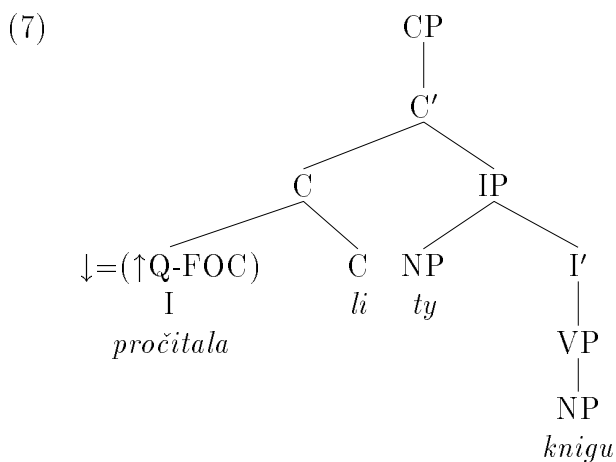
This problem is illustrated below by three different types of focus assignment in Russian. Neutral yes-no questions received the correct, wide-scope focus interpretation, although they give rise to a circular f-structure. However, contrastive focus of verbs and new-information focus of the VP cannot be assigned correctly by this approach.

3.1 Yes-no Questions

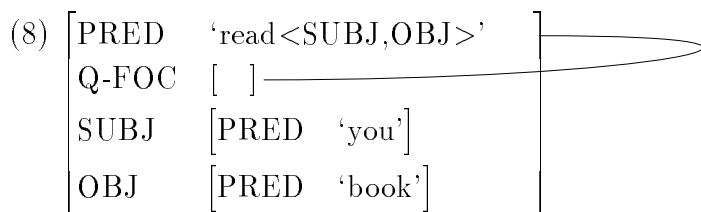
Neutral yes-no questions focus the entire clause/event. In Russian, such questions consist of a fronted finite verb followed by the interrogative complementizer *li*, as in (6).³

- (6) Pročítala li ty knigu?
 read Q you book
 Did you read a book?
 focus=entire clause

The annotated c-structure corresponding to (6) is shown in (7). In particular, the finite verb in I⁰ is annotated (\uparrow Q-FOC)= \downarrow , similar to the annotation used with focused maximal projections in this construction in (4) and (5). As seen in the corresponding f-structure in (8), this correctly places the entire f-structure in Q-FOC, which corresponds to focusing the entire event.



³The interrogative complementizer in Russian is currently falling out of use in matrix yes-no questions. However, it is obligatory in embedded ones.



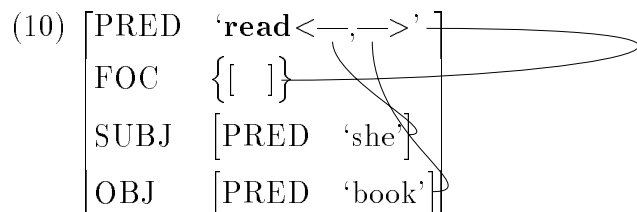
However, there is a problem in that although the entire event is contained in the Q-FOC, a circularity is created in that the Q-FOC contains itself.

3.2 “Contrastive” Focus

Contrastive focus picks out one element as prominent new information (Choi 1996 and references therein). In Russian contrastive focus is encoded intonationally, not via the phrase structure (Junghanns and Zybatov 1995). That is, there is no one phrase structure position associated with contrastive focus, although contrastively focused arguments and adjuncts tend to occur immediately before the verb (King 1995). In (9) the verb *pročítala* ‘read’ is contrastively focused. The heavy stress on the verb, indicating its focus status, is indicated by small caps.

- (9) Ona PROČITALA knigu.
 she read book
 ‘She READ the book.’
 focus = contrastive on ‘read’

Contrastive focus assignment can be captured by annotating the c-structure node containing the focused material and assigning the appropriate stress. The question is what the appropriate annotation should be. Using $\downarrow \in (\uparrow \text{FOC})$ will result in too wide a scope because it will focus the entire f-structure, as with the *li* yes-no questions, and will also create the same circularity found with these.⁴ The other alternative is to use $(\downarrow \text{PRED}) \in (\uparrow \text{FOC})$. This gives rise to the f-structure in (10).



The problem is that by focusing the head ‘read<SUBJ,OBJ>’ not only is the core meaning of the PRED focused, but so are its arguments, the subject ‘she’ and the object ‘book’. However, the interpretation of contrastive focus on the verb excludes focus of any material other than the verb itself. This is particularly problematic since the arguments have other discourse functions which clash with the assigned focus role.

⁴The set notation \in is used since a clause can contain more than one contrastive focus.

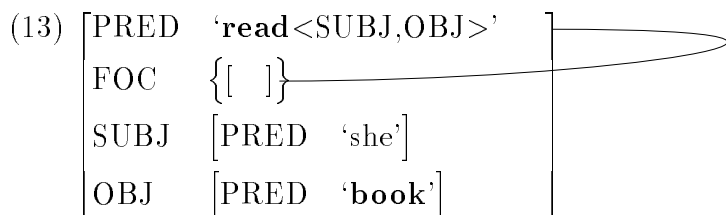
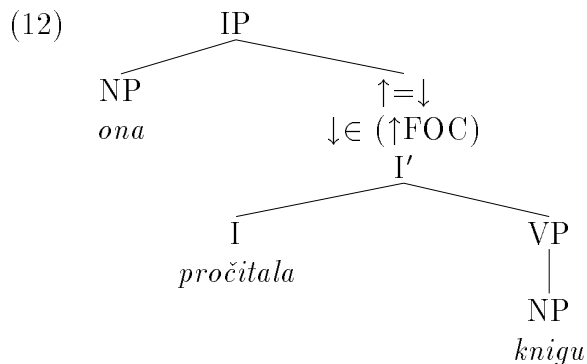
3.3 Sub-Constituent Focus

A similar problem to that of contrastive focus on the verb arises when constituents which contain the heads of larger constituents are focused.

In Russian declaratives with neutral intonation⁵ have right-edge focus. The size of the focus constituent depends on the context. So, (11) can either be interpreted as focusing just the object *knigu* ‘book’ or the verb and its object *pročitala knigu* ‘read book’.⁶

- (11) *Ona pročitala knigu.*
 she read book
 ‘She read the book.’
 focus = ‘read the book’ (in answer to: what did she do?)
 [also can have: focus = ‘book’]

The question is how to assign this type of focus. One possibility is to annotate a clause-final constituent $\downarrow \in (\uparrow\text{FOC})$, as in (12).

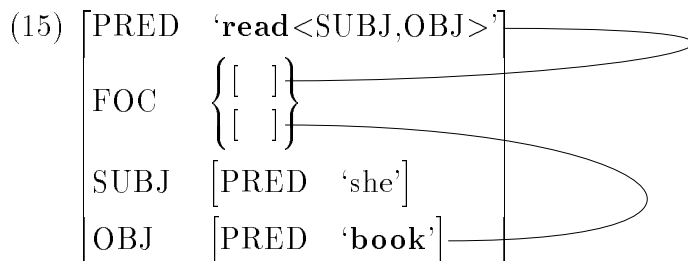
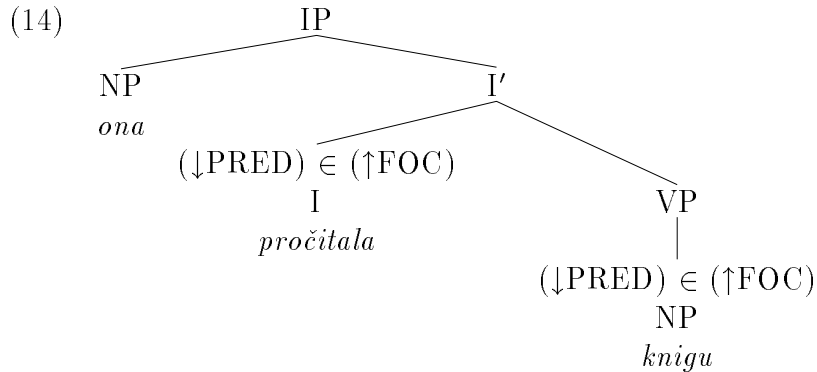


However, this results in the entire f-structure being the focus of the clause, not just the verb and its object. This is the same problem that arose with contrastive focus. Since the head of the f-structure is focused, the entire f-structure is focused, not just the desired sub-parts. It also has the same problem with the focus containing itself as occurred with the focus in neutral yes-no questions.

Another possibility is to annotate clause-final leaf-nodes $(\downarrow\text{PRED}) \in (\uparrow\text{FOC})$ from right to left. As such, only the PRED values of the relevant constituents will be focused.

⁵There is a large body of work on Russian intonation. Yokoyama 1986 describes neutral intonation (her Type I) as a series of LH tones followed by a single HL tone, where the series of LH tones are realised with a downstep. The falling LH tone always falls on the focus.

⁶It is possible to focus the entire sentence in this way. However, (11) cannot have this reading because the subject *ona* ‘she’ is topicalised and hence incompatible with focus interpretation.



However, the PRED of the verb contains its arguments, here the subject and object, and as a result will incorrectly include the subject in the focus. Once again, the problem is that focusing the head of the f-structure results in the whole f-structure being focused, including the arguments of that head.

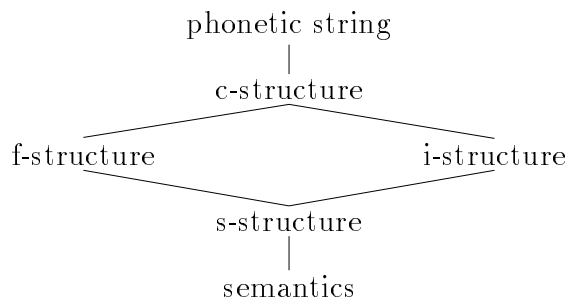
4 Towards a Solution

There are two basic parts to the solution of these problems. The first involves the positing of an i(nformation)-structure projection distinct from that of f-structure. The second is to remove the argument structure of the predicate, thus employing only their core meaning in the i-structure.

4.1 I-Structure

In a complete analysis of a sentence, all lexically substantial items have a discourse function role (topic, focus, background, etc.) based on the utterance context. Since the discourse function constituents does not always overlap with the f-structure constituency, information should be projected from the c-structure into a distinct i(nformation)-structure, which can be accessed by the s(emantic)-structure. This is shown in (16).

(16)



The mapping between i-structure and s-structure serves a dual role. First, it allows the semantics access to discourse function information as needed. Second, the fact that all lexical items with PRED values are assigned a discourse function role can be checked here; that is, any item with a semantic predicate must have a corresponding i-structure role. This effectively ensures completeness of the i-structure.

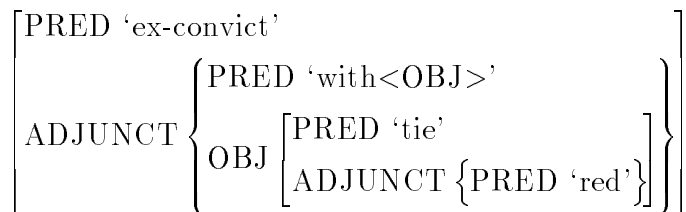
Consider the mismatches occurring between the f-structure and i-structure. There are phrases which are constituents in f-structure, but not in i-structure. A classic example of this is the English cleft. In English clefts, the clefted material must contain the focus of the cleft, but need not be focused in its entirety (see Jackendoff 1972 for detailed discussion of these and similar examples).

(17) Q: Was it the ex-convict with the red SHIRT that he was warned to look out for?

A: No, it was an ex-convict with a red [TIE]_{focus} that he was warned to look out for.
(Jackendoff 1972:232)

In (17) the entire NP ‘an ex-convict with a red tie’ is clefted and forms an f-structure constituent. Only the head noun ‘tie’ of the adjunct modifier of the clefted NP is focused; the remainder of the NP is presupposed and hence background material. As seen by the partial f- and i-structures in (18), there is a mismatch between f- and i-structure constituency. By having distinct projections for these two types of information, such mismatches can be captured by the LFG architecture.

(18) F-structure



I-structure

$$\left[\begin{array}{l} \text{FOC } \{ \text{TIE} \} \\ \text{BCK } \left\{ \begin{array}{l} \text{EX-CONVICT} \\ \text{WITH} \\ \text{RED} \end{array} \right\} \end{array} \right]$$

4.2 Core PRED Values

In all the examples in section 3, the main problem was that the arguments of the verb were included in the scope of the focus when the verb was focused. This problem is also found with non-verbal elements which have argument structures, although these are not discussed here. Instead of focusing the entire PRED, including its argument structure, just the basic meaning of the PRED should be focused. Kaplan and Maxwell 1996 refer to this value as PRED FN. For example, the verb ‘read’ has the PRED and PRED FN values in (19).

- (19) PRED ‘read<SUBJ,OBJ>’
 PRED FN read

By stripping off the arguments of the PRED and hence not projecting the argument structure into the i-structure, many of the above problems can be solved, as will be seen in the next section.⁷

4.3 Sample Analyses

I propose the following focus mappings for Russian; these mappings warrant further investigation, but they provide a starting point for future research into the interaction of c-structure and i-structure. With contrastive focus the relevant node is annotated with $(\downarrow \text{PRED FN}) \in (\uparrow_i \text{FOC})$.⁸ This will place the relevant core PRED in the FOC of the i-structure. Additional annotations can be used to indicate subtypes of discourse functions, e.g., prominence for contrastive focus. In addition, a mapping must be made to the prosodic structure to assign appropriate intonation; this is not formalised here. New information focus involves annotating clause-final leaf nodes from right to left with $(\downarrow \text{PRED FN}) \in (\uparrow_i \text{FOC})$ and assigning default falling intonation to the clause.

Other discourse function mappings in Russian include the c-structure rule annotations on SpecIP for topics. Topic will also be assigned to all pro-dropped elements since in Russian topichood is a necessary, but not sufficient, requirement for pro-drop.⁹ The default assignment of items is to neutral or background information (see Butt and King 1996 on further differentiating types of background information).

⁷However, see Dalrymple, Lamping, and Saraswat 1993 for arguments that the argument structure of PREDs is not necessary in the f-structure either.

⁸Here I have used subscripts on the up and down arrows to indicate projections other than that of the f-structure. However, it would be more accurate to use the * and M* notation proposed in Kaplan 1987. In this notation, * refers to the node (i.e., \downarrow), while M* refers to its mother (i.e., \uparrow). A prefixed letter refers to the projection. So, \uparrow_i should in fact be $i::M^*$.

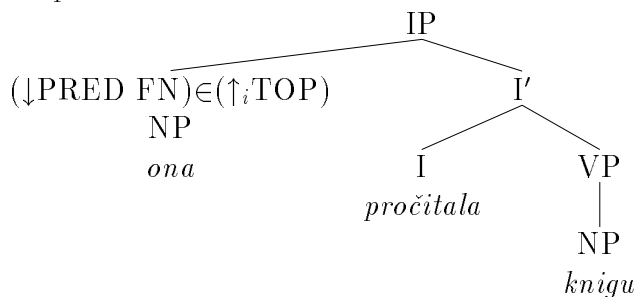
⁹This assignment can be placed wherever the PRED ‘PRO’ value is provided. One possibility is to do this in the lexical rule of the verb so that when a subject’s PRED is provided (optionally in Russian), then the subject’s PRED FN will be topicalised in the i-structure:

Consider the sentence, repeated in (20), which contains a contrastively focused verb.

- (20) Ona PROČITALA knigu.
 she read book
 ‘She READ the book.’
 focus = contrastive on ‘read’

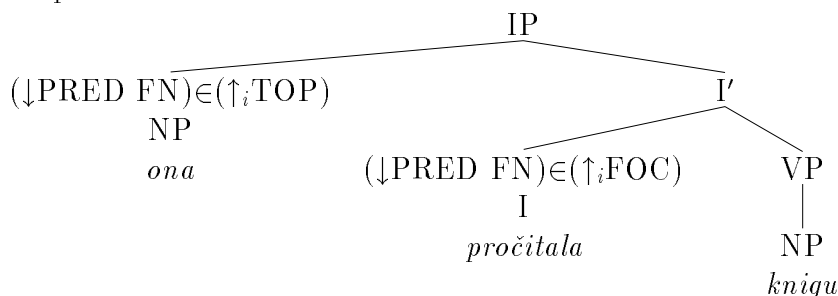
The c-structure rules result in the i-structure annotations in (21) (annotations giving grammatical function information are not shown) whereby the subject’s PRED FN is the value of TOP.¹⁰

- (21) Step 1: annotations from c-structure rules



The focus rules then assign the verb’s PRED FN to be an element of FOC. The fact that it is a contrastive focus can be captured by further annotations.

- (22) Step 2: annotations from focus rules

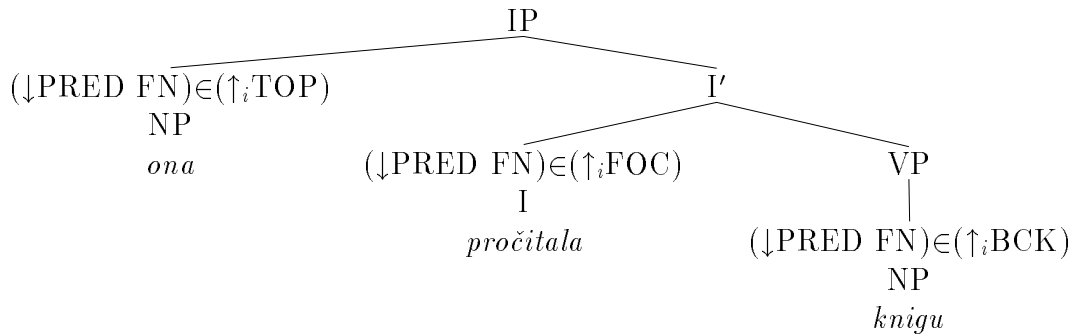


Finally, all PREDs which are not assigned a discourse function are designated as background information. Here this is shown by further annotations on the c-structure tree. However, it may be that this assignment is the result of constraints and mapping between i-structure and s-structure. That is, there independently must be a mapping between s-structure and i-structure which ensures that all items with PREDs receive a discourse function. This may also allow free assignment of PREDs to the BCK role. Items which already have a role will not be assigned another due to the i-structure equivalent of coherence.

čitaem PRED = ‘read<SUBJ,OBJ>’
 (↑SUBJ NUM)=PL
 (↑SUBJ PERS)=1
 ((↑SUBJ PRED)=‘we’
 (↑SUBJ PRED FN)∈(↑i;TOP))

¹⁰Russian allows multiple topics; hence the set notation.

(23) Step 3: default assignment



These annotations in addition to the assignment of f-structure grammatical relations result in the f- and i-structures shown in (24). Note that while the verb's f-structure PRED still has its argument structure, the i-structure's does not.

(24) F-structure

$$\left[\begin{array}{l} \text{PRED} \quad \text{'read<SUBJ,OBJ>'} \\ \text{SUBJ} \quad \left[\text{PRED} \quad \text{'she'} \right] \\ \text{OBJ} \quad \left[\text{PRED} \quad \text{'book'} \right] \end{array} \right]$$

I-structure

$$\left[\begin{array}{l} \text{TOP} \quad \{ \text{SHE} \} \\ \text{FOC} \quad \{ \text{READ} \} \\ \text{BCK} \quad \{ \text{BOOK} \} \end{array} \right]$$

Sub-constituent focus works similarly, as seen below. The subject is assigned to TOP due to its c-structure position in SpecIP, while the verb and its objects are assigned to FOC.¹¹

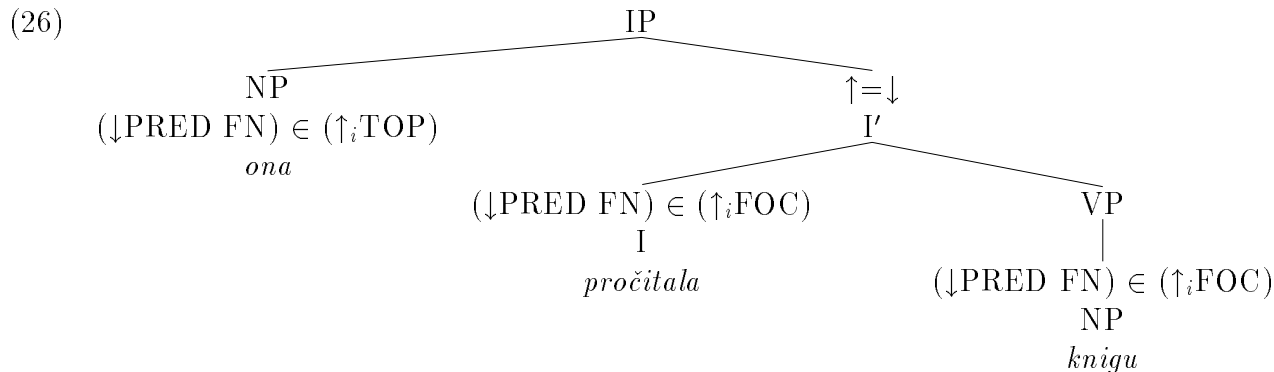
(25) Ona pročítala knihu.

she read book

'She read the book.'

focus = 'read the book' (in answer to: what did she do?)

¹¹If just the object were focused, which is a possible reading of (25) given the appropriate context, then the $(\downarrow\text{PRED FN}) \in (\uparrow_i\text{FOC})$ annotation would just appear on the object and the verb would be assigned to BCK by the default assignment of i-structure roles.



The resulting f-structure is identical to that of the corresponding sentence with contrastive focus on the verb. This is the desired result since the basic grammatical functions of the two sentences are identical; they differ only in their i-structure content. The i-structure of (25) is shown in (27).

(27) F-structure = (24)

I-structure

$$\left[\begin{array}{l} \text{TOP} \quad \{ \text{SHE} \} \\ \text{FOC} \quad \left\{ \begin{array}{l} \text{READ} \\ \text{BOOK} \end{array} \right\} \end{array} \right]$$

5 Conclusions

In this paper I have proposed that an independent projection is needed in the LFG architecture to represent discourse-function information: i-structure. The argument structure of predicates, as represented in the f-structure, is inappropriate for the i-structure in that it leads to incorrect scoping of the discourse functions. Instead, the core value of the predicate must be used. The internal organisation of i-structure is left for further research; here it is represented as a simple attribute-value matrix.

This paper gives rise to two major questions which remain unanswered: First, should any discourse function information be in the f-structure? Topic, and to a much lesser extent focus, have been syntacticized in a number of languages to the extent that they show agreement like f-structure grammatical functions. In such cases it might be argued that there is a syntactic (=f-structure) topic and focus, as presented in Bresnan and Mchombo 1987 and Alsagoff 1992, as well as the i-structure representation. That is, all f-structure grammaticalized discourse functions will have the corresponding i-structure role, but most i-structure roles will not be grammaticalized into the f-structure. Second, what is in i-structure and how is it organized? It is widely assumed that all “substantial” lexical items have a discourse function; this can be represented in LFG by all items with a PRED having an i-structure function; this is ensured via the s-structure. However, how these functions are organised and what divisions are needed remains to be investigated as a largely i-structure internal phenomenon despite the substantial literature on this topic.

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