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0. Abstract[1]

One of the main semantic roles of *free focus* (cf. van Leusen and Kálmán (1993)) is expressing contrast, e.g., in contrastively co-ordinated sentences. Consider the following example, from Hungarian:

(1) *Nem* PÉTER *eszik, hanem* PÁL.[2]
not Peter eats but Paul
'It is not Peter who is eating, but Paul'

Note that the non-focussed parts of the contrasted clauses (which I will call *focus frames* in the following) carry a *presupposition.* For example, the sentence in (1) presupposes that someone is eating.

This paper is dedicated to the problem of a special type of contrastive co-ordination in Hungarian,[3] superficially similar to the type illustrated in (1), but interpreted differently:

(2) *Nem a* VONAT *kerül sokba, hanem* ÉN *voltam beteg.*
not the train is expensive but I was ill
'It is not that the train is expensive, but that I was ill'

Obviously, this sentence presupposes neither that something was expensive, nor that someone was ill. Instead, it is to be used in a conversation in which the common ground (the context) includes a fact that the two clauses may offer alternative explanations for. For example, the common base of the two clauses in (2) might be 'I did not commute', and either the fact that the train is expensive or that I was ill are plausible explanations for this fact. This means that, in a sentence like (2), two propositions are contrasted. Therefore, I will account for the syntactic aspect of the phenomenon using *focus projection* (cf. Selkirk (1984:Ch5)), i.e., a mechanism that shifts focus from the prosodically prominent element to a constituent containing it (see section **1**).

From the semantic point of view, I will address two questions: (i) What is the 'focus frame' when entire propositions are in focus? (ii) How can we account for the relationship between the common base and both co-ordinated clauses? As for the question in (i), I will propose that the focus frame is the common base of the two clauses. As for (ii), an account of how the common base is shared will be

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[1] I am grateful to László Kálmán for his comments about both the substance and the phrasing of this paper and for the TEXwork he did on it.

[2] In this and the following examples, prosodically prominent elements are written with SMALL CAPITALS.

[3] Russian examples work analogously.

offered within the framework of the *Linguistic Discourse Model* (*LDM*) of Polanyi (1988) (see section **2**), which I will provide with a dynamic semantics, along the lines of Groenendijk and Stokhof (1990) (in section **3**).

1. Contrast and Free Focus

Since the type of sentences that I will concentrate on involve both contrast and free focus, I will first examine these two concepts (sections **1.1–1.2**). In section **1.3**, I will sketch how examples like (2) fit into the paradigm of contrast and co-ordination.

1.1. Contrast

By *contrast* I will mean a pair of inconsistent propositions, i.e., two propositions that cannot be true at the same time. Contrast has two main subtypes:

(a) A pair of contrasted propositions may originate from two different speakers in a conversation. This case might be called *correction* (the second proposition is a *corrective reply* to the first);
(b) If the two propositions are part of the same assertion, connected with a conjunction, then one of the propositions has to be negated, otherwise the entire assertion would be a contradiction. In this case, we can speak of a *contrastive conjunction.*

There are other types of relations between propositions that are sometimes called contrast. In particular, clauses can be opposed for rhetorical reasons, e.g., because of the incompatibility of the expectations that they give rise to. I will refer to those cases as *adversity* rather than contrast. For example, the following sentences are instances of adversity, but not of contrast:

(3) *I am old, but you are young.*
(4) *The cup is warm but the tea is cold.*

In Hungarian, contrast has a conjunction of its own (*hanem* 'but'), distinct from those of adversity (*de, pedig* etc.). In accordance with my definition of contrast, these conjunctions stand in a complementary distribution:

(5) *Péter nem utazott el, *de/hanem a városban kószál.*
Peter not left but$_{adv}$/but$_{contr}$ the city-in strolls
'Peter has not left, he is strolling in town'

(6) *Péter nem horkol, de/*hanem elaludt.*
Peter not snores but_{adv}/but_{contr} slept
'Peter is not snoring, but he is asleep'

The first proposition in (5) would be inconsistent with the second without the negation, thus only the contrastive conjunction is appropriate there. To the contrary, the propositions in (6) are far from incompatible (indeed, snoring entails sleeping), so only an adversative conjunction can be used. It expresses that Peter's sleeping would give rise to the expectation that he is snoring, but he is not.

Under the above approach, contrast need not involve free focus. The sentence in (5) qualifies as contrastive co-ordination, although its clauses contain no free focus, unless we want to regard their verb phrases as focussed.

1.2. Free Focus

The semantics of free focus involves three components: *the focussed part*, *the focus frame*, and *the relevant domain*. Both the focussed part and the focus frame have an overt representation in the syntax. The former is connected to the prosodic prominence of one word or phrase, which is either identical or part of the focussed part. The focus frame includes what remains after extracting the focussed part from the sentence. Finally, the relevant domain has no overt representation in syntax, its content is to be computed from the context somehow.

According to Karttunen and Peters (1979), free focus presupposes the existence of some entity of the same type as the focussed part for which the focus frame holds. The main assertion of a sentence that contains a free focus is that the focus frame holds *exhaustively* (i.e., uniquely and maximally) for the constituent in focus. Van Leusen and Kálmán (1993) arranges these meaning components differently. They locate the exhaustivity in the presuppositional part. That is, according to them, the presupposition of the sentence is that there exists something of the same type as the focussed part for which the focus frame holds exhaustively. They posit that the main assertion is the identification of the focussed part with the presupposed unique maximal entity. In both theories, the function of the relevant domain is to restrict the domain on which exhaustivity operates to a set of contextually relevant entities. In some cases, the relevant domain plays no role at all.

It follows from either of the above theories that a co-ordination of a negative and an affirmative clause that have different focussed parts and the same focus frame qualifies as a contrastive co-ordination. Taken for granted that the relevant domain is the same for both clauses, the two clauses must share the same presuppositions, because they share the focus frame. Without the negation, the two propositions must be contradictory, since the focus frames have to hold true

exhaustively for two different focussed parts. So the conditions for contrast are satisfied in such a case.

If the focus frames of the co-ordinated clauses are not identical, then the two clauses may refer to the same issue, but they are not inconsistent. Such co-ordinations are not necessarily incorrect, but they do not express contrast (in the following, the focussed parts will be enclosed in $[\cdot]^F$):

(7) *Nem az érett* [FÉRFIAK]^F *tetszenek Zsuzsának,*
not the mature men appeal Sue-DAT
hanem az *[AGGASTYÁNOK]^F / *érett* [GYÜMÖLCSÖK]^F.
but the graybeards/ ripe fruits
'It is not mature men, but graybeards/ripe fruits that Sue likes'

In the starred version of (7), the focus frame of the first clause is different from that of the second: it includes the adjective *érett* 'mature, ripe', which the focus frame of the second clause does not. This sentence could still work as a non-contrastive co-ordination (of two focus-containing sentences), if it was not conjoined with the obligatorily contrastive conjunction *hanem*.

Although, as we saw in the previous section, free focus is not a necessary ingredient of contrastive co-ordination, those cases in which only one of the contrastively co-ordinated clauses contains free focus seem infelicitous:

(8) **Károly nem volt vegetariánus, hanem* [IRMGARD]^F *volt az.*
Charles not was vegetarian but Irmgard was it
'Charles was not a vegetarian, it is Irmgard who was one'

This sentence certainly satisfies the criteria I have proposed for contrastive co-ordination. The first clause contains (in a negated form) the proposition that there is at least one person who was vegetarian, namely, Charles; the second clause claims that there is a unique person who was vegetarian, namely, Irmgard. The contradiction is obvious. According to van Leusen and Kálmán (1993), (8) is out because of a presupposition failure. The second clause presupposes the existence of a unique vegetarian, but the first clause fails to provide a context entailing this.

1.3. Focussed Propositions: Contrasted Explanations

In Hungarian (as well as in Russian), there are contrastive co-ordinations (like (2) or the examples in (9–11) below) the properties of which do not seem to square with the concept of contrastivity sketched in section 1.1:

(9) *Nem* PÉTER *aludt a padlón,*
not Peter slept the floor-on
hanem a HÁZIGAZDA *költözött szállodába.*
but the host moved hotel-into
'It is not that Peter slept on the floor, but that the host moved to a hotel'
Common base: 'the accommodation worked out well'

(10) *Nem* PÉTER *nem hozta el a tortát,*
not Peter not brought the cake-ACC
hanem a CUKRÁSZ *nem készült el még vele.*
but the confectioner not was-ready yet it-with
'It is not that Peter did not bring the cake, but that the confectioner has not prepared it yet'
Common base: 'the cake is not here'

(11) *Nem* PÉTER *nem kapcsolta fel a villanyt,*
not Peter not turned on the light-ACC
hanem a HÁZBAN *van áramszünet.*
but the house-in is power cut
'It is not that Peter did not turn the light on, but that there is a power cut in the house'
Common base: 'the light is not on'

These co-ordinations show the typical properties of contrast: a negative and an assertive clause are co-ordinated in each of them, and both contain prosodically prominent elements. Furthermore, the occurrence of the conjunction *hanem* is an independent argument for their contrastivity.

On the other hand, the sentences in (9–11) have a very peculiar feature as well, namely, that there are no common elements in the co-ordinated clauses which could indicate the focus frame of the contrast (cf. Szabolcsi (1981)). To explain why there is no overt focus frame in these sentences, I propose that *each clause belongs to the focussed part as a whole*:

(9) *Nem* [PÉTER *aludt a padlón*]^F, *hanem* [*a* HÁZIGAZDA *költözött szállodába*]^F.
(10) *Nem* [PÉTER *nem hozta el a tortát*]^F, *hanem* [*a* CUKRÁSZ *nem készült el még vele*]^F.
(11) *Nem* [PÉTER *nem kapcsolta fel a villanyt*]^F, *hanem* [*a* HÁZBAN *van áramszünet*]^F.

From the semantic point of view, the propositions in the co-ordinated clauses in (9–11) are not inherently incompatible with each other. I suggest that these

propositions are *competing explanations for the common base*. Their incompatibility is linked to this role: due to the exhaustive character of free focus, both explanations are presented as unique and maximal explanations for the common base.

The syntactic and semantic aspects of the approach sketched above corroborate each other. The informal term 'exhaustive explanation' corresponds to a focussed clause in the syntax and a focussed proposition in the semantics. This is what characterizes the phenomenon illustrated in (2) and (9–11). In what follows, I will refer to this construction as *contrastive co-ordination with focussed clauses*, or *CCFC* for short.

To make the explanation proposed above explicit, I will now examine (i) how the focussed part extends from the prosodically prominent word to the entire clause (section **1.3.1**), and (ii) how the concept of *explanations* can be fit into the semantics of contrasted propositions (section **1.3.2**).

1.3.1. Focus Projection

In the literature on focus, the technical devices used for explaining the connection between prosodic prominence and semantic focus are known as *focus projection* (henceforth, *FP*). There are two major theories about FP in the transformationalist tradition: Chomsky (1971) and Selkirk (1984). Both theories assume a level of representation of focus extension, which mediates between the phonological form (prosody) and the semantic module (meaning). A one-to-one mapping is assumed between focus extension and meaning, while the function from focus extension to prosody is a neutralizing one. The the two theories are quite dissimilar, they share two important features connected to the treatment suggested in this paper: (i) neither of them excludes the theoretical possibility of focussed clauses; and (ii) neither of them can be applied to Hungarian (or Russian) without modifications.

Both authors claim that the focussed part is always a constituent. According to Chomsky (1971), the maximal potential focussed part is the highest VP of a clause (that is, an S or IP cannot be focussed). This does not exclude the possibility of focussed clauses, because an entire clause might be dominated by a VP. Furthermore, Chomsky (1971) posits that prosodic prominence is always carried by the last word of the focussed part. On the other hand, the two languages quoted here (i.e., Hungarian and Russian) exhibit an opposite distribution of prosodic prominence: it is mostly the first word of the focussed part that is prosodically prominent (in the following examples, embedded foci represent alternative focussed parts, only one of which realizes):

(12) a. *He was* [*warned* [*to look out for* [*an* [*ex-convict* [*with* [*a red* SHIRT]^F]^F]^F]^F]^F]^F.
b. *He was warned to look out for an ex-convict with a* [RED]F *shirt.*

(7′) a. *Nem az érett* [FÉRFIAK]^F *tetszenek Zsuzsának, hanem...*
'It is not mature MEN that Sue likes, but...'

... az érett [GYÜMÖLCSÖK]^F.
the ripe fruits
'ripe fruits'

*... *az* [AGGASTYÁNOK]^F.
the greybeards
'greybeards'

*... [VACSORÁZNI *szeret járni*]^F.
dinner-INF likes go-INF
'she likes to go to dinners'

b. *Nem az* [[[ÉRETT]^F *férfiak*]^F *tetszenek*]^F *Zsuzsának, hanem...*
'It is not MATURE men that Sue likes, but...'

... az [ÉLTES]^F *férfiak.*
the elderly men
'elderly men'

... az [AGGASTYÁNOK]^F.
the greybeards
'greybeards'

... [VACSORÁZNI *szeret járni*]^F
dinner-INF likes go-INF
'she likes to go to dinners'

The three possible continuations in (7′b) correspond to wider and wider focussed parts in the first clause.

This type of difference between English, on the one hand, and Hungarian and Russian, on the other, suggests a solution involving syntactic parameters. Selkirk (1984) formulates her theory of FP in terms of head, arguments and adjuncts. Prosodic prominence — as a reflex of the 'focus' feature — is always associated with a word. This word is always a possible focussed part. If it is the head or an unmoved argument of a phrase, then the phrase itself is a possible focussed part as well. Adjuncts are excluded from the recursion. This theory is much more permissive than Chomsky's (1971), yet it cannot account for the Hungarian (and Russian) facts about modified constructions in focus. In (7′b), the entire modified construction can be interpreted as a focussed part, though prosodic prominence is carried by an adjunct, namely, the adjective. So FP has to be investigated further.

1.3.2. Semantics for Contrasted Explanations

This section approaches the semantics of CCFC in two steps. First, I am going

to make the meaning of focussed propositions explicit. Then I will outline the problems arising from the co-ordination of two such propositions.

As for the meaning of focussed propositions, it should be guaranteed somehow that the focussing of propositions is analogous to the focussing of other types of objects. A generalized non-syncategorematic formulation of the meaning of free focus would prove rather useful for carrying this out, and by applying this treatment to propositions would provide us with a null-hypothesis on what a focussed proposition means. In what follows, I will construct such a formulation along the lines of van Leusen and Kálmán (1993).

Exhaustivity can be captured using the concept of *infimum* of lattice theory. That is, the interpretation of exhaustivity requires a partially ordered set. If each item in the syntactic category of the focussed part is semantically represented as a set of those entities that turn them into true sentences, then the subset relation over those sets will do the job of the partial ordering. For example, in the case of noun phrases, the partial ordering will be the subset relation over sets of predicates. The NP *Peter* corresponds to the set of those predicates that are true for the individual assigned to *Peter*. The semantic counterpart of *Peter and Paul* is the set of predicates true for both individuals, i.e., the set resulting from the intersection of the two respective sets. Therefore, the semantic value of *Peter and Paul* is a subset of the denotations of both *Peter* and *Paul* and is thus ordered after them.

If the focussed part is semantically of type α s.t. $\exists\beta.\langle\beta,t\rangle = \alpha$(i.e., it can be considered a characteristic function of a set *fp*), then there is a poset $\langle D_\alpha; \subseteq\rangle$ where D_α is the set of the denotations of all terms of type α, and $\subseteq$ is the subset relation over them. The focus frame and the relevant domain are both of type $\langle\alpha,t\rangle$, so they can be seen as characteristic functions of some sets *ff* and *rd*, respectively. Free focus presupposes that there is an entity X of type α such that

$$X = \bigwedge(ff \cap rd).$$

Furthermore, the sentence containing free focus asserts that

$$fp = \bigwedge(ff \cap rd)^4.$$

What remains to be done is to instantiate *fp*, *ff* and *rd* for the case when an antire clause is focussed. I have assumed that the focussed part is semantically a

[4] Assuming an 'externallly dynamic' presupposition operator δ for which the following equivalence holds (cf. Beaver (1992)):

$$\neg(\delta(X) \wedge Y) \equiv \delta(X) \wedge \neg Y,$$

proposition. Though there is no overt focus frame in the sentence, we still assume for the semantics that there is a function mapping propositions into their truth values in the actual world. This is also a characteristic function the corresponding set of which is W_{act}. Let the focussed proposition be q. Assuming no relevant domain, the application of the categorematic formula yields

$$q = \bigwedge W_{\text{act}}.$$

Since W_{act} is a set of propositions, the partial ordering over it is semantic entailment. Being the infimum of W_{act} means that all propositions true in the actual world follow from q. Using a blasphemous paraphrase, q is the *prima causa*[5] of the actual world.

This formulation of the meaning of focussed propositions is too strong, because its exhaustivity ranges over an exceedingly large domain of propositions. This set has to be constrained. Two questions arise at this point: (i) What should constrain it? (ii) To which meaning component should the restrictor belong?

Ad (i): I propose that the domain of exhaustivity consists of all and only the propositions that possibly *specify, elaborate on* or *detail* the common base. In what follows, I will refer to the relation that holds between these propositions and the common base as *SED* (from the initials of the terms Specification, Elaboration and Detail). The content of the common base (henceforth, *CB*) may vary from context to context, but the character of its relation to the relevant propositions remains the same. We will build this into our representation in the following way. Let SED_{CB} stand for the set of those propositions that are SED-related to the common base CB. The focussed proposition is the infimum of the set of propositions that both are true in the actual world and stand in the SED relation to the CB:

$$q = \bigwedge(W_{\text{act}} \cap \text{SED}_{\text{CB}}).$$

Ad (ii): Since there are three components (*fp*, *ff* and *rd*), three possibilities are open. The focussed part can surely be excluded as the possible carrier of SED_{CB}, because SED_{CB} has to be a sub-formula that infimum operates on. There still are two candidates. SED_{CB} is either identical to *rd*, or a subformula of *ff*. The latter possibility needs further explanation. Let us assume that the translation of a clause in the discourse includes a sub-formula that there exists a proposition

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we could represent the meaning of focus as follows:

$$\delta(\exists X.X = \bigwedge(ff \cap rd)) \wedge X = fp.$$

[5] Cf. St. Thomas, *Summa Theologiae*.

(namely, the common base) to which the proposition of the clause is SED-related. That sub-formula is so general that it does not change the truth conditions of the entire formula. Abstracting away from the proposition of the clause yields the semantic equivalent of the *ff*:

$$\lambda p\,(\exists \mathrm{CB}.p \in \mathrm{SED}_{\mathrm{CB}} \;\&\; p(w_{\mathrm{act}}))\,.$$

This is a characteristic function of a set of propositions which is conceivably identical to $W_{\mathrm{act}} \cap \mathrm{SED}_{\mathrm{CB}}$. In section **2**, I will present some independent motivation for the presence of $\mathrm{SED}_{\mathrm{CB}}$ in the translation of clauses as they appear in discourse.

The distinction between the focus frame and the relevant domain can be justified straightforwardly. The focus frame is an essential component of sentences containing free focus. It must exhaustively hold for the focussed part. As for the relevant domain, it is only a supplementary device to avoid too strong readings. From this point of view, it seems plausible that $\mathrm{SED}_{\mathrm{CB}}$ should be identical to the relevant domain, since its purpose is also to avoid too strong readings. Nevertheless, I want to argue that either the *ff* and the *rd* are to be conflated or else $\mathrm{SED}_{\mathrm{CB}}$ is to belong to the focus frame.

As far as the first possibility is concerned, the properties of the focus frame and the relevant domain are largely identical. Both components are of the same semantic type. Both focus frames and relevant domains must be shared by the members of contrastive co-ordinations. The relevant domain has no overt linguistic representation, so its content is computed somehow from the context. According to van Leusen and Kálmán (1993:9), focus frames are also left implicit quite often, in which case their content is also to be computed from the context. In sum, if we were to conflate the two, many questions would not arise at all.

If we did not conflate *ff* and *rd*, then $\mathrm{SED}_{\mathrm{CB}}$ should be a sub-formula of *ff*. My argument for this runs as follows. The relevant domain may occur in any instance of free focus, irrespective of the type of the focussed constituent. On the other hand, $\mathrm{SED}_{\mathrm{CB}}$ is linked to a particular category of focussed parts. It only appears when the *fp* is a proposition, and then it is obligatorily there. Now, the focus frame is likewise category specific. It is the result of abstracting over the focussed part. If we want to explain why it is present when a proposition is focussed, we have to include it in the focus frame.

To assess whether CCFC qualifies as genuine contrast, we have to check whether it satisfies our criteria for contrast. If we disregard the restriction to $\mathrm{SED}_{\mathrm{CB}}$, the answer is clearly on the positive. There cannot be more than one *prima causa* of one possible world: two such propositions must be inconsistent or equivalent. If we also take the restriction to $\mathrm{SED}_{\mathrm{CB}}$ into account, then the requirements for contrast are satisfied only if CB is the same in each and every clause. When entities of other types are focussed, the linguistic identity of focus frames ensures that they refer to the same thing. Although $\mathrm{SED}_{\mathrm{CB}}$ is not an

overt part of the focus frame, co-ordinated focussed clauses are still interpreted in a way that they refer to the same issue. Putting the problem in formal terms, one should ensure that the propositional variable CB in a clause be able to bind the occurrence of the variable in another clause. The problem seems to challenge compositionality.

In the following section, I will present some motivation for the presence of SED_{CB} as a sub-formula in every proposition of a piece of discourse. In section **3**, I will attempt to give a formal account of the cross-sentential binding of propositional variables.

2. Discourse Structure and Common Base

2.1. The Linguistic Discourse Model

The individual sentences in a discourse usually do not contain all information necessary for interpreting them. Anaphors carry *par excellence* (referentially) partial information, but individual sentences may also remain agnostic about other — spatial, temporal, modal etc. — aspects of meaning. In principle, a piece of discourse as a whole is interpretable. So there must be algorithms to complete underspecified or missing information. This implies that discourse must be a structured entity. On the other hand, the fact that sentences in a piece of discourse are interpreted together implies that discourse has got coherence on its own. For example, topics cannot follow one another in an arbitrary manner, and old topics cannot be taken up again arbitrarily.

Polanyi's (1988) *Linguistic Discourse Model* (*LDM*) is a formalized theory about discourse structure. Pieces of discourse are seen as constructed from *discourse constituent units* (*dcus*) using recursive syntactic rules. Every *dcu* is associated with a semantic content, and every syntactic rule has a semantic counterpart that computes the semantic content of composed *dcus* from the semantics of their constituents.

So *dcus* are either *atomic* or *composed*. Every clause automatically belong to the former category, and no other entities belong there. Even though discourse particles are not *dcus* at all, from the point of view of the theory they count as kind of atomic. They come in three varieties: *rhetorical* (*because, therefore*), *logical* (*and, or, if ... then ...*) and *push/pop* markers (*well, anyway*). This subcategorization is semantically motivated.

Composed *dcus* are split into subcategories, too. There are *co-ordinations*, *subordinations*, *interruptions* and *binary structures*. Since the properties of each subcategory are determined by the syntactical/semantical rule that creates the composed *dcu* in question, they will be presented together with the syntax and semantics of LDM.

The grammar of discourse consists of context-free rules. Its basic — nominalist — intention is to represent all the atomic *dcus* as terminals and all the composed ones as non-terminals. Composed *dcus* of any subcategory can function as discourse initiators.

A co-ordination can be rewritten as the sequence of an arbitrary number of *dcus* of any type. Rules about subordination are more restricted: they can be constructed of at most two *dcus*. A rather important linear precedence rule applies to their construction: the subordinating *dcu* always precedes the subordinated one. The typical subordinative discourse operators are *because, since, whereas.* According to the classification in Polanyi and Scha (1984), the residual subcategories range with the previous two. Interuptions only differ from subordinations in their semantics. Binary structures are either subordinative (these are the *par excellence* subordinations) or co-ordinative. The latter type includes some logical and deductive types of co-ordination. Their typical discourse operators are *either ... or ...*, *if ... then ...* and *therefore.* By definition, they must consist of two *dcus*.

The semantics of the LDM uses *context frames* (*cf*s). Every context frame is associated with a *dcu* token (an integer in the case of atomic *dcus*, the symbols C or S, which indicates the type of composition). Formally speaking, *cf*s are ordered n-tuples (in practice, triples). There is a slot for each piece of information that is relevant for the context: one for *participants*, one for *time*, and one for the *properties and relations* of participants. Polanyi (1988) uses these parameters only, although nothing in the theory excludes the possibility of other slots, e.g., for space and modality. The frame of atomic *dcus* is given by the formal translation (or at least expressible in its terms). The information about the assignment of values to individual variables appears in the slot for participants; the information about temporal variable assignments appears in the time slot; and the information about the interpretation function appears in the slot for properties and relations. The frame of composed *dcus* is computed from the frames of their constituents and from the character of the composition.

The operation that computes the frame of co-ordinative *dcus* is called *Generalized Union* (*GU*). It operates on a set of vectors, and calculates 'the most restrictive relevant natural set' (Polanyi (1988:617)) or 'the most specific common denominator' (Polanyi and Scha (1984:574)) for each slot. The GU also acts as a condition on co-ordinability. The unification cannot result in a trivial frame, e.g., ⟨NOW, exist⟩. Although the authors provide us with many examples of the result of calculating GUs, they remain agnostic on how exactly it works.

(13) a. *Jim took all the home ec. courses in the high school.*
1⟨Jim, PAST, take all the home ec. courses in the high school⟩

b. *He took the Cordon Bleu Course in France last year.*
2⟨Jim, PAST, take the Cordon Bleu Course in France⟩

a+b. *C*⟨Jim, PAST, take courses⟩

If we co-ordinate the sentences in (13a) and (13b) with the *cf* that follow them, the context frame of the co-ordination will be as in (13a+b). It is the result of the GU of the two individual context frames. In this example, two atomic *dcus* were composed into a co-ordination. But remember that both GU and the syntactic operation of co-ordination may operate on an arbitrary number of *dcus*, including composed ones.

The frame inheritance mechanism of subordination is rather simple: the whole subordination always inherits the frame of the subordinating constituent. Both interruptions and subordinative binary structures (proper subordinations) are characterized by this configuration of context frames. But there is an extra condition on the latter. Proper subordinating *dcus* must stand in a so-called *IS-A* relation to the proper subordinated ones, while the same condition does not hold for the constituents of interruptions. For the IS-A relation, Polanyi (1984) adopts J.R. Hobbs' definition as a starting-point:

> 'A segment of discourse S_1 is (stands in the IS-A relation with) the segment S_0 if the same proposition P can be inferred from both S_0 and S_1, and one of the arguments of P is more fully specified in S_1 than in S_0.'

Even though Polanyi (1984) does not revise this formulation explicitly, in practice she qualifies a much broader class of relations as instances of the IS-A relation. Polanyi (1984) considers (14) as proper subordination:

(14) a. *Jim is a great cook.*
1⟨Jim, NOW, being a great cook⟩

b. *He has been learning cooking for a long time.*
2⟨Jim, PAST, learn cooking for a long time⟩

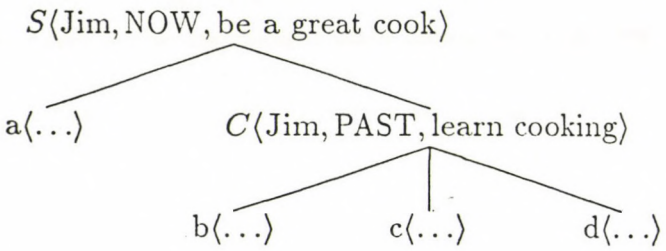
Although the relation between (14a) and (14b) does not fit well into the Hobbsian definition, Polanyi assumes that it is an IS-A relation. There are some propositions that are 'corollaries' of both (14a) and (14b) (e.g., 'Jim has some experience in cooking') with respect to which (14b) is more specific than (14a) in some sense.

Since composed *dcus* can also constitute subordination, the IS-A relation has to be defined for them, too. There is a proposition that can be reconstructed from the *cf* of *dcus*. Its predicate is taken from the slot for properties and relations, while its individual and temporal arguments come from the other slots. This proposition is called the *discourse theme* (D^θ), and it stands in the IS-A relation with the *dcu*. For atomic *dcus*, D^θ is identical with the proposition of their clause. The D^θ of a co-ordination is the new proposition computed through GU, whereas the character of the D^θ of a subordination depends on the character of the subordinating *dcu*.

Every LDM analysis has a graphical representation as well, called the *Discourse Parse Tree* (*DPT*). In the example below, the piece of discourse in (15) is

represented by the DPT in (16). In (15), indentation represents subordination, and equal indentation represents co-ordination. In (16), indentation represents dominance: the daughters of a tree node follow their mother node with an indentation.

(15) a. *Jim is a great cook.*
| b. *He took all the home ec. courses in the high school.*
| c. *He worked as a cook in the army.*
| d. *He took the Cordon Bleu Course in France last year.*



The DPT format is not only a visually expressive device, but also enables Polanyi to formulate well-formedness/felicity conditions on how pieces of discourse can be incremented with new *dcus* in terms of *adjunction*. It would be hard to do this in terms of a linear representation.

New units are incorporated in the structure of the discourse in accordance with the semantic relation they bear to one of its *dcus*. If this relation is of the IS-A type, the new clause will be subordinated to the old *dcu*; if the new clause has a non-trivial common denominator with the old one, they will be co-ordinated. Syntactically, this is realized by a step of (proper or not-so-proper) adjunction (cf. section **2.1.1**).

However, not every old *dcu* of the discourse is accessible to the new clause. Polanyi formulates a condition on accessibility in terms of dominance. The new unit has only access to the most recently added *dcu* and the *dcus* that dominate it. Since an adjoined unit is always to the right of lower segments in a DPT, only the *dcus* of the rightmost nodes of the tree are accessible. The other nodes cannot be resumed, i.e., their D^{θ}s are not accessible. Furthermore, NPs that have been introduced in such closed-off *dcus* cannot be picked up by pronouns in the new unit.

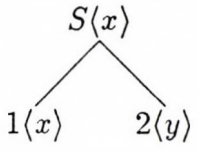
2.1.1. Adjunction

This section aims at explaining a syntactic device that Polanyi (1988) uses implicitly. At the same time, it proposes a modification of the LDM in order to make it more transparent, theoretically more appealing and easier to formalize.

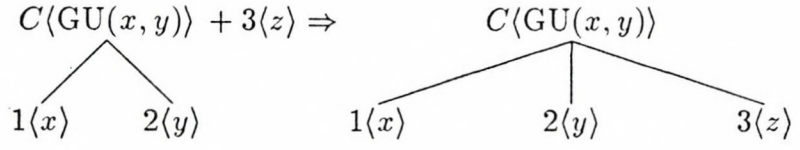
Adjunction is a structure-preserving operation on graphs, which can be divided into two sub-operations: (i) The targeted node splits up into two segments (which are still one node), so that the upper segment is dominated by the same nodes as the original node was, while the lower segment dominates the same nodes as the original node did. Furthermore, the upper segment immediately dominates the lower one. (ii) A new node is added to this two-segment node, so that the upper segment immediately dominates it.

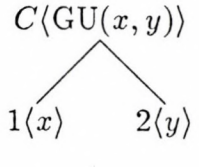
I propose that every step that updates discourse structure — including both subordination and co-ordination steps — take the form of adjunction syntactically. Due to its structure-preserving character — and to the parallelism between syntax and semantics —, adjunction ensures monotonicity in semantics.

Adjunctions that yield subordinations are always proper adjunctions. The subordinating *dcu* forms the lower segment of the adjunction, whereas the upper segment is the subordination *dcu* itself. The two segments form one node, especially as the have the same *cf*:

(17) $1\langle x\rangle + 2\langle y\rangle \Rightarrow$ 

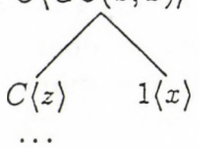
As for adjunctions that result in co-ordination, Polanyi either adds a new branch to the co-ordination (this can only happen when the new *dcu* is adjoined to an already existing co-ordination, see (18) below), which is not an adjunction at all, or creates a new co-ordination node when so needed. This adjunction is improper, because the lower segment of the adjunction (the old *dcu*) and the upper segment (the co-ordination *dcu*) cannot have the same context frame (see (19) below).

(18) $C\langle \mathrm{GU}(x,y)\rangle + 3\langle z\rangle \Rightarrow$ 

(19) $1\langle x\rangle + 2\langle y\rangle \Rightarrow C\langle \mathrm{GU}(x,y)\rangle$ 

The type of operation in (18) can be transformed into an improper adjunction, so that the old co-ordination *dcu* becomes the lower segment, whereas the upper segment is a newly created co-ordination *dcu* with a new frame:

(20) $C\langle z\rangle + 1\langle x\rangle \Rightarrow C\langle \mathrm{GU}(z,x)\rangle$



2.2. LDM and CCFC

We have seen that the relation that I dubbed SED plays a central role in the analysis of CCFC. As a consequence, a necessary condition of embedding CCFC into the LDM is to incorporate the SED relation into the theory. To do this, I propose to collapse the SED relation with the IS-A relation. Given that both concepts are defined in a rather vague way, there is no *a priori* reason why they could not be the same. To assess whether this is feasible on empirical ground, I will briefly consider some facts about CCFC again.

Quiescent common bases and focussed clauses of CCFCs can be transformed into (audible) subordinations. For example, the CCFCs in (9–11) can be converted into (9′–11′) below, where the continuations in (–a) and (–b) are alternative subordinated *dcus* to the first sentence:

(9′) *The accommodation worked out well.*
- a. *It is that Peter who slept on the floor.*
- b. *It is that the host moved to a hotel.*

(10′) *The cake is not here.*
- a. *It is that Peter did not bring it.*
- b. *It is that the confectioner has not prepared it yet.*

(11′) *The light is not on.*
- a. *It is that Peter turned it off.*
- b. *It is that there is a power cut in the whole house.*

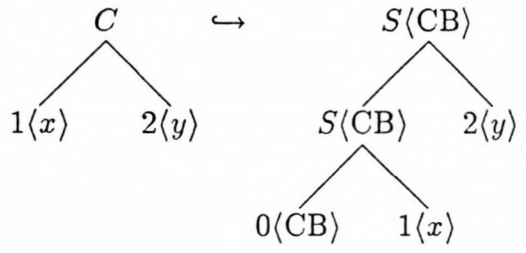
As can be seen, each one of the pairs of contrastively co-ordinated clauses of (9—11) can act as clauses subordinated to a clause that expresses their common base. This justifies the identification of SED with IS-A.

It seems, then, that CCFC can be embedded into the LDM, if we assume that every subordinated *dcu* contains the sub-formula that its proposition is IS-A-related to the proposition of the subordinating *dcu*. Since every *dcu* is a possible subordinated *dcu*, the translation of every *dcu* has to contain the sub-formula that there is a proposition that its D^{θ} is IS-A-related to. This sub-formula is identical with the sub-formula corresponding to the SED that I have added to the translation of clauses to account for propositional focus. In this sense, Polanyi's LDM is an

independent motivation for doing so. This way of representing D^{θ}-inheritance challenges compositionality, since the D^{θ} of the subordinating *dcu* must cross-sententially 'bind' the proposition that the D^{θ} of the subordinated *dcu* is IS-A-related to. Common-base inheritance in CCFCs also challenges compositionality. A *panacea* for both will be presented in section **3**.

A direct embedding of CCFC into Polanyi's LDM, however, does not seem viable. If one intends to IS-A-relate the proposition of the focussed clause to the common base, one should create a subordination where the quiescent common base is the subordinating *dcu* and the focussed clause is the subordinated one. The assumption of vacuous *dcu*s is not appealing at all. Furthermore: In case of contrastive co-ordinations, not only the common base should subordinate the first clause, but one also has to assume the existence of another subordination between this subordination and the second clause. The co-ordination would be transformed into a double subordination (cf. (21) below). This is heavily counter-intuitive.

(21)



To sum up, the frame-inheritance mechanism of the LDM provides CCFC with the desired *cf*s. Since the subordination *dcu* inherits its D^{θ} from the subordinating *dcu*, both focussed propositions are IS-A-related to the common base. On the other hand, the structural properties of CCFC cannot be accommodated in the existing LDM machinery.

2.3. IS-A and GU

Subordinability and co-ordinability are expressed in terms of IS-A and GU. If an IS-A relation holds between the D^{θ}s of two *dcu*s or the application of GU to two *dcu*s result in non-trivial context frames, then the two *dcu*s can be subordinated or co-ordinated, respectively. Due to the frame inheritance mechanism of the LDM, the D^{θ}s of a subordination *dcu* and that of its subordinated *dcu* also stand in an IS-A relation. I will show that the D^{θ} of every co-ordinated *dcu* is also IS-A-related to that of its co-ordination *dcu*. First, I will show that the D^{θ} of each co-ordinated *dcu* (except for the ones with downward monotone NPs) is IS-A-related to the D^{θ} of the co-ordination *dcu*, even in the Hobbsian sense. In the second step, I will show that the IS-A relation of Polanyi holds even between the D^{θ}s of co-ordinated *dcu*s with downward monotone NPs and the D^{θ} of their co-ordination *dcu*.

Polanyi considers Hobbs' definition of IS-A as the core of the semantic relation in subordination. So if two propositions stand in a Hobbsian relation, then they also stand in a Polanyi-type IS-A relation between them. The summary of Hobbs' definition is that (i) the propositions that are IS-A-related have a common entailment; and (ii) an argument of the second proposition of IS-A is more specific than the corresponding argument in the first. (In addition, (iii) the above argument has a counterpart in the common entailment as well.)

First I will show that point (ii) holds between a co-ordination *dcu* and any of its constituents. The GU computes 'the most specific common denominator' for each slot of the context frames of the co-ordinated *dcu*s. But even 'the most specific denominator' can at most be as specific as the slot it has been generalized from. If every slot is a representation of a type of argument, there must be at least one slot — or a part of a slot — that is more specific in the frame of the co-ordinated *dcu* than in that of the co-ordination itself. Otherwise it is not a co-ordination. So I am left with the first point.

In order to prove that co-ordinated *dcu*s have non-trivial entailments, I first have to make it explicit how the reconstruction of D^{θ}s works in the case of co-ordination. As for the slot for properties and relations, GU abstracts over the most specific common meaning postulate of the predicates in question (all the better if these meaning postulates define the common predicate of the co-ordinated clauses). As for the slot for individuals, I suppose that GU abstracts over the most specific common properties of the individuals in question (all the better if these properties define an individual).[6] Therefore it is not crucial that the reconstruction should provide a D^{θ} with the appropriate type of quantifier. I assume that Polanyi's GU works as follows: if all NPs of the co-ordinated *dcu*s were non-downward-monotone, existential quantification would do in the D^{θ} of the co-ordination *dcu* (cf. (22) below).[7]

(22) *First co-ordinated clause:*
Every lion runs.
Second co-ordinated clause:
Some zebras galop.
D^{θ} *of their co-ordination dcu:*
'Some (savannah) animals move fast'

It is conceivable that the existential quantifier does not work in case of down-

[6] The alternative of this kind of operation is not too appealing. If GU abstracted over the biggest set of common referents, much of the generalization would be lost.

[7] I call an NP downward monotone if if the tests for quantifiers that are downward monotone in their second argument justify it.

ward monotone NPs. Indeed, sometimes there is no quantifier that would do. Consider:

(23) *First co-ordinated clause:*
At most five ladybirds creep.
Second co-ordinated clause:
No may-bug crawls.
D^θ of their co-ordination dcu: ???

I do not know how to solve this problem in terms of reconstruction. I know, however, how to solve it in terms of IS-A. First, I prove that the D^θs of *dcu*s with non-downward-monotone NPs are IS-A-related to the D^θ of the co-ordination *dcu*.

$$P(a) \models \exists x.P(x)$$

This is true irrespective of the type of P, a and x. The formula remains true even if P in the entailment is replaced with a superset of P. The relation between the D^θ of a co-ordinated *dcu* and that of the co-ordination itself is just an instance of this. Since everything that follows from the logical consequence of a formula follows from the formula itself, point (i) of the Hobbsian definition is satisfied as long as we consider cases with non-downward-monotone NPs.[8]

Step two: Polanyi's IS-A relation accounts for cases with pure downward monotone NPs. It is easy to find a subordinating clause for either one of the co-ordinated clauses in (23), cf. (24) below. Since the D^θ of the subordinated *dcu* is IS-A-related to the D^θ of the subordinating *dcu*, this means that Polanyi's IS-A relation easily accounts for the D^θ of co-ordination *dcu*s like

(24) a. *Insects hardly move these days.*
| b. *At most five ladybirds creep.*
| c. *No May-bug crawls.*

Polanyi's IS-A relation does not account for clauses with NPs of mixed monotonicity, although it seems possible to co-ordinate them:

(25) a. *A lion often has no difficulty catching its prey.*
| b. *Every lion runs.*
| c. *No zebra galops.*

The co-ordinability of (25b) and (25c) can easily be explained in terms of IS-A. The D^θs of both are IS-A-related to the proposition 'lions are much faster than zebras',

[8] One can manage to find analogous arguments in the common entailment to satisfy point (iii) as well.

which is a possible D^θ of the co-ordination itself. This intermediate proposition is, of course, IS-A-related to (25a).

The next task is to replace GU with IS-A both as a condition on co-ordinability and as an operation to compute *cf*s. The co-ordinability condition will sound as follows: an old *dcu* of the discourse and a new unit can be co-ordinated if the set of propositions that the D^θ of both *dcu*s is IS-A-related to has at least one non-trivial element. Let the most informative elmenet of this set be the D^θ of the new co-ordination *dcu*. This replaces the GU operation.

This move has the following important consequences:

(A) The GU operation can be dispensed with.
(B) CCFC can be represented as a co-ordination (cf. Figure 3). The most informative proposition that the D^θ of either *dcu* is IS-A-related to is exactly the common base. In this sense, CCFC provides independent motivation for replacing GU with IS-A.

That is, the new definition accounts for co-ordinations that could not have been captured otherwise.

$C\langle$most informative $z \in (\text{IS-A}_x \cap \text{IS-A}_y)\rangle$, alias $\langle\text{CB}\rangle$

$1\langle x\rangle$ $\quad$ $2\langle y\rangle$

Figure 3.

3. Dynamic Discourse Semantics

The task of this section is to give a formal account of the non-compositional properties of both CCFC and the LDM. I will present a dynamic semantics for discourse structure along the lines of Groenendijk and Stokhof's (1990) *Dynamic Predicate Logic* (*DPL*). This semantics does not account for all the effects of the LDM, but the treatment of CCFC will be preserved by the formalization.

In section **3.1** I will outline some properties of dynamic semantics in general and of DPL in particular. Section **3.2** is about the central idea underlying the dynamization of the LDM, which I will formulate in a dynamic discourse semantics in section **3.3**.

3.1. Dynamic Logics and DPL

The definitive property of dynamic semantics is that it conceives of the meaning of a sentence not as its truth conditions, but as the way in which it changes

the information state of the hearer. That is, the meaning of a sentence is a function mapping information states before its utterance to information states after uttering it. The various types of dynamic semantics differ in the way they represent information states. Some semantic systems characterize such states by the functions that assign values to free variables (or 'discourse referents'). DPL and Heim's (1982) 'File Change Semantics' belong to this type. Other theories represent information states by pairs of interpretation functions and assignment functions (such as Beaver's (1992) KPL). These functions may be fully specified functions compatible with an information state (as in DPL), or may be partial functions specified only for a subset of 'salient' expressions (such as the discourse referents in Heim's theory).

Dynamic Predicate Logic accounts for certain phenomena related to anaphoric relations, such as cross-sentential anaphoric binding and donkey anaphora, but it can only deal with extensional, first-order formulae. The language into which natural-language sentences are translated is that of first-order predicate logic. On the other hand, conjunction is not interpreted in a commutative manner, and the translations may contain free variables that are interpreted as if they were bound by quantifiers in formulae to their left.

The interpretation of a DPL formula is a relation between assignment functions. In each pair that belongs to such a relation, the first member is a possible input information state, whereas the second member represents the corresponding output state. For some expressions the input and the output states are identical. These can only impose conditions on the input information states. They are said *externally static*, and they are called *tests* (e.g., conditionals are of this type). In the interpretation of other expressions, the input and ouput assignments can be different. These expressions can change states of information, and are called *externally dynamic* (in particular an existentially quantified formula is externally dynamic, because it introduces a new variable binding). There are also several ways of conjoining two expressions: in some cases, the second sub-formula is interpreted with respect to the output state created by the first. In this case, the resulting expression is *internally dynamic* (dynamic conjunction belongs here). Otherwise, it is said *internally static* (as, e.g., disjunctions).

3.2. The Central Idea

Polanyi (1988) formulates a well-formedness condition in terms of DPTs, namely, on the accessibility of old *dcus* to new ones. According to Polanyi's condition, the accessible *dcus* are the most recently adjoined *dcu* and the *dcus* that dominate it. This affects both possible ways of continuing discourse themes and anaphora resolution. The continuability of a discourse theme means that it can reappear in — or affect the computation of — a newly added constituent. So, clearly, the possibility of adjunction and continuability are connected with each other.

This is not the case with anaphora resolution. The LDM does not explain how possible adjunction and anaphora resolution are connected. As a matter of fact, the LDM has nothing to say about the distribution of pronouns. On the other hand, anaphora resolution is the central concern of DPL which, however, cannot deal with the book-keeping of discourse themes. But these two phenomena seem interconnected, as shown by (26) below.[9]

(26) 1 *Mr. Morris*$_1$ *has three daughters.*
| 2 *Mary*$_2$ *is the eldest.*
| | 3 *She*$_2$ *admires her*$_2$ *father*$_1$,
| | 4 *but she*$_2$ *would find it childish to display it.*
| | | 5 *After all, she*$_2$ *is a real woman.*
| | | | 6 *She*$_2$ *already has a boyfriend*$_3$.
| 7 *Sue*$_4$ *is the middle one.*
| | 8 *Sue*$_4$ *loves him*$_1$/**him*$_3$, *too.*
| | | 9 #*Mary*$_2$ *may even stay out all night.*

Subordination enables pronominals in their subordinated *dcu* to be coreferential with NPs in the subordinating *dcu* even from a considerable linear distance. However, no resolution is possible between an NP in a subordinated *dcu* and a pronoun outside the subordination, even if they are quite close to each other (cf. *boyfriend*$_3$ and *him*$_3$ in 6, and *him*$_3$ in 8). The same is true for discourse themes. A discourse theme is easy to continue via subordination, but no continuation is possible if the subordination has already terminated, as 9 shows.

The above generalizations can be captured in a dynamic spirit as follows: subordination is *internally dynamic* and *externally semi-static* regarding both anaphora resolution and discourse theme continuability. (By 'semi-static' I mean that only one of the sub-formulae is dynamic, the other one is static.) Given this formulation, DPL can be extended to account for the continuability of discourse themes and anaphora resolution simultaneously.

3.3. Extending DPL: DPLDM

The aim of this section is to develop a system of dynamic discourse semantics. The system will be called *DPLDM*, since it is a contamination of DPL and the LDM.

3.3.1. The Machinery

Starting from the DPL side, the treatment of discourse themes makes it possible

[9] This example is analogous to one of Grosz (1988), a technical description of the dismantlement of a water pump.

to modify the concept of information states. In DPLDM, they will be similar to what Polanyi (1988) calles context frames. That is, the information content of an entire context will be represented as one *cf*, as if all contextual information originated from a single *dcu*. For the sake of simplicity, however, I will omit the 'time' slot from *cf*s. So a *cf* representing an information state will be characterized by an (individual) assignment function (for the participants) and a propositional variable (for D^θ). As in DPL, the meaning of an expression is a relation over pairs of information states, i.e., of *cf*s of this sort. The first member of each pair is the *cf* through which the expression can be incorporated to earlier discourse (input state), whereas the second member is the *cf* through which subsequent expressions can be attached to it (output state).

As a matter of course, only those expressions will denote relations over information states which correspond to *dcu*s in the LDM (we will call these *discourse formulae* or *DF*s in the following) or operators on such formulae. These together form the vocabulary of DPLDM. Other expressions will be interpreted as in DPL. The distinction between DPL expressions and DFs, we will use a special operation that creates discourse formulae from formulae of ordinary predicate logic. We will call this operation *discoursivization*, and indicate it by $\boxed{\text{boxing}}$ the formula in question. In addition, we will introduce the operators 'S' and 'C' for subordination and co-ordination, respectively:

(27) *Discourse Formulae*
The set of *discourse formulae* (*DF*s) is the smallest set such that:
(i) If φ is a formula that corresponds to a *dcu* in LDM and none of its subformulae does, then $\boxed{\varphi}$ is a DF;
(ii) If Φ and Ψ are DFs, then so is Φ S Ψ;
(iii) If Φ and Ψ are DFs, then so is Φ C Ψ.

It follows from the above definition that DPLDM is built 'on top of' DPL. DPLDM does not interpret atomic formulae, it is parasitic on DPL in that respect.

An expression is interpreted with respect to a model $\mathcal{M} = \langle D, W, F\rangle$, where D is a non-empty set of individuals, W a set of possible worlds, and F the interpretation function. We will distinguish W_{act} as the set of propositions true in the actual world, and ISA_X as the set of propositions that are IS-A-related to the proposition X. An assignment function g assigns an individual to each variable (it is a total function). G is the set of all assignment functions, and Γ is the set of all propositions.

The semantic-value function $[\cdot]^{\mathcal{M}}$ will assign values to both DPL formulae and DFs. In the case of a DPL formula, it yields a subset of G^2, whereas for DFs it yields subsets of $G \times \Gamma \times G \times \Gamma$. If φ is a DPL formula, then

$$[\boxed{\varphi}]^{\mathcal{M}} =_{\text{def}} \{\langle g, G, h, H\rangle : \langle g, h\rangle \in [\varphi]^{\mathcal{M}} \;\&\; H = |\varphi|_h^{\mathcal{M}} \;\&\; H \in \text{ISA}_G\},$$

where $|\cdot|_h^{\mathcal{M}}$ is the classical (static) first-order semantic-value function. I will leave out the index $^{\mathcal{M}}$ for simplicity's sake. The assignments g and h are inherited from the DPL formula, while G and H are propositions, namely, the input and output D^θs, respectively. H is Φ's own discousre theme, whereas H serves as an input D^θ for subsequent expressions. The expression $H \in \mathrm{ISA}_G$ functions as $h[x]g$ does in DPL. It determines to what extent the input and the output states can/must differ from each other.

Subordination is a type of dynamic conjunction. As I said earlier, it is internally dynamic and externally semi-static. If Φ is a DF, then

$$[\Phi \text{ s } \Psi] =_{\text{def}} \{\langle g, G, h, H\rangle : \langle g, G, h, H\rangle \in [\Phi] \;\&\; \exists k \exists K.\langle h, H, k, K\rangle \in [\Psi]\}.$$

If two 'atomic' DFs are in subordination, the IS-A relation between their D^θs is ensured by the transfer of the second D^θ of the first to the first D^θ of the second. This corresponds to the internal dynamism of D^θs in subordination. The internal dynamism also applies to variables, since the assignment h is also transmitted from Φ to Ψ. External semi-staticity is alse ensured: The ordered quadruple of the subordination as a whole is identical to that of the subordinating DF, so neither the D^θ nor the new variables of the subordinated DF are accessible from the outside. Both the D^θ and the variables introduced by the subordinated *dcu* are accessible by a DF X that is, say, subordinated to Ψ, but then the structure of the resulting formula must be Φ s (Ψ s X).

Co-ordination is also a type of dynamic conjunction. It is both externally and internally dynamic. The complexities it involves stem from the fact that we replace the LDM's n-ary with a binary operation (cf. section **2.3**). In Polanyi's LDM, n *dcus* create one new *dcu* with a new *cf* in an n-ary co-ordination. If we split such co-ordinations up into binary co-ordinations, we face the following dilemma: Either every binary co-ordination forms a new *dcu* with a new D^θ or none of the co-ordinations form new D^θs. The former solution consider co-ordination externally dynamic, at least from the discourse theoretic point of view, whereas the latter views it as externally static. I will show that the former option fits the facts better.

Polanyi assumes an intermediate D^θ in a 'topic chain' such as (15) which is indispensable (in (15), it is 'Peter learned cooking for a long time'). It is IS-A-related to the D^θ of the head of the chain, and every co-ordinated *dcu* is IS-A-related to it. It cannot be dispensed with because the D^θs of the co-ordinated *dcus* are not really IS-A-related to the D^θ of the head. The following example is not a felicitous subordination:

(28) 1 *Jim is a great cook.*
| #2 *He took all the home ec. courses in the high school.*

To account for the intermediate D^θs, propositional variables have to behave in a dynamic way externally:

$$[\Phi \text{ c } \Psi] =_{\text{def}} \{\langle g, G, h, H\rangle : H \in \text{ISA}_G \;\&$$
$$\& \; \exists k, K.\langle g, H, k, K\rangle \in [\Phi] \;\&\; \exists L.\langle k, H, h, L\rangle \in [\Psi]\}.$$

The stipulation that $H \in \text{ISA}_G$ makes it possible for the co-ordination *dcu* to have a D^θ on its own, i.e., an intermediate D^θ. (If we were to consider co-ordination static, $H = G$ would stand here.)

From the point of view of internal dynamism, individual variables and D^θs behave differently from each other. Individual variables behave in a dynamic way internally, just like in DPL, whereas D^θs do not. The D^θs of co-ordinated DFs are still connected to each other: they must be IS-A-related to one and the same D^θ, that of the co-ordination. This is certainly true when the co-ordinated DFs are 'atomic': The D^θ of the co-ordination itself (i.e., H above) reappears as the input D^θ of the co-ordinated DFs, and there is an explicit sub-formula in discoursivization, which guarantees that they should be IS-A-related. The case when the co-ordinated DF is a co-ordination itself is analogous, i.e., H is IS-A-related to G. If the co-ordinated constituent is a subordination, it is always the subordinating constituent that matters: whatever it is, it can be recursively recuded to one of the above cases.

I will show how DPLDM works on the following example of a 'topic chain':

(29) 1 *An ex-schoolmate of mine is a great cook.*
 | 2 *He worked as a cook in the army.*
 | 3 *He took the Cordon Bleu Course in France last year.*

$$[\boxed{1} \text{ s } (\boxed{2} \text{ c } \boxed{3})] =$$
$$= \{\langle g, G, h, H\rangle \in [\boxed{1}] : \exists k, K.\langle h, H, k, K\rangle \in [\boxed{2} \text{ c } \boxed{3}]\} =$$
$$= \{\langle g, G, h, H\rangle : \langle g, h\rangle \in [1] \;\&\; H = |1|^{\mathcal{M}}_h \;\&\; H \in \text{ISA}_G \;\&$$
$$\exists k, K.K \in \text{ISA}_H \;\&\; \exists m, M.\langle h, K, m, M\rangle \in [\boxed{2}] \;\&$$
$$\exists L.\langle m, K, k, L\rangle \in [\boxed{3}]\} =$$
$$= \{\langle g, G, h, H\rangle : \langle g, h\rangle \in [1] \;\&\; H = |1|^{\mathcal{M}}_h \;\&\; H \in \text{ISA}_G \;\&$$
$$\exists k, K.K \in \text{ISA}_H \;\&\; \exists m, M.\langle h, m\rangle \in [2] \;\&\; M = |2|^{\mathcal{M}}_m \;\&\; M \in \text{ISA}_K \;\&$$
$$\exists L.\langle m, k\rangle \in [3] \;\&\; L = |3|^{\mathcal{M}}_k \;\&\; L \in \text{ISA}_K\}.$$

Any further elaboration of this would require the semantic machinery of the LDM as well as the internal logical structure of the clauses. I stop here because what we have so far is sufficient to show how dynamism works in the above example, although a deeper analysis would be desirable.

As for the dynamism of individual variables, (29) is internally dynamic for each conjunct. The output assignment of the first formula (i.e., h) is the input assignment of the second, and the output assignment of the second (i.e., m) is the input assignment of the third. The entire formula, however, is semi-static. Only the output assignment of the 'subordinating formula' is accessible from the

outside. As far as the D^θs are concerned, the IS-A relations between the D^θs of the clauses in (29) can be represented as follows (the notation $G \longleftarrow H$ stands for '$H \in \mathrm{ISA}_G$'):

$$\begin{array}{ccccc} & & & \longleftarrow & M \\ G & \longleftarrow & H & \longleftarrow & K \\ & & & \longleftarrow & L \end{array}$$

There is an intermediate D^θ, namely, K, to which the D^θs of the co-ordinated clauses are IS-A-related, and which is IS-A-related to the D^θ of the subordinated clause. K can be paraphrased as 'He learned cooking in several places', and it cannot be omitted. Neither (29/2) nor (29/3) are elaborations of (29/1). Accordingly, neither the D^θ called M nor the D^θ called L are IS-A-related to H. G is the discourse theme through which the discourse fragment in (29) can be attached to larger pieces of discourse.

3.3.2. DPLDM and CCFC

We can account for CCFC in DPLDM by introducing a new operator, that of propositional focus or FOC. Remaining agnostic about the representation of presuppositions, I introduce a separate operator that includes negation and propositional focus, called NEG-FOC.

Certain restrictions on Hungarian are worth taking into account. Neither propositional focus nor its negation can be iterated. Co-ordinations and subordinations cannot be focussed. So the new definition of Discourse Formulae is extended by the following clauses:

(iv) If Φ is a DF, then FOC(Φ) is also a DF;
(v) If Φ is a DF, then so is NEG-FOC(Φ).

The propositional focus operator does not affect the dynamism of the DF in its scope; it merely enriches its D^θ:

$$[\mathrm{FOC}(\Phi)] =_{\mathrm{def}} \{\langle g, G, h, H\rangle \in [\Phi]\colon H = \bigwedge(W_{\mathrm{act}} \cap \mathrm{ISA}_G)\}.$$

The constraint '$H = \bigwedge(W_{\mathrm{act}} \cap \mathrm{ISA}_G)$' should be familiar from section **1.3.2**. It means that H is the infimum of the set of propositions that are both true in the actual world and are IS-A-related to G. The above formula does not capture much of the generic meaning of focus, and it is rather stipulative. Its only merit is that it shows that a semantic system created for the treatment of discourse structure yields the presence of G, or 'the common base' for free. In this sense, DPLDM provides independent motivation for propositional focus.

On the other hand, the negative propositional focus operator *does* affect the dynamism of the DF in its scope. The operator blocks the dynamism of individual

variables introduced in its scope, but it does not affect the dynamism of D^θs. Negative focus asserts that the D^θ of the DF in its scope has a deepest true explanation, and it merely denies that this deepest explanation is the proposition that the DF in its scope expresses:

$$[\text{NEG-FOC}(\Phi)] =_{\text{def}} \{\langle g, G, h, H\rangle : h = g \;\&\; \exists k, K.\langle g, G, k, H\rangle \in [\Phi] \;\&\; K = \bigwedge(W_{\text{act}} \cap \text{ISA}_G) \;\&\; K \neq H\}.$$

To illustrate how these operators work, consider the following example:

(30) *Nem* [*egy* FIÚ$_1$ *köhög* *az* *utcán*]^F,
not a boy caughs the street-on
hanem [*a* KUTYÁJA *ugat* *neki*$_2$]^F.
but the dog-POSSD barks he-DAT
'It is not that a boy$_1$ is caughing on the street, but that his$_2$ dog is barking'

$$\begin{aligned}
&[\text{NEG-FOC}(\boxed{1}) \text{ c } \text{FOC}(\boxed{2})] = \\
&= \{\langle g, G, h, H\rangle : H \in \text{ISA}_G \;\&\; \exists k, K.\langle g, H, k, K\rangle \in [\text{NEG-FOC}(\boxed{1})] \;\&\; \\
&\quad \exists L.\langle k, H, h, L\rangle \in [\text{FOC}(\boxed{2})]\} = \\
&= \{\langle g, G, h, H\rangle : H \in \text{ISA}_G \;\&\; \exists k, K.k = g \;\&\; \exists m, M.\langle g, H, m, K\rangle \in [\boxed{1}] \;\&\; \\
&\quad M = \bigwedge(W_{\text{act}} \cap \text{ISA}_H) \;\&\; M \neq K \;\&\; \\
&\qquad \exists L.\langle k, H, h, L\rangle \in [\boxed{2}] \;\&\; L = \bigwedge(W_{\text{act}} \cap \text{ISA}_H)\} = \\
&= \{\langle g, G, h, H\rangle : H \in \text{ISA}_G \;\&\; \exists k, K, m, M.\langle g, m\rangle \in [1] \;\&\; K = |1|_h^{\mathcal{M}} \;\&\; \\
&\quad K \in \text{ISA}_H \;\&\; M = \bigwedge(W_{\text{act}} \cap \text{ISA}_H) \;\&\; M \neq K \;\&\; \\
&\qquad \exists L.\langle g, h\rangle \in [2] \;\&\; L = |2|_h^{\mathcal{M}} \;\&\; L \in \text{ISA}_H \;\&\; L = \bigwedge(W_{\text{act}} \cap \text{ISA}_H)\}.
\end{aligned}$$

As for individual variables, the co-ordination in (30) should behave as both externally and internally dynamic. The operator NEG-FOC, however, blocks its internal dynamism. So the output assignment of the first sub-formula (i.e., m) is not the input of the second. But the output assignment of the entire formula (i.e., h) is the output of the last sub-formula. This explains why 'a boy' and 'his' cannot be coreferential in (30). As for the D^θs, their IS-A structure can be represented as follows:

$$\begin{array}{ccc} & & \longleftarrow K \\ G & \longleftarrow & H \\ & & \longleftarrow L \end{array}$$

H is the intermediate D^θ, which can be paraphrased as 'Some sharp, guttural noises can be heard from the outside'. It cannot be omitted: it is the common base of (30/1) and (30/2), i.e., the proposition that the CCFC in (30) presupposes. As before, G functions as the D^θ through which the entire CCFC can be attached to a larger piece of discourse.

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