Anatoli Strigin and Assinja Demjjanow
ZAS Berlin
strigin@zas.gwz-berlin.de

Secondary Predication in Russian*

Abstract

The paper makes two contributions to semantic typology of secondary predicates. It provides an explanation of the fact that Russian has no resultative secondary predicates, relating this explanation to the interpretation of secondary predicates in English. And it relates depictive secondary predicates in Russian, which usually occur in the instrumental case, to other uses of the instrumental case in Russian, establishing here, too, a difference to English concerning the scope of the secondary predication phenomenon.

1 Introduction

1.1 Secondary predication

There are many problems surrounding the phenomenon of secondary predication, and the greatest of them is the absence of an a priori definition of the phenomenon. Thus, we must live with the absence of the criteria of what data counts as manifesting the phenomenon a priori, and turn to the aims and claims of linguistics. The idea behind introducing a piece of linguistic terminology is to propose that there is some interesting linguistic generalization behind it. In the case of secondary predication the usual procedure is to introduce some examples and call them secondary predicates. Of course, some core must be intuitively present. We would like to recall the core in this section and start by reviewing some history.

Part of the phenomenon which would later come to be known as secondary predication in English was described by Jespersen as nexus-object (Jespersen, 1924, the quotation is from p. 122 ff. of the 1963 reprint). Jespersen described nexus as the relation covering, e. g., the two terms *the dog* and *barks* in *the dog barks*, but also cases like *I found the cage empty*. The idea was probably that the relation between *the cage* and *empty* is very similar to the one between *the cage* and *is empty* in *the cage is empty*. Jespersen insists that the nexus-object is the whole underlined phrase, i. e. it is an object containing a nexus. He comments that it is usual to say about 'I found the cage empty'

> ... that *the cage* is the object and that *empty* is used predicatively of, or with, the object, but it is more correct to look upon the whole combination *the cage empty* as the object.

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His argument runs like this (though not quite in these words): in (1) and (2) the inferences from (a) to (b) do not go through.

(1) a. I found Fanny gone

b. I found Fanny

(2) a. I found Fanny not at home

b. I found Fanny

The logical form of both (1a) and (2a) could be something like *I found(Fanny)*$\&$ $\neg$*at home(Fanny)*, from which *I found(Fanny)* should follow, which it does not. So, assume *Fanny gone* to be an object, and the inference is blocked. If so, and if nexus is a clause-defining relation, we have a clausal object.

Moreover, Jespersen assumed that

> . . . verbs otherwise intransitive may take a nexus-object of result: he slept *himself sober*

thus proposing the clausal analysis also for a part of what later became known as resultative secondary predication or simply resultatives. Jespersen thus suggested a treatment which was later reintroduced under the name of the small clause analysis of resultatives (Hoekstra, 1988). Other ingredients of the theory sketched by Jespersen are the nature of the secondary predicates and similarities to AcI-clauses. Quote Jespersen:

> . . . The predicate part of the nexus my be any word or group that can be a predicative after the verb *to be*.

> . . . The close analogy between the accusative with the infinitive and this nexus-object makes it easy to understand that we sometimes find the same verb taking both constructions in the same sentence: *he felt himself dishonored and his son to be an evil in the tribe* (Wister).

Assuming that AcI-constructions are clausal, plus the constraint on the type parallelism of terms in conjunction, Jespersen's hypothesis would nicely account for the observation.

That the clausal analysis is not without weakness becomes clear on a moment's inspection: the desirable inference seems to be absolutely correct in (3).

(3) a. John drank the *coffee cold*

b. John drank the coffee

Is this not a nexus object? Is then there a difference between this sentence and *I found the coffee cold*? Or merely a difference between the latter and (1)? How do we go about extrapolating from (1) to (3)? Should we extrapolate?

The position which Jespersen criticizes without naming its proponents is to analyze *cold* in (3) as a non-clausal phrasal constituent, i. e. predicative constituent which does not have a subject. Assuming the basic logical form of *John drank*(x) &*coffee*(x) &$cold(x)$ we readily obtain *John drank*(x) &*coffee*(x). This position was articulated in the generative literature in Williams (1980) and Rothstein (1983). It would probably deny that (1) exhibits the same kind of structure as (3), so is there a class of data pointing out to some interesting linguistic generalization which deserved the unifying term *secondary predication*? And if yes, how do we proceed determining it, given that we only have an ostensive definition of its prototypical cases?

The main ingredients of secondary predication for finite clauses seem to be the following:

- in addition to a finite verb in a finite clause there must be at least one constituent which is able to occur as the predicate of the copula sentence,
- it serves as a semantic predicate of some constituent in the clause, although there is no explicit copula present which mediates this relation,
- the group including this predicate and the subject it is predicated of has roughly the semantic type of a clause,
- the structure of the clause with secondary predication is approximately the conjunction of the matrix clause with the secondary predicate clause.

Given this, consider the first mention of secondary predication in Russian in generative literature. In her paper on secondary predicates Johanna Nichols (Nichols, 1978) distinguished four groups of secondary predicates, though she acknowledged that they were also called other names, including types of nexus. The four groups are illustrated below. The examples are Nichols'.

Major types of secondary predicates after Nichols (1978)

Type 1

(4) a. he works as an engineer

b. they elected him president

c. rocks serve them as support

d. he played goalkeeper

Type 2

(5) a. he sat there sad

b. he returned a hero

Type 3

(6) a. first they weigh the truck empty

b. he drank the tea cold

Type 4

(7) a. as a child he lived in Paris

b. this tea isn't good cold

Running down the list of symptoms for secondary predication questions the inclusion of (4a-4b, 7a) because of the particle *as*, and (7b) because of different entailments. The entailments of (4b) are also suspect. So what are Nichols' reasons to speak of a unified phenomenon in all four types[1]?

Nichols proposes, in the terminology of that time, that " All the examples given would be derived ...from structures in which the main verb and the secondary predicate appeared in separate clauses, each as a predicate of its own clause...". This seems to be the basic idea: there are two clauses, each of which with a separate predicational structure. Which fits, after all, the property catalog, though only inner-theoretically. Moreover, Nichols considers *as* to be just a morphological expression of secondary predication, which can also be left morphologically unexpressed. What about the fourth type?

Type four contains temporal, concessive and conditional uses of secondary predicates, according to Nichols. It is rather different from the first three, as she notes, and uses paraphrases to show the difference, cf (8).

(8) a. as a child he lived in Paris

b. when he was a child, he lived in Paris

c. this tea isn't good cold

d. when this tea is cold, it isn't good

e. he drank the tea cold

f. when he drank the tea, it was cold

The inference to the matrix clause, e. g. in (8c) only goes through, if the secondary predication is satisfied. For the moment it is therefore not quite clear whether the term *secondary predication* should be taken to cover type 4. And we see no reason to distinguish between the other types on the basis of our criteria.

Apart from these four types Nichols mentions separately the type usually termed *resultative* secondary predication, e. g. (9).

[1]To quote: "I will argue for the unity of the generic relation of secondary predicate and for the reality of the numbered subtypes above".

(9) a. wash it clean

b. sand it smooth

c. laugh yourself sick

This type differs intuitively in that the state which is described by the secondary predicate comes about as the result of the change which happens with the predication subject. This change is associated with the process denoted by th verb.

Right from the start it should be said that resultative secondary predication is not available in Russian, and therefore we are not interested in the restrictions on the resultative secondary predication[2]. But we are, naturally, interested in the reason why this type is not present in Russian and we hope to be able to provide an explanation. This will be one aim of the paper. Establishing the relation of the first three types to their counterparts in Russian and providing the semantics to all of them will be the second aim of the paper.

1.2 Secondary Predication in Russian

First, we will delimit the scope of the present work. We only consider secondary predicates which are based on nouns or on adjectives, or which are prepositional phrases. Other categories present additional problems of their own. Again, we start out following Nichols. The abbreviation 'instr' indicates that the word is in the instrumental case, 'acc' that it is in the accusative, 'dat' in the dative, and 'nom' in the nominative.

Major types of Russian secondary predicates after Nichols (1978)

Type 1

(10) a. On rabotaet inženerom
he works engineer-instr
he works as an engineer

b. ego vybrali prezidentom
he-acc elected-3-pl president-instr
they elected him president

c. kamni im služat oporoj
rocks they-dat serve support-instr
rocks serve them as support

d. on igral vratarem
he played goalkeeper-instr
he played goalkeeper

Type 2

[2]See Winkler (1997), Rothstein (2000) and Rothstein (2001) as well as Rappaport Hovav and Levin (1998) and Levin and Rappaport Hovav (1995)

(11) a. on sidel grustnyj
he-nom sat sad-nom
he sat there sad

b. on vernuls'a gerojem
he returned hero-instr
he returned a hero

Type 3

(12) a. snačala mašinu vzvešivajut pustuju
first the truck-acc weigh empty-instr
first they weigh the truck empty

b. on vypil čaj xolodnym
he drank the tea-acc cold-instr
he drank the tea cold

Type 4

(13) a. reb'onkom on žil v Pariže
child-instr he lived in Paris
as a child he lived in Paris

b. xolodnym etot čaj nevkushyj
cold-instr this tea-nom not tasty-nom
this tea isn't good cold

The examples show that the secondary predicate in Russian, if secondary predication is not reflected morphologically, is usually in the instrumental case, though it may be in the case of the subject term of the secondary predication , e. g. in nominative in (11a).

This morphological marking of the secondary predicate constitutes a major difficulty for an analysis of Russian secondary predication. As is well known, Russian instrumental has quite a number of uses which do not necessarily have a corresponding secondary predicate in English or in German. Consider (14). This example is taken from Jakobson (1936), reprinted in Jakobson (1984). The translations of the DPs in the instrumental are in italics.[3]

(14) a. On el reb'onkom$_{instr}$ ikru
He ate child-instr caviar
He ate caviar *as* a *child*

b. On el pudami$_{instr}$ ikru
He ate pud-instr caviar
He ate caviar *by* the *pood* (36lbs)

[3]The literal translation of the idiom in (14f) would be *sinful matter*.

c. On el ložkoj$_{instr}$ ikru
He ate spoon-instr caviar
He ate caviar *with* a *spoon*

d. On el dorogoj$_{instr}$ ikru
He ate road-instr caviar
He ate caviar *on* the *way*

e. On el utrom$_{instr}$ ikru
He ate morning-instr caviar
He ate caviar *in* the *morning*

f. On el grešnym$_{instr}$ delom$_{instr}$ ikru
He ate sinful-instr matter-instr caviar
He ate caviar I am sorry to say

The italicized prepositions clearly show that rather different relations between the DP in the instrumental and the rest of the sentence are involved. Of these, Nichols would classify (14a) as secondary predication. What about the rest? Moreover, there are even more potential candidates.

Wierzbicka (Wierzbicka, 1980) counted seventeen uses of the instrumental case in Russian, cf. (14).

(15) a. Ivan udaril Petra palkoj
Ivan hit Peter stick-instr
Ivan hit Peter with a stick

b. Ivan švyryal kamnjami
Ivan was throwing stones-instr
Ivan was throwing stones

c. Ivan kivnul golovoj
Ivan nodded head-instr
Ivan nodded with his head

d. Deti ob"jelis' slivami
The children ate-refl plums-instr
The children overfed themselves on plums

e. Ivan gordils'a synom
Ivan was proud son-instr
Ivan was proud of his son

f. Ivana ubilo derevom
Ivan-acc killed-neut tree-instr
Ivan was killed by a tree

g. Okno bylo razbito det'mi
The window was broken children-instr
The window was broken by the children

h. Ivan nagruzil telegu senom
Ivan loaded the wagon hey-instr
Ivan loaded the wagon with hey

i. Ivan xarkal krov'ju
Ivan coughed blood-instr
Ivan coughed blood

j. On vyl volkom
He howled wolf-instr
He howled like a wolf

k. Ona plakala gor'kimi slezami
She cried bitter tears-instr
She cried bitter tears

l. On šol lesom
He was going wood-instr
He was going through the wood

m. On prišel nočju
He came night-instr
He came in the night

n. On časami vozilsja s radiopriemnikom
He hours-instr was busy with receiver-
He was busying himself with the receiver for hours

o. On prijexal avtomašinoj
He arrived car-instr
He arrived by car

p. Ona byla bledna licom
She was pale face-instr
She was pale in the face

q. On byl togda titul'arnym sovetnikom
He was then titular-councellor-instr
He was a titular councillor then

Some of them were already mentioned in discussing Nichols, some were mentioned in the example of Jakobson, some are new. Taken at face value, there is a plethora of uses of the instrumental, which seem unrelated, and it is unclear why secondary predicates are marked by instrumental.

There are two interesting facts about case assignment in secondary predication structures in Russian. Secondary predicates of subjects may occur in the nominative, secondary predicates of objects may occur in the accusative, cf (16) where (16a) illustrates the first and (16b) the second case.

(16) a. on vypil čaj sonnym/sonnyj
he drank the tea-acc sleepy-instr/nom
sleepy, he drank up the tea

b. snačala mašinu vzvešivajut pustuju/?pustoj
first the truck-acc weigh empty-acc/instr
first they weigh the truck empty

This case assignment is called *congruent case*. The factors governing the distribution of the two are not as yet clear, and this probably is also in need of explanation.

The second fact is an interesting restriction on this congruent case assignment: the alternation instrumental/congruent case is impossible for nouns as SPs. Thus, (17a,17b,18b) are acceptable, whereas (18b) is not.

(17) a. on vernuls'a domoj ustalym
he-nom returned home tired-instr
He came back home tired

b. on vernuls'a domoj direktorom
he-nom returned home director-instr
He came back home a director

(18) a. on vernuls'a domoj ustalyj
he-nom returned home tired-nom
He came back home tired

b. *on vernuls'a domoj direktor
he-nom returned home director-npm
He came back home a director

We would like to present a treatment which unifies the treatment of secondary predication with many uses of the instrumental. Under this treatment Russian uses instrumental in general to mark secondary predicates, and therefore secondary predication turns out to be a much more pervasive phenomenon, than in English.

In constructing a semantics which is able to support this claim we will resort to the notion of contextually computable meaning. A similar idea concerning the uses of instrumental is implicit in the work of one of the most interesting Russian linguists of the beginning of the 20th century Alexandr Matveevič Peškovskij (Peškovskij, 1956). Discussing different shades of use of the instrumental which he termed semi-predicative (e. g. Nichols' example (10a)), he writes

> These shades of meaning, as it seems, depend more on the material side of the speech...

From the following discussion it is clear that he meant that the final interpretation of this secondary predication depends on the contextual knowledge which specifies the relation between the term in the instrumental and the situation described by the matrix sentence.

We therefore tentatively identify the three basic ingredients of the program for the treatment of secondary predication in Russian which we propose in this paper. It will have a uniform small clause syntax for secondary predication, a uniform general interpretation of the instrumental case as the case of secondary predication, and a uniform semantic core together with a mechanism of contextual specification of this core semantic interpretation.

We will start by discussing the syntax of secondary predication. The aim of section 2 is to provide an account of the instrumental case form and an account of syntactic relations which are involved in the interpretation of sentences with secondary predication. Section 3 presents a general formal development of an inferential context-dependent semantics. We use this development to give then in section 4 the core cases of secondary predication in Russian (the depictives). As the main contribution of this paper, we discuss the reasons for the absence of resultative secondary predication in Russian in this section. It also contains the discussion of how other uses of the Russian instrumental could be integrated into this treatment. Section 5 provides a short summary.

The literature on secondary predication is vast, and we shall only be able to mention alternatives at points where the difference between it and our approach can elucidate the latter, or where an alternative makes contrary assumptions which we think not really conflicting with ours. For a very good discussion of different approaches see Winkler (1997) and Boas (2000).

2 The syntax of SP in Russian

This section deals with the syntactic object "secondary predicate", i. e. its constituency, its position in the sentence structure and with syntactic factors its morphological properties are due to. The aim of this section is to provide an account of the instrumental case form and an account of syntactic relations which are involved in the interpretation of sentences with secondary predication.

Vergnaud (1985) suggested that case marking is basically a morphological reflex of syntactic relations. According to his theory and in general terms, a case form α is assigned to a case-bearing element a, if this element is in some syntactic relation to a specified element b and if a certain syntactic proximity is observed. Chomsky (2000) is the most recent sketch of such a theory. Note that no semantics is involved, although differences in case forms may correlate with semantic distinctions, in principle. Sometimes the notion "semantic case" is used in the literature. Baker (1988, p. 113) defines that a semantic case is assigned whenever its form is associated with a set thematic role, e. g. ablative is a semantic case in Estonian, because it is associated with the thematic role *source*. Semantic case in this sense need not be inconsistent with the relational case theory, if we assume that there need not be a unique case assignment under one syntactic relation. Such an assumption is independently motivated for Russian, as we will note

later. Thus, to account for the instrumental in secondary predication we need to specify the syntactic relation it is associated with, and the proximity domain of its assignment.

We shall suggest that two forms of case assignment to secondary predicates are due to two different properties of its case assigner. Moreover, congruent case is in part a consequence of subject-predicate agreement. We shall also suggest that the prohibition of the congruent case might have a partially syntactic explanation.

2.1 Formal assumptions

The proposals discussed below are to a high degree adaptations of various ideas. We assume the syntactic framework outlined in Chomsky (2000). The framework is suggested there to be used for theory building and not to be treated as a final coherent formal statement. Consequently, we will have to make suggestions at some points where the paper has no solutions, but we do not insist that they are the best possible. The minimalist framework of the cited paper dispenses with the tree notions as a structural skeleton of the theory. If they are to be used at all, then only for expository purposes. Consequently, if there are syntactic relations relevant to phonological/phonetic or semantic properties, they are defined in terms not involving tree geometry.

The theory works with syntactic objects on which three fundamental operations *Merge*, *Agree*, and *Move* are defined. The basic objects are lexicon items which are composed of features. The correct formalization of features being not uniquely determined yet, we decided to use a suitable one. The first basic operation, *Merge* is responsible for the construction of new syntactic objects from given ones: two syntactic objects are merged to produce a third one. We consider *Merge* applicable if one object which is an argument of the *Merge* operation selects the other argument[4]. We see the status of selection in the minimalist program more like that of a functional type a in the categorial grammar than the selectional requirement of the Aspects-theory. The relation of selection holds if one object has a requirement on what information is to be in the other object with which it forms a new syntactic object via *Merge* operation and this object satisfies the requirement. Informally we will distinguish between semantic selection, under which we indirectly select the semantic type of the syntactic object via some syntactic feature associated with it, and syntactic selection, where syntactic features are selected on their own merits. To forestall misunderstandings: since we are in the domain of syntax, no semantic types are actually available. The checking of semantic conditions is done in semantics. The syntax merely provides some feature value of the feature selected to indicate that syntactic selection encompasses the intended semantics. Thus, we may have cross-categorial syntactic features which are bound to semantic types. For example, some such semantic selection feature could probably encompass both nouns which denote eventualities and sentences, so that a semantic selectional feature with this value could cover both sentences and nouns denoting eventualities, and verbs can use this feature in their selectional requirements.

Following Chomsky we distinguish two kinds of $Merge$ operation which differ in their result. If a and b are syntactic objects, we have either $Merge(a, b) = \{a, b\}$, i. e. the set of two objects, where either a selects b or b selects a, or adjunction $Merge(a, b) =< a, b >$, with the ordered pair as the result. Here a is adjoined to b.

The second operation, *Agree*, is defined within a syntactic object on its parts. Some objects contain a set ϕ of active formal *agreement* features. These features must be rendered inactive before the object can be used at an interface level of the syntax with other subsystems involved in linguistic processing. The presence of purely formal agreement features at the interface levels of the syntax indicates the incorrectness of the object[5]. Therefore, if another object in the domain of *Agree* has a matching set, *Agree* applies. Such a formal agreement feature F is called the

[4]This is in broad agreement with Chomsky (2000), though perhaps not with other variations of minimalism. The passages we consider relevant are on pp. 133, 134, 138. The idea is this: "When α, β merge, it is to satisfy (selectional) requirements of one (the *selector*) but not both". The operation will be defined as producing sets, but it is inherently asymmetric, since it is not simply set formation. The difference is in the application conditions.

[5]The minimalist terminology is they cause the derivation of the object to crash.

probe, the matching feature is called the *goal*. If all such feature matches are established, the syntactic object is complete with respect to *Agree*. Given syntactic object $K = \{a, b\}$, the domain of *Agree* is b, if the probe is in a. The goal with respect to the probe is either b or b is the minimal domain of the operation (Chomsky, 2000). This means that if $b = \{c, d\}$ either c or d must contain the goal.

After it is established that *Agree* holds, the original probe is modified so that the formal agreement features are erased and the object becomes syntactically inactive. In principle, both the probe and the goal are modified under agreement. If, however, the agreement features in the goal are considered to be interpretable, they must remain, though they turn inactive and cannot trigger another *Agree* operation.

The operation *Agree* indirectly defines the role of the feature *case* in the framework. If *case*-feature of a syntactic object α has a well-defined value, this object is said to be case-marked and the case is said to be assigned. Nouns have a case feature and a set of formal agreement features (ϕ-features) which may serve as the goal of *Agree*. The ϕ-features of the noun are considered to be interpretable. If the agreement features on the noun are to be marked as inactive, but cannot be deleted, there must be a mechanism to mark them so. The *case* feature gets a value under *Agree* instead of erasing ϕ. The noun is thus signaled to be inactive, or flagged by case. The flag indicates the successful result of the operation and the inactive state of the ϕ-features of the goal. The value of *case* feature depends on the probe, which is said to *assign* the case. Thus, for instance, we will assume that the *case* feature of the verb complement is specified to what is cataloged as the dative case in morphology in Russian. But some verbs require a different morphological case, so we allow the *case* value to depend on some individual diacritics of the verb in order to be able to state this *inherent* case. In both cases verbs assign case. An assigned case is *structural*, if it is assigned by a probe defined by reference to a structural position. A case is *lexical* if it is assigned by a probe which is a head. In the broader sense lexical case is also structural, so we do not care much about the terminology.

At the point when all *case* features have got a value, the ϕ-features of all their probes have been deleted under feature identity (not necessarily feature value identity). The phonological representation of the the syntactic object in which all *Agree* operations have been effected can be dispatched to the phonological component, if the object is of a category which allows this. The net effect is simply that this syntactic object is unavailable for further syntactic operations.

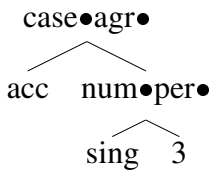
We do not think that the theory of case assignment under agreement is complete. According to this theory case is assigned by a verb to its direct and indirect objects, though neither the direct nor the indirect objects in Russian agree with the verb in gender or number. Moreover, we have to postulate two sets of agreement features for the verb to account for the case of the two objects, and one set to account for the morphologically and phonetically realized agreement with the subject. We will stick to this theory for definiteness, nevertheless, but we would not, in principle, exclude other possibilities of case assignment than under agreement. To avoid the proliferation of formal invisible agreement sets by themselves we will package them into the theory of selection.

Syntactic objects are also constructed by applications of the operation *Move* which is does what it promises: it copies a constituent to some other place. One – perhaps the – reason for movement is to satisfy $Agree$ which would cause the syntactic object to be non-well-formed (the derivation of this object to crash) otherwise.

We will now define some ingredients to make this exposition more concrete. The definitions follow Frish (1995).

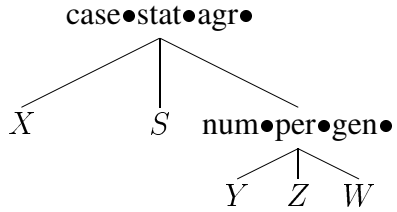
Feature structures are objects which are described by a grammar. We therefore distinguish between the features and their descriptions in the grammar. This distinction is similar to the one between numbers and their (possibly abstract) representations. The feature structures of a grammar are constructed from the features $\mathcal{F}$ and the values $\mathcal{V}$. A feature structure is basically a finite tree in which each arc is labeled by a feature, each leaf is labeled by a value, and no node has two outgoing arcs with the same label. Viewed from a different angle, a feature structure consists of paths. A path is either a value or a pair, $< f\ p >$ where f is a feature and p a path; note that there always must be a value, which may be unspecified, though, in the description of the feature structure. In this case we write X, using a variable, as if the feature structure itself had variable value. A path $< f_1\ < f_2 \ldots < f_n\ v > \ldots >>$ is usually written as $[f_1\ f_2 \ldots f_n\ v]$. A feature structure s is a finite set of paths such that if $[f_1\ f_2 \ldots f_n\ v]$ and $[f_1\ f_2 \ldots f_m\ v\prime]$ are members of s, then $n = m$, and $v = v\prime$. In other words, a feature structure cannot contain two paths of the kind, e. g. $[f_1\ f_2 \ldots f_n\ v]$ and $[f_1\ f_2\ v\prime]$. It also cannot contain two paths that are identical except that they terminate with different values. Thus we might have a feature structure $s = \{[agr\ num\ sing],\ [agr\ per\ 3], [case\ acc]\}$. We can also have a description $s\prime = \{[agr\ num\ sing],\ [agr\ per\ 3], [case\ X]\}$, in which case the syntactic object which contains this feature structure has no phonetic realization. Feature structure s displayed as a tree is given in (19). For typographical reasons the bullets at a node denote outgoing arcs from left to right, and the label of an arc is displayed to the left of its bullet.

(19)



Agreement in Russian also includes gender. Therefore we may assume that a case-bearing feature structure has a subpath (20).

(20)



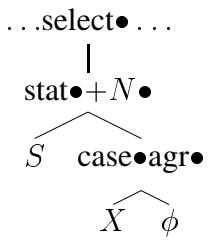
where $X \in \{nom, instr, \ldots\}$, $Y \in \{sg, pl\}$, $Z \in \{1st, 2nd, 3d\}$, $W \in \{masc, fem\}$.

In implementing the operations we could take deletion of features literally, hence resort to the algorithmic specification of syntactic structures. But to facilitate presentation we would like to give static descriptions and therefore assume a special feature called *stat*, as in (20), which reflects the status of *agr*, i. e. whether the ϕ-features are active, $[agr\ stat\ a]$ or deleted $[agr\ stat\ d]$. It will also reflect the status of selectional requirements, i. e. whether they are satisfied or not.

To account for the selection of syntactic objects to trigger *Merge* we introduce the feature *select* together with the feature *stat* to indicate the status of a selectional requirement which will be one of the characteristics of the selecting category, much like in categorial grammar. We see ourselves forced to make an additional assumption later to avoid the proliferation of *agr* features in the verb we talked about. We assume that heads can select two elements at most, perhaps for

reasons of conceptual structuring of information contained in the semantics of heads, perhaps for some other reasons. And we assume two general kinds of selection, one of which is further subdivides in two. A selector may either select a category (*categorial selection* or *c-selection*) or require the presence of *case* in the selected element, in which case we call it *agreement selection* (*a-selection*), since case is a reflection of agreement in this fragment, cf. (21).

(21)



C-selection requires there to be *some* nominal category, e. g. the requirement only specifies a variable Y as a value of $+N$-branch. Agreement selection works to select case-bearing elements, perhaps with a particular case form requirement. This is needed because there are two options available in general. If the description of the selector contains X as the value of *case* of the selected category, we have structural case which we will sometimes call lexical, if it is required by a lexical category. If this value is specified outright as a requirement of the selector we have an idiosyncratic case. To reflect this we must be able to refer to the lexicon entry of the selector, and specify the case form in this lexicon entry. Thus, e. g. (22) is the structure for the verb 'izbegat' (avoid) and the lexicon should specify that it requires genitive. From here we will switch to the standard notation for feature structures, to facilitate presentation.

(22) $\left[\begin{array}{ll} select & \left[\begin{array}{ll} status & X \\ +N & \left[\begin{array}{ll} case & gen \end{array} \right] \end{array} \right] \end{array} \right]$

Consider idiosyncratic case in more detail. If the selectional requirement is satisfied by $Merge$, the status flag of the selector is set to d, i. e. $[select\ stat\ d]$. The ϕ-set of the goal is then considered inactive because of the status flag of the selector, also reflected by the fact that the case value of the goal is set to the value required by the verb. This is a kind of agreement, so we would like *agr*-matching to accompany this kind of selection. The other option, that of lexical case, with X as the value of *case* in the selectional requirement, assigns a structural case to the selected object. Again, since *case* is assigned we have a kind of agreement and therefore should require that *agr* be present in the selector. But in both cases this is not the ϕ set of the verb itself which is involved, but a selection path.

For categorial selection, cf (23), *case* is not required.

(23) $\left[\begin{array}{ll} select & \left[\begin{array}{ll} status & X \\ +N & Y \end{array} \right] \end{array} \right]$

This has some consequences. Since there is no *case* feature in this selectional requirement, the status of *agr* in the selected element cannot be changed via this selectional requirement. This selector feature does not allow the selector to assign case. Since case is not assigned to the selected case-bearing object under this option, it must get case assigned only as a reflex of *agr*-deletion under $Agree$, The latler may become operative after *Move* has applied.

We now have a mechanism to treat case assignment by verbs which select two objects. If a verb selects an indirect object as well as a direct one, it has two selector paths, one with a-selection, the other with c-selection, and a set of nominal *agr* features. This set is then responsible for the case assignment to the c-selected syntactic object.

Under c-selection, if no set of nominal *agr* features is present in the selector, the object must be moved somewhere, where it can get case assigned. Therefore we also need the option of case assignment which occurs under agreement due to movement when the selector has *agr* of its own, but the selected object is in the minimal domain of $Agree$, and not the sister of the probe. This seems to be relevant in cases when *agr* on the selector is necessary to drive movement of one selected item and at the same time the selector selects another item, which constitutes the domain of the moved element. We will consider this case when we discuss the nature of PrP category in the next section.

We will call both a-selectors and objects with *agr* features which c-select a nominal element *case assigners* and consider them to be the only source of case in this paper. We have thus three options to account for the instrumental case in Russian: either it is a structural case assigned under selection, or it is assigned under agreement, or it is an inherent case. We may safely discard the latter possibility in most cases, however. Whenever the instrumental is idiosyncratic, it does not mark the construction which we characterize as secondary predication. That leaves two options: instrumental case is assigned under c-selection by a case assigner which has *agr* features or it is assigned under a-selection.

Thus, a selector is a possible structural case assigner, if it c-selects a nominal category and has nominal agreement or it a-selects a case-bearing element. In the former case one part of the feature structure is (24).

(24) $\begin{bmatrix} select & \begin{bmatrix} stat & X \\ +N & \end{bmatrix} \\ agr & \end{bmatrix}$

In the latter case, since we assumed that verbs may be selectors with an a-selectional requirement, verbs with an indirect object in structural case must have (25).

(25) $\begin{bmatrix} select & \begin{bmatrix} stat & X & \\ +N & \begin{bmatrix} case & X \\ agr & Y \end{bmatrix} \end{bmatrix} \end{bmatrix}$

The status of this *agr* together with *case* in such a probe is set to d with the status of selectional requirement. And the selected category gets the structural case associated with the verb, which we may assume to be dative case. The c-selected object merged with the verb (direct object) gets its case value assigned under agreement with the nominal *agr* of the verb, if it is present and the latter is then deleted. Note the asymmetry of the two case assignments: a satisfied a-selectional requirement does not render the object syntactically inactive, deleting all *agr* does. Thus, if a-selectional requirement is not met when the nominal *agr* of the verb is deleted, the object is not well-formed, but is syntactically inactive as a selector for merge. Thus, lexical or idiosyncratic case is to be assigned prior to the second structural case of the verb. Note that we have two different kinds of grammatical relations here differentiated via different kinds of selection, since

the agr feature in the selection requirement does not warrant closing off the projection for the needs of syntax.

Verbs are one kind of case assigner. Another kind is a functional category which probes for a case-bearing element as well as selects it, i. e. it has its own nominal *agr*-probe and a c-selectional requirement. Then case is deleted in the goal as a reflex of agreement, perhaps under movement. A common assumption about such categories are that there are at least two functional categories, say T and v[6], which probe for case and c-select a nominal category, as well as a-select another category from which the nominal category which gets no case there assigned is moved. The morphological case form assigned under agreement with T is called nominative case. Since we do not intend to contribute to the status of the theoretical controversy about different kinds of functional heads, we will assume that the present state of research does not allow us to specify these categories satisfactorily, so we do not place much weight on their exact characteristics. We shall assume that there is a case assigned under agreement with the verb which is called accusative case. We will also reserve the term 'direct object' for the nominal element which is assigned this case. As noted, we also assume that the complement of the verb, if selected, gets dative assigned under selection. We will call it indirect object.

Some remarks are necessary about the agreement between verbs and sentential subjects. Since finite verbs agree with the subject of the sentence (in the more traditional senses of the terms) in number, person and gender (in the past tense) in Russian, we assume that this morphological marking reflects the head-adjunction movement of V^0 (verb) to T^0. The new complex syntactic object $\{V^0, T^0\}$ picks up the agreement which is then manifest on the verb. We will not consider the mechanism of this movement here.

This sketch provides general views on case assignment and selection, but no concrete case assigner for the instrumental in the secondary predication structures as yet, to which we now turn.

2.2 Case assigners for SP in Russian

We will proceed on the following assumption of categorial uniformity:

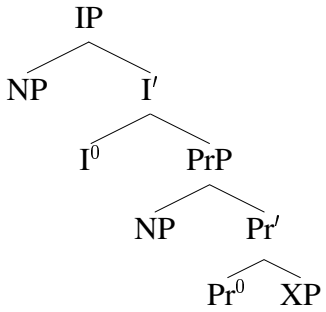
> **Categorial Uniformity of SP**
>
> A secondary predication is a uniform clause-like predication structure which is a projection of a functional head.
>
> The instrumental case of secondary predicates in this SP-clause will be a lexical structural case assigned by this functional head.

We were guided in our choice of the small clause SP constituent by the hypothesis by Bowers (1993)[7]. According to him any English sentence has at least one (in which case it is primary) functional predicative constituent, as in (26). This constituent introduces the subject of the sentence, which therefore is selected not by the verb, but by the new functional head. The verb phrase is also selected by this functional head. Bowers uses I to select this phrasal constituent in the cited paper, and T in Bowers (2001). We shall keep the notation of the corresponding examples.

[6]For the latter, see Larson (1988)

[7]His use of the terms *primary predication* and *secondary predication* in the Appendix of the paper does not coincide with ours!

(26)

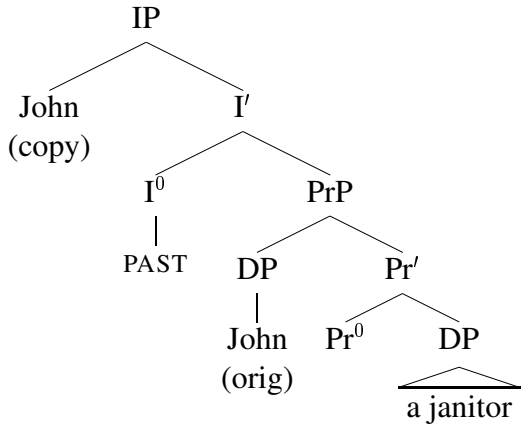


The *XP* constituent in this scheme, which we will call the *predicate* of the predication structure can be any major constituent with head in *V, A, N, P*, according to Bowers. Similar proposals of a functional projection selected by another functional head and selecting a verb phrase were made by Collins (Collins, 1997, his term is *Tr*) and Kratzer (Kratzer, 1996, with the *voice* category).

A simple copula sentence like (27) could have a partial syntactic structure like in (28), ignoring the status of the copula *be*. We shifted from *NP* to *DP*.

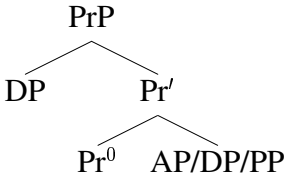
(27) [[John]$_i$ [was t_i a janitor.]]

(28)



If there are more than two predicative constituents, the second one is a secondary predicate. Secondary predicates have thus the structure like in (29).

(29)



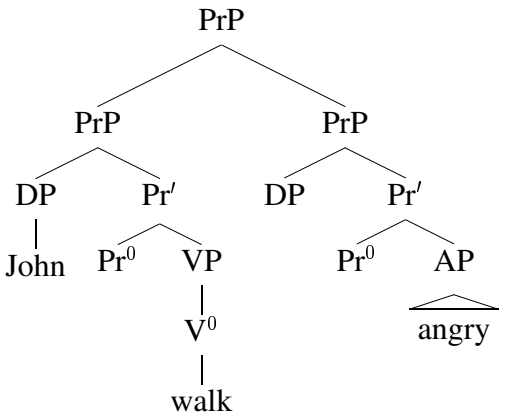
We have still to specify the the exact syntactic site at which secondary predication phrase occurs, the nature of the subject of the secondary predication phrase and the relation between the host (i. e. subject of the secondary predication) and the subject of the predication phrase.

Depictive secondary predicates are treated in Bowers (2001) as small clause adjuncts with different adjunction sites. The sentence (30) with the subject-oriented depictive predication (SOD) gets the relevant structure in (32), sentence (31) with the object-oriented depictive predication (OOD) that in (33).

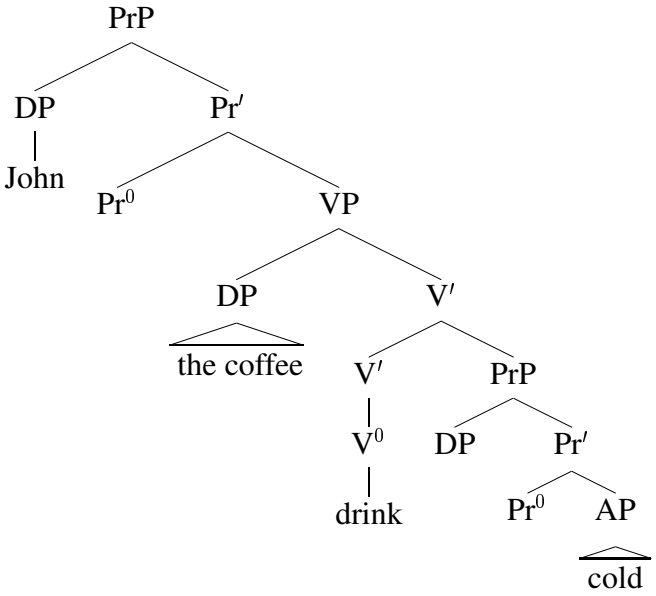
(30) John walked angry.

(31) John drank the coffee cold.

(32)



(33)



Hans-Martin Gaertner pointed out to us in a personal communication that among other arguments in favor of the adjunct analysis of depictive predicates rather than arguments we could count the impossibility of extraction from them. This behavior patterns with the behavior of adjuncts in general, cf. (34).

(34) a. What did you consider John angry about?

b. *What did John walk angry about?

The difference between the SOD and OOD depictives is usually taken to be shown by tests of stranding, e. g. (35) (Rothstein, 2000).

(35) a. What Mary did was paint the house drunk

b. What Mary did drunk was paint the house

c. What Mary did was drink the coffee hot

d. *What Mary did hot was drink the coffee

And similarly for resultatives:

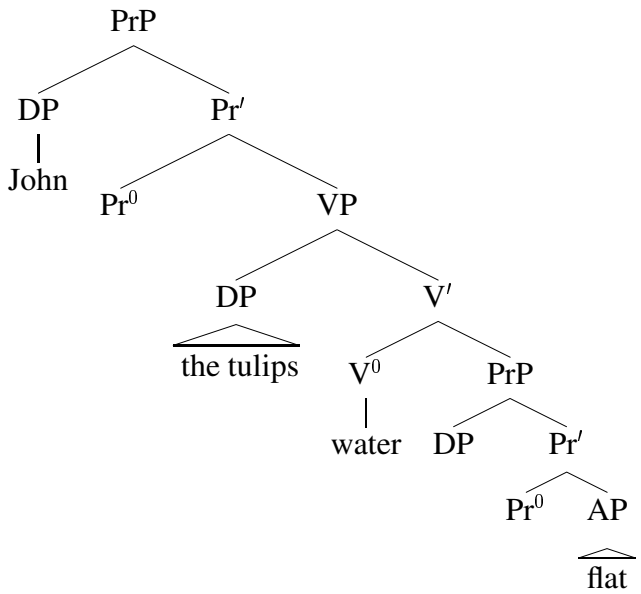
(36) a. What Mary did was paint the house red

b. *What Mary did red was paint the house

Resultatives are usually subdivided into weak and strong, cf. (Kaufmann and Wunderlich, 1998). Weak resultatives have a secondary predicate which characterizes the resulting state of the object of the verb, strong resultatives characterize the state of an argument which only is acceptable in the secondary predication construction and the verb is not subcategorized for it in the normal environment. Weak resultatives, e. g. (37), receive the structure in (38), strong resultatives, e. g. (39), that in (40), according to Bowers[8].

(37) John watered the tulips flat.

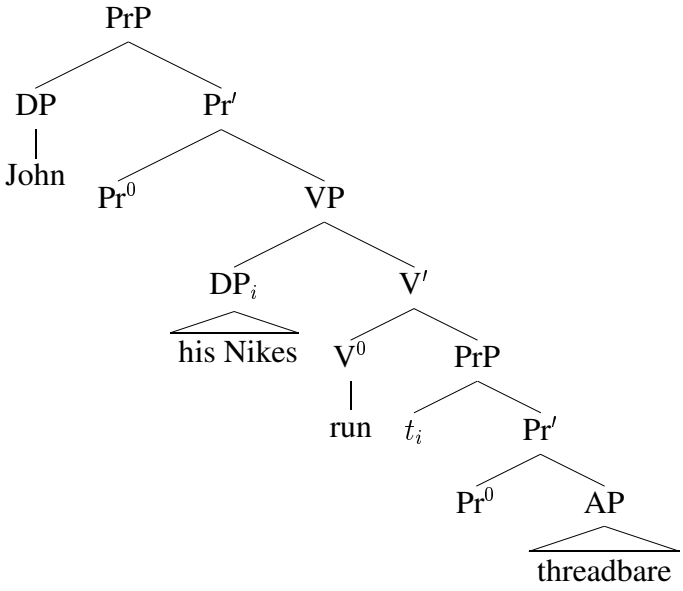
(38)



(39) John ran his Nikes threadbare.

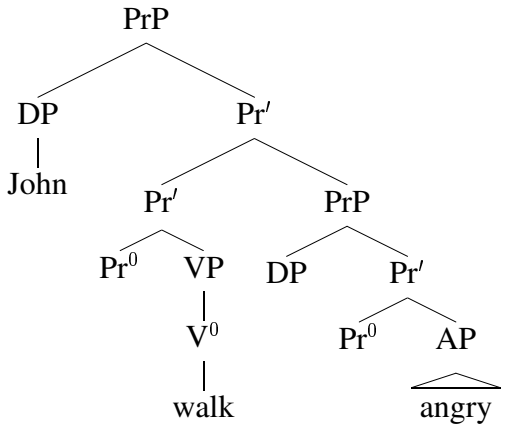
[8]A very similar approach for Chinese is advocated by Zhang (2001), except that Pr of Bowers is taken to be the small v. The consequences of this distinction for the intended semantics are unclear at present, so we will follow Bowers.

(40)



Thus, we will adopt this secondary predication structure for Russian as a starting point, but with one amendment. We assume that SOD SP has the structure in (41), where the secondary predication structure is adjoined below the maximal PrP-projection, and not to it.

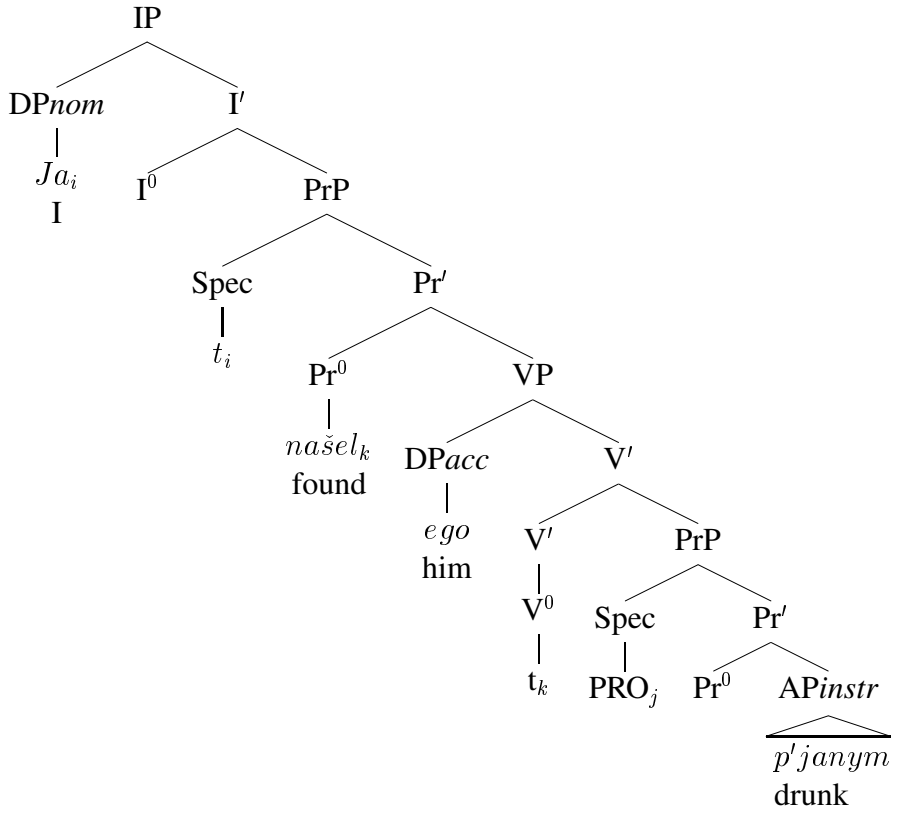
(41)



We can now investigate the possibility of assigning instrumental case to SP in these structures following Bailyn (1995) and Bailyn and Citko (1999). These are two similar proposals to treat secondary predication in Russian based on Bowers. Russian does not have the resultative interpretation of SP, but does have depictive predicates. The AP- or a DP-predicate is either in the instrumental or has the case congruent to that of its host[9]. Bailyn assumes the structure proposed by Bowers and suggests that the instrumental case is assigned by the Pr^0 head of the predicate phrase to a case-bearing predicate.

[9] A host of the secondary predicate is that constituent which is its subject, intuitively. This term is not intended to be theoretically defined.

(42)



It is obviously necessary to specify, whether Pr a-selects the predicate (via some syntactic feature covering only semantic predicates) or c-selects and agrees with it, because it has *agr*.

We shall discuss the alternative in the section on case alternation (section 2.3), and discuss the status of the subject of PrP first. Before this, we would like to show that such structures already possess some explanatory capacity.

Note that a possible indirect object would be located as a sister to V^0. Now there is a restriction on the use of secondary predicates in Russian: if a predicate is predicated of an explicitly realized host, the host is preferably the subject or the direct object in the matrix sentence (Nichols, 1981, p. 68 ff.). Nichols (1982) contains a thorough description of this constraint for what was called Type 4 secondary predication, which sometimes allow marginally acceptable indirect object controllers. There she also assumes that this structure manifests the same relation of control as, e. g. the null subject of the infinitive and its matrix-clause antecedent. This assumption is made by Bowers, too and we will follow, but with some reservations. Assume for the moment with Bowers that the status of *DP* in the secondary *PrP* is a phonetically null *PRO*-noun controlled from the primary predication structure, either by the subject (*SpecPrP*) or by the secondary subject (i. e. direct object, *SpecVP*) (this will be subject to a small modification below). It is commonly assumed that the controller of PRO should be a c-commanding element. If so, we immediately obtain the syntactic restriction of the use of depictive SP: neither the oblique object, which is a sister to V^0, nor the DP in the prepositional phrase are able to control PRO. The proposal that depictives are in general small clauses with a *PRO*-subject dates back at least to Hornstein and Lightfoot (1987). Winkler (1997) criticized it, but inconclusively so, in our opinion, which brings us back to the status of the subject of SP.

Russian also exhibits embedded finite sentences with phonetically unrealized subjects which are claimed to have an empty pronominal *pro* in subject position, cf. (43) (Lindseth, 1998).

(43) On zamečal čto *pro* dumaet o nej postojanno
He realized-iterative that *pro* thinks about her constantly
He kept realizing that he was constantly thinking about her

Though the status of the Russian language within the theoretical framework seems to differ from *pro*-drop languages like both Italian or Croatian, it seems that some phonologically empty (pro)nominal category is indeed necessary. And, following Borer (1989) and Huang (1989, 1992, fn. 2) we would not distinguish between ***PRO*** and *pro* as between fundamentally different entities, although we continue to use the terminology of the quotations where necessary. We thus consider the null subject of a small clause and the null subject of a null-subject finite sentence in Russian to be fundamentally the same element, different properties being supplied by the context. We will follow Huang (1992) and call it Pro. Both Franks and Hornstein (1992) and Huang (1992) seem to envisage the small clause with the ***PRO*** or resp. Pro subject as an explication of the notion of controlled predicate, i. e. a predicate, for which the choice of a subject referent is not entirely free, but is not rigidly fixed by the governing functional category either. The term *controlled predicate* is ours, and is not intended to be theoretically important, though. Still, to answer the question about the relation between the host and the secondary predicate, we should note that PRO-control is not usually supposed to cover the hosts of secondary predicates in (15l) or (15m), for example. However, since we do not distinguish between PRO and pro, we will assume that in Russian implicit controllers of Pro are possible, if they are consistent with the syntactic constraints. We will provide a tentative formalization of this implicit control in section 4.2.2.

Consider now the hypothesis of Bowers/Bailyn from the standpoint of the our formalization of a piece of the minimalist program somewhat closer. As suggested, the instrumental case should be assigned by the predicate head Pr^0, i.e. it is a lexical structural case in our terminology. Now, Pr should have two selectional requirements: one for its subject, and one for its complement. The two paths should differ in their characteristics: one is a-selection, one is c-selection. In the second case there must be a nominal agreement on Pr. But nominal agreement on Pr is undesirable, since Pr should not assign case to its subject. Its subject must either move, as in finite sentences, or get its agreement features deleted by some kind of anaphoric agreement under control in controlled secondary predication structures.

Three options of assigning case to the complement of Pr are possible in principle: (a) Pr^0 selects a predicate plus *case* (i. e. a-selects it), either semantically or syntactically; (b) it c-selects its predicate without agreeing with it; (c) it c-selects and agrees with the predicate, because it has its own nominal *agr* feature. We should bear in mind that Pr may also select a finite verbal predicate in primary predication, and then should not possess the nominal *agr*. Let us consider these options in more detail.

Suppose a predicate is selected and its case assigned as a result of a-selection, i. e. option (a). This selection might be syntactic or semantic. Syntactic selection could refer to categorial features of the complement. Syntactic selection would imply that the selector requires a syntactic category which is semantically a predicate. It seems futile to introduce such a category into syntax. We could therefore assume semantic selection, i. e. that there is a special syntactic feature which is interpreted as a kind of schema summarizing the type of predicates cross categorially, i. e. any category which can be used as a predicate gets this syntactic feature. Pr requires such

a feature and also requires *case* to be present, if a nominal category is selected[10] which is then structural instrumental. This option rules out finite verbs and infinitives in SP, since they have no *case*. Let us call this version *nominal selection* hypothesis. We must assume two Pr-heads, however, one selecting verbal predicates, and one selecting nominal, case-bearing predicates.

Consider option (b), i. e. c-selection without *agr* in Pr. Since *agr* is not mentioned in the selectional requirement of Pr, *agr* of the nominal or adjectival SP is not deleted, hence case not assigned, thought the selectional requirement is satisfied. A nominal predicate, if selected, has to move somewhere else to get case assigned. We thus have no way to obtain the instrumental from Pr under this option.

Consider now option (c), under which *case* in the goal is assigned as a result of agreement with the probe in Pr. We must assume nominal agreement features for Pr^0 in SP-clauses. Therefore case assignment is a consequence of agreement. Moreover, Pr^0 c-selects a predicate it agrees with. This assumption seems to conform to the Bowers/Bailyn hypothesis. A Pr which has *agr* and selects a predicate in small clauses would also exclude finite verbs *and* infinitives from the position as the complement of Pr^0 in SP, since the *agr*-features of the probe would remain undeleted. Call this option the *Pr-agr* hypothesis, for future reference. Note that here, too, we are forced to assume two variants of Pr, one with *agr*, the other without.

Remember that there is also the requirement for Pr to select its subject, but not to assign case to it[11]. Note that if Pr has agreement it can in principle assign case to its subject instead of the complement. Since this would mean that its complement remains without case, it should move to get its case assigned. Either there are constraints which prohibit this movement, hence the complement must use the Pr-agreement, or this hypothesis is untenable.

While both (a) and (c) accounts may describe the assignment of the instrumental, they both face a problem. This major problem is the occurrence of congruent case forms in the position of an adjectival secondary predicate[12]. In subject-oriented depictives (SOD) the secondary predicate may occur in the nominative, in object-oriented depictives (OOD) it may occur in the accusative, cf (44) where (44a) is SOD and (44b) is OOD.

(44) a. on vypil čaj sonnym/sonnyj
he drank the tea-acc sleepy-instr/nom
sleepy, he drank up the tea

b. snačala mašinu vzveševajut pustuju/?pustoj
first the truck-acc weigh empty-acc/instr
first they weigh the truck empty

This case assignment is called *congruent case*. Neither (a) nor (c) can pinpoint the source of the congruent case and of the alternation in general as yet.

2.3 The instrumental vs. congruent case alternation in Russian

To analyze this problem we should determine the case assigner in the congruent case constructions and the constraints which might show up in their distribution properties. Nichols (1981)

[10]For non-nominal categories like PP the selectional requirement for case should be void, since they need no case to be assigned.

[11]We must consider this as a description of the state of things, without offering an explanation for it.

[12]Nouns invariably get instrumental here.

did a great job of collecting and investigating the material to identify the distribution constraints on either the congruent from, or on the instrumental. Though there are many such constraints, one lesson could be drawn from her investigation immediately: there might not be a single explanation of the distribution. Of particular interest in this respect is the observation that among the adjective-SPs in singular there are preferences based on syntactic features, though it is often claimed that the relevant distinction is of semantic nature. Feminine singular predicates favor the congruent form, masculine singular favor the instrumental, cf. (45), which occurs on p. 151 of Nichols (1981).

(45) a. on otpravils'a v put' ?veselyj/veselym
he set off in way happy-nom/instr
he set off on his way happy

b. ona otpravilas' v put' veselaja/?veseloj
she set off in way happy-nom/instr
she set off on her way happy

c. snačala mašinu vzvešivajut pustuju/?pustoj
first the truck-acc-fem weigh empty-acc/instr
first they weigh the truck empty

d. snačala grusovik vzvešivajut ?pustoj/pustym
first the truck-acc-mask weigh empty-acc/instr
first they weigh the truck empty

But probably the task of finding a case assigner for the congruent form could be taken up regardless of distribution factors at first.

Both under the nominal selection hypothesis (a) and the *Pr-agr* hypothesis (c) we must assume two Pr-heads. We will assume *Pr-agr* as a working hypothesis, hence assume that movement of the complement of Pr is impossible for some reason, but in principle we could assume the nominal selection hypothesis as well.

Now, Pr selects a predicate. We sometimes require it to have ϕ-features, and sometimes require it not to have them. It is not allowed to have them, if the selected predicate is finite VP, otherwise they would remain undeleted. It is required to have them, if the instrumental case assignment is to work.

The existence of two or more syntactic options in a language is a bifurcation point, seen developmentally. Such a point may start two potential lines of language development. If they occur in the same position, these lines could drift apart for the two Pr-variants to become associated with different implicatures (picking up some pragmatic load) or even different semantics. But for a period of time it could be expected there to be no consistency in exploiting these options, either semantically or pragmatically. If we assume this to be the case with Russian Pr, we could be able to pinpoint the source of the variability of preferences in the case assignment. If there is a non-ϕ- version of Pr in Russian, it could be present in the SP-constructions alternating with the ϕ- version there, and we expect that it will presumably have a varying pragmatic or other preference load.

What are then the consequences of the existence of both the ϕ and the non-ϕ versions of Pr in Russian in the SP-construction and how could this distinction help us to solve the problem of congruent case assignment?

We assume that SP-PrP is in some sense anaphoric on the main clause. This anaphoricity is manifest in three respects. First, no copula is allowed to be present in SP-PrP. Second, SP-PrP has only a very restricted temporal interpretation which is relative to that of the main clause. Third, SP-PrP cannot have an overt pronominal subject, e. g. (46) is impossible.

(46) *Petr$_i$ xodit [on$_i$ zlym]
Peter$_i$ walks [he$_i$ angry]
Peter walks angry

We take these properties to be a confirmation that SP-PrP has no TP embedding it. Now, suppose we have an *agr*-less PrP. Then there is no way for the predicate to get case assigned. We propose that this *agr*-less Pr is responsible for the congruent case assignment. However, this proposal is very tentative and should be given further thought to.

Russian is at present in a state in which it often allows case congruence in the *primary* predication structures, e. g. in copula sentences with marked tense, cf. (47), which sometimes alternate with the instrumental case.

(47) a. on byl interesnyj sobesednik
he-nom was interesting conversation partner-nom
he was interesting to talk to

b. on byl interesnym sobesednikom
he-nom was interesting conversation partner-instr
he was an interesting conversation partner

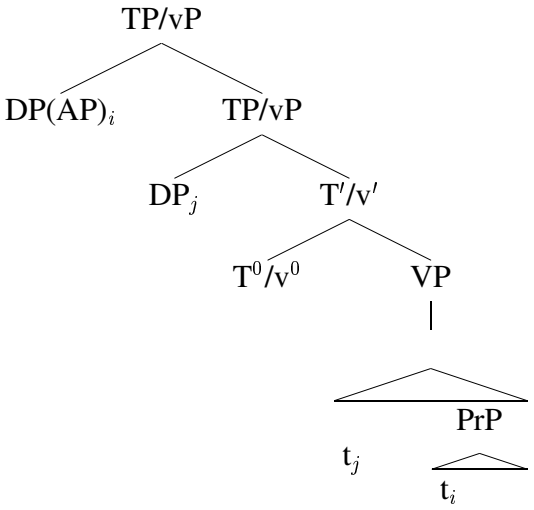
Whatever the mechanism of the congruent case assignment to the primary predicate is operative here, we might expect it to be operative in SP-structures as well. For primary predication we might assume that if Pr has no nominal ϕ-features the predicate gets its ϕ-features deleted by some mechanism with reference to the subject of the predication phrase. In this mechanism which operates in contexts of primary predication Pro serves as a case transmitter. We expect it to serve the same function in SP-PrP, too. The difference is that the subject in primary predication (e.g. (28) gets its nominative case assigned by T, whereas there is no T in SP, and the subject of the PrP-phrase must get its case from somewhere else.

Therefore we assume that the predicate in SP-PrP will get the case of the antecedent of the subject of PrP, which we have to provide first. Note that the structures in (32) and (33) have these antecedents aligned in the position where they *can* control Pro. So if we postulate that Pro *must* anaphorically agree with whatever probe of the antecedent it *may* agree, we can compute the congruent case via the agreement chain. The finite VPs and the infinitivals are still barred from SP-position in secondary predication, because there is no T, hence there is no way to check the verbal agr part of the VP.

There is an alternative proposal of congruent case assignment made in Bailyn (2001). It differs from our in that it envisages that the complement of Pr in SP-PrP moves to get case to the position as a second specifier of the category which contains the antecedent of Pro in

our terminology. This proposal, being very close to ours in essence, differs in assuming a very unsurface-like word order. Consequently, some stylistic movement operation must be postulated to get rid of it. Thus, nominative would be assigned both to the moved secondary predicate DP_i and to the subject DP_j in the structure (48) by T^0/v^0.

(48)



Our version relies on the notion of the anaphoric case assignment, hence has no need of undoing movement.

To sum up the syntactic developments up to now: though some details are fairly difficult to spell out, some properties of Russian SPs are explainable, if a sufficiently interesting notion of anaphoricity can be developed. But there is one more point to be accounted for.

As noted, there is yet another interesting restriction on SP: the alternation instrumental/congruent case is impossible for nouns as SPs. Thus, (49a,49b,50b) are acceptable, whereas (50b) is not.

(49) a. on vernuls'a domoj ustalym
he-nom returned home tired-instr
He came back home tired

b. on vernuls'a domoj direktorom
he-nom returned home director-instr
He came back home a director

(50) a. on vernuls'a domoj ustalyj
he-nom returned home tired-nom
He came back home tired

b. *on vernuls'a domoj direktor
he-nom returned home director-npm
He came back home a director

Since there is case-form alternation on nouns in primary predication, it seems that there is some property of the construction which is relevant here, and not the difference between nouns and adjectives per se. The observation could be accommodated, if we assume that SPs based on nouns

do not have special features relevant to aspect in Russian, whereas those based on adjectives do have them. This assumptions needs more elaboration though.

Some linguists assume that there is a special functional projection, which they call Asp for aspect, and which is the locus of aspectual semantics of the sentence. Do we need such a projection for Russian? It seems that assuming this projection for English makes sense, if we accommodate progressive and perfect tense forms in it. Both forms are analytic in English. There is no overt manifestation of aspect via analytic forms in Russian, though. Russian displays a wide variety of prefixation instead which usually is assumed to play a role similar to that of English analytic constructions, cf. Wade (1992). Thus, though the idea that aspectual properties might be coded for semantic selection is interesting, its implementation for Russian should probably be different. We assume that Russian does not have a separate head Asp, but it has aspectual features on the verb, so that in Russian VP is marked for aspect even though there is no separate functional head associated with aspectual semantics.

In assuming this we adopted the hypothesis that

- congruent case forms are associated with the absence of agr on Pr,
- this version of Pr categorially selects a predicate.
- Since in general this seems to be the version associated with verbal predicates we might also assume that is has the aspectual feature which must be matched by agreement.
- if adjectives (and participles) are also endowed with this feature, but nouns are not, we have the corollary that nouns are not eligible for congruent case, but only for the instrumental in SP, whereas adjectives (and participles) are.
- With primary predication the situation is different: the copula manifests that Pr has an inactive aspectual feature, irrespective of the predicate. This seems plausible, provided a corresponding semantics of the copula.

A major problem for the whole framework of assumptions presented so far is the semantics of the proposed construction. We will now proceed with the formulation of the general approach to context-dependent semantics, and its application to SP-structures.

3 The semantics of SP in Russian: general issues

In this section we will first sketch some general ides of the context-dependent semantics which we intend to use, and then proceed by making more specific assumptions for the case of secondary predication. The move is dictated by our conviction that a semantics which depends on the context is the proper approach to phenomena involving all kind of grammatically relevant anaphoricity.

3.1 Inference in semantics

It is rather well known that a word can be used to refer to any number of things by the processes of metaphor and metonymy. It is not plausible that all of them are available in each context, where the listener has to arrive at a *single* interpretation of a structure. This is an old observation, and Bréal (1887, p.141) is an early attempt to sort out these ideas: "It will be asked, how it is that these meanings do not thwart each other; but we must remember that each time the words are placed in surroundings which predetermine their import. We are not even troubled to suppress the other meanings of the word: these meanings do not exist for us, they do not cross the threshold of our consciousness. It is bound to be so, since happily the association of ideas is for most men based on essentials of things, and not on the sound".

Note the double-sided role of the context. The context is to provide an amount of information for the interpretation on the one side (association of ideas), and to help to weed out the implausible interpretations from this limited amount on the other. The whole task of integrating the contextual information into the meaning of the word and filtering out the implausible interpretations can be viewed as an instance of inference. The distinguishing feature of this view is the use of plausible inference on structures in propositional format instead of computations on general data structures. The context both provides the resources for inference and evaluates the plausibility of the solution. Note that this might be simply a profitable perspective on a range of phenomena regardless of whether some particular data structures and algorithms on them are used. This is the stance taken here.

Inference is a process of transition from premises to conclusions codified in the form of rules. If a rule takes us to true consequences on the assumption that its premises are true every time it is used, the rule is sound. Sound forms of inference are not context-dependent, so, for instance, sound deductive rules are valid in any context, if valid in one particular context. Other forms of inference are not sound, yet are often claimed to be part and parcel of the human mental activity. Hypothetical inference is among these. We adopt hypotheses to explain observations, and their adoption, considered as inference rule, is not a sound rule, since hypotheses may turn out to be false, given new observations.

The main characteristics of hypothetical or assumption based reasoning is that we use ordinary logic to conduct it. We adopt hypotheses from which out observations follow by ordinary logic. But these adopted assumptions must be canceled, if their consequences lead to conflicts with facts. Inference of this kind is more like guess-work. Different hypotheses as well as different criteria determining which of them may be used are possible. The fundamental criterion remains that the use of hypotheses should not lead to irresolvable conflicts. A conflict is usually an outright inconsistency, but other similar notions are relevant, too. The choices of values of all these parameters give rise to different systems of reasoning. One more parameter of variation, relevant to formal languages only, is the expressive power of the language in which reasoning is conducted.

There are different uses of hypothetical reasoning. It can be used to explain observations, e.g. when we hypothesize that it has rained, if we come into the yard and see that the grass is wet. We can use hypothetical reasoning to predict situations, e.g. when we assume that the car we came to the office by is still at the place where we left it. We use it to contemplate alternatives, e.g. saying things like "If I were a carpenter, and you in my shoes..., you...". We could also use it to codify new knowledge given some observations, e.g. when we assume that all swans

are white, having observed a number of white swans, but no swan of a different color. The knowledge thus codified can be used in its turn for the tasks mentioned above.

We may consider establishing the meaning of words and sentences represented as propositional structures to stand in the relation of interpretation Int between these and syntactic structures. In a theory of semantic interpretation based on hypothetical reasoning Int is considered to be established by hypothetical inference. The inference can be described as assuming an appropriate piece of conceptual knowledge for the sake of explaining some more abstract linguistic structures. We will call these structures *semantic forms*. A semantic form is deduced from the conceptual knowledge which we hypothetically adopt as relevant. In current terminology this would be an instance of abductive inference (abduction). Hence, our theory postulates that Int is based on abductive inference. If semantic forms are directly associated with some phrasal syntactic structures we have the induced relation of interpretation of these structures. If some of these semantic forms are associated with words, we interpret words. Using abduction to do lexical interpretation is the basic idea behind the project reported on in this paper. The idea is not new, and the project can draw upon some previous work.

Abduction as one of the basic forms of reasoning alongside with deduction and induction first figured prominently in the works of Peirce (Peirce, 1931-1958, for example). In (Peirce, 1992, Lecture 2) Charles Saunders Peirce provided a short, essential characteristic of this inference form:

(51) Still more convenient is the following conditional form of statement:

If μ were true, $\pi, \pi\prime, \pi\prime\prime$ would follow as miscellaneous consequences.
But $\pi, \pi\prime, \pi\prime\prime$ are in fact true
$\therefore$ Provisionally, we may suppose that μ is true.

This kind of reasoning is often called *adopting a hypothesis for the sake of its explanation of known facts*. The explanation is the *modus ponens*

If μ is true, $\pi, \pi\prime, \pi\prime\prime$ are true
μ is true
$\therefore \pi, \pi\prime, \pi\prime\prime$ are true

The role of hypothetical reasoning in theory formation in natural sciences, e.g. in physics, is undisputed. Its usefulness as a mechanism of interpretation in natural-language based communication seems also to be acknowledged. The first extensive formal proposal to use abduction to model language comprehension was made in Charniak and McDermott (1985). The problem complex involved in text understanding discussed by the authors concerned hypothetically inferring plans underlying the narrative with the aim to infer more information than the literal meaning of the sentence in the narrative, speech act recognition, resolving the reference of pronouns and definite descriptions, and word-sense disambiguation. The discussion amounted to miscellaneous suggestions of what the algorithms doing abduction for these problems could look like, and indications of expected difficulties.

The difficulties in using abduction are considerable, and if recently a growth of interest in the use of abduction in linguistic theories could be noted, (e.g. Hobbs et al. (1993), McRoy and Hirst (1995), Meyer-Klabunde (1995), Norvig and Wilensky (1993)), then probably as a consequence of the growing popularity of hypothetical reasoning over the years in the field of artificial intelligence, where it is used in plan recognition, diagnosis and commonsense reasoning in general,

cf. Konolige (1996). Abduction is seldom tractable computationally (Eshghi, 1993), but work on inductive logic programming shows that such results can be fruitful, and not detrimental, cf. Muggleton (1996)[13].

We will briefly discuss the general background of abductive reasoning an then lay out our assumption about a theory of semantic interpretation by abduction.

3.1.1 Abduction as interpretation

Abductive reasoning is considered to be a kind of inference. We follow Genesereth and Nilsson (1987), and describe inference as the process of obtaining conclusions from premises. Such a process is taken to consist of small inference steps each of which is justified by some inference rule. An inference rule consists of a set of sentence patterns called *conditions* in Genesereth and Nilsson (1987), and another set of patterns called *conclusions*. Whenever there are sentences which match the conditions of the rule we can infer sentences matching the conclusions. A rule is sound, if any set of conditions logically implies any set of conclusions derived from these conditions with the help of the rule. Deductive inference uses only sound rules, definitionally.

Consider now the case when some sentences match the patterns of the *conclusions* of the rule, and we derive sentences which match the conditions of the rule. Under this kind of inference we assume that we possibly deal with a more restricted set of models, than our observations tell us. Exactly what set this is is a matter of speculation, if no additional information is available, since there may be different sentences which match the pattern of conditions given the conclusions.

We do not introduce new rules of inference in addition to the sound rules used in deductive inference, but change the use of these rules. Consider the case of *modus ponens*, (52).

$$(52)\ \frac{p \quad p \rightarrow q}{q}$$

Whenever we have p and $p \rightarrow q$, the rule of modus ponens allows us to conclude q. Suppose we have q. Due to the soundness of the rule used in the normal direction we know that p implies q relative to $p \rightarrow q$, so we may jump to a special case of the set of models satisfying q by assuming that we are confronted with its subset in which p holds. This may be wrong, and the rule of modus ponens used in reverse direction is not a sound rule, hence the inference is not deductive. We simply consider q to be an evidence that p holds, because this would imply q, given our knowledge that they are related, which is expressed by $p \rightarrow q$. So we make the assumption that p is the case.

The notion has a flavor of explanation, since we kind of explain why q holds, and the term has become standard. It can be generalized using a formal definition of semantic entailment or of proof. It is a technical notion and it cannot be taken as an adequate explication of general ideas

[13] Kautz et al. (1995) note that "... abduction problems can be solved in polynomial time when the background Horn theory is represented by a set of characteristic models." They point out an interesting perspective: "... The fact that abduction is hard for clausal Horn theories, but easy when the same background theory is represented by a set of characteristic models, means that it may be difficult to generate the characteristic models of a given Horn theory: there may be exponentially many characteristic models, or even if there are few, they may be hard to find. None the less, it may be worth while to invest the effort to "compile" a useful Horn theory into its set of characteristic models, just in case the latter representation does indeed turn out to be of reasonable size. This is an example of "knowledge compilation"." These ideas may be relevant to the questions of semantics, too.

on what kind of thing an explanation is. But even in this technical sense there are still degrees of freedom in this definition. There may be different μ and $\mu\prime$ which have $\pi, \pi\prime, \pi\prime\prime$ as observed consequences, but are not distinguished by them, and we would like to know, which hypothesis is better. There are implicit constraints on what can be a hypothesis in a given context. We could try to generalize Peirce's proposal to other rules of inference to see the problem. Consider a special case of modus ponens (53).

$$(53)\ \frac{p \,\&\, q \qquad (p \,\&\, q) \rightarrow q}{q}$$

We can conceive q as an indication that $p\&q$ is the case. If we have no evidence that p and q are somehow related, the assumption $p\&q$ seems to be unwarranted. But if a number of observations established that q is often accompanied by p, then the reverse use of this instance of modus ponens amounts to assuming that in the case under observation the situation is the same, though we have no observed data on p. The point here is context-dependence of the criteria of what is a good assumption. Since $(p\&q) \rightarrow q$ is a tautology, we can always use modus ponens to make the assumption that $p\&q$, given q, but in some contexts it is a good hypothesis, in some a less good one. If I see an unknown dog carrying a newspaper in the maw, I am inclined to think that its owner must be somewhere around. If it were just an unknown dog without any printed embellishments, the hypothesis might be ill justified. Note that the mere presence of the owner in the same place does not imply that the dog carries a newspaper, but it is implied at the moment the owner gives the dog one to carry, so the conjunction may be established deductively. Thus, (53) may be used as a way of assuming that there is some proposition which implies both conjuncts.

We need a formalization of abduction which can be used in the language of semantic representations. Such a formalization has two aspects. Talking about AI treatments of diagnosis, Raymond Reiter (Reiter, 1987) notes that "Many non-monotonic inferences are *abductive* by nature, which is to say they provide plausible explanations for some states of affairs... The problem, of course, is that not just any explanation will do; it must, in some sense, be a "best" explanation... But if there is a best theory, there must be poor ones; so diagnostic reasoning really consists of two problems: (a) What is the space of possible theories that account for the given evidence? (b) What are the best theories in this space?" In this paper we will by and large ignore the problem of the choice of the best explanation in a context, and concentrate on the description of the space of available explanations and on their structure.

3.1.2 Poole systems

A simple formalization of this idea for first order languages is as follows (Poole, 1988a): a subset P of ground instances[14] of a set of some possible hypotheses Π is an explanation for observation ϕ, according to (54).

(54) $\Gamma \cup P$ *explains* ϕ if and only if
(i) $P \cup \Gamma \models \phi$
(ii) $P \cup \Gamma$ is consistent

[14]Ground instances are basically substitution instances of formulas in which all variables are replaced by constants.

The set of propositions Γ represents our factual knowledge in the situation in which inference is done, ϕ is the observation to be explained, and P is the set of hypotheses available to us. Whenever hypotheses must be used each time they can be consistently used, we can speak of defaults. In this case we shall use the notation Δ for defaults. A formal theory with hypotheses Π or defaults Δ and with the facts Γ will also be sometimes called *abductive framework* $A = (\Gamma, \Pi)$ or $A = (\Gamma, \Delta)$.

Let us consider an example. Suppose we have a theory which tells us that birds fly as a rule, but that ostriches definitely do not fly. Call this abductive framework A_{bird}. It has a set of defaults, Δ, which contains the rule-like assumption that birds fly. It is actually an open formula which gives rise to a hypothesis whenever all its variables are replaced by some constants. Such a substitution instance can be used as a hypothesis only if it is consistent, otherwise (54ii) is violated.

(55)
$$
\begin{aligned}
A_{birs} &= (\Gamma, \Delta) \\
\Delta &= \left\{ \; bird(X) \rightarrow flies(X) \; \right\}, \\
\Gamma &= \left\{ \begin{array}{l} (\forall X)(ostrich(X) \rightarrow bird(X)), \\ (\forall X)(ostrich(X) \rightarrow \neg flies(X)), \\ ostrich(polly), \\ bird(tweety) \end{array} \right\}
\end{aligned}
$$

This theory allows us to explain that *tweety* flies, but not that *polly* flies, because such an explanation would contradict the facts.

Using implications with open formulas as a formalization of rules is sometimes unwieldy. There is a transformation which is for most purposes equivalent with the original theory which replaces such defaults and hypotheses by their names. The form of the names can be standardized to atomic predicates, and the names can serve as defaults or hypotheses then instead of the rules they stand for. Let $d(X_1, \ldots, X_n)$ be some default with the free variables $X_1, \ldots, X_n$. Let $dpred(X_1, \ldots, X_n)$ be a new n-place predicate which we want to use as the name of the default. We add it as a hypothesis or a default, add the implication $(\forall X_1, \ldots, X_n)(dpred(X_1, \ldots, X_n) \rightarrow d(X_1, \ldots, X_n))$ as a new fact to Γ, and through out the original default or hypothesis $d(X_1, \ldots, X_n)$. The new theory does not add any new deductions to the old one, as Poole (1988b) shown, but all the hypotheses and the defaults are now atomic predicates with as many free variables, as there are in the original defaults and no other parameters.

Consider a modification of (55) as an example of this transformation. The modification concerns the status of the rule for ostriches. Suppose we are not sure that all emus do not fly, although we expect them not to. Then $(emu(X) \rightarrow \neg flies(X))$ is assigned the status of a default. Now we choose a new predicate to name this default and another one to name the original default. Then we have the standardized form of (55) and this modification is (56), where $birdsfly(X)$ and $emusdontfly(X)$ are the new atomic default predicates.

(56) $A_{emus} = (\Gamma, \Delta)$

$$\Delta = \left\{ \begin{array}{l} birdsfly(X) \\ emusdontfly(X) \end{array} \right\}$$

$$\Gamma = \left\{ \begin{array}{l} (\forall X)(emu(X) \rightarrow bird(X)), \\ (\forall X)(birdsfly(X) \rightarrow (bird(X) \rightarrow flies(X))), \\ (\forall X)(emusdontfly(X) \rightarrow (emu(X) \rightarrow \neg flies(X))) \\ emu(polly), \\ bird(tweety) \end{array} \right\}.$$

Now we can explain both $flies(polly)$ and $\neg flies(polly)$

Given this basic idea of abductive reasoning, how can it be put into use in a theory of interpretation? What is the structure of such a theory and which problems does it present?

We postulate a semantic level of representation the formulas of which build some kind of the semantic form of a sentence. These formulas are treated as evidence to be explained in formal sense by their more specific contextual meanings.

We therefore need the following three components in our theory: semantic patterns (semantic forms) associated with the syntax, contextually specified knowledge which provides formal explanations of the semantic forms and rules that relate them. The rules use the mechanism of abduction. The task of the theory of interpretation in case of a sentence ϕ may be formally described as finding an abductive framework A such that $A = (\Gamma, \Pi, \Delta)$ and for some $P,\ D$

$$(INT') \qquad \Gamma \cup P \cup D \models_c SF(\phi)$$

In this formula, D and P are subsets of ground instances of formulas in $\Pi,\ \Delta$ respectively, c a context and $SF(\phi)$ is the semantic form of ϕ. We will call c the context of interpretation. From this it is clear that we are interested in the origin of $Gamma,\ \Pi,\ \Delta$.

Since we do not want to provide explanations on a sentence by sentence basis, we must specify what are explanations which are in some sense basic (perhaps corresponding to words) and how they are combined. Also, INT' does not specify how the truth conditions for ϕ are reflected in $P \cup D$, though we might suspect that $\Gamma \cup P \cup D$ defines the truth of ϕ in the context of interpretation. We shall turn to these questions in the sequel. They all have to do with the space of hypotheses used for INT'.

3.2 The explanation space for abduction

We assume that the semantic form of ϕ is related to the representational devices usually called logical forms in linguistics. Logical forms are a kind of syntactic structures which serve as a basis for the recursive definition of truth. The level of Logical Form where these objects are located encodes the principles of compositionality under standard assumptions borrowed from model-theoretic semantics. However, both the truth-definitional and the compositionality properties of semantic forms are somewhat different, since truth conditions cannot usefully be defined on them, and explanations do not easily compose. Compositionality receives a different status as a consequence of this. Let us see why this is so.

A standard development of compositional semantics would have it that given two meanings A and B together with an operation of composition C defined for them, $C(A, B)$ is just another meaning. The truth conditions for $C(A, B)$ depend on those of A and B. Somewhat similarly, if A and B are semantic forms, and C an operation of composition defined for them, $C(A, B)$ is just another semantic form. But what can we say about the *explanations* of $C(A, B)$? Can they be derived from those for A and those for B? Not necessarily. For one thing, A may have no or less explanations in the context $c\prime$, which is like the context of interpretation c for $C(A, B)$, but without the resources of B. Or it may be the case that some explanations of A become canceled in the transition from $c\prime$ to c. The principle of compositionality for explanations is manifest only in our expectations that any explanation of $C(A, B)$ must be somehow based on the explanations of A and B, and, perhaps, on the additional hypotheses introduced by c for some reason, if this is an option. Explanations do not come out of the blue. Similarly, truth definitions use explanations rather than semantic forms, so we do not expect to find strict compositionality. We compose a semantic form and pool the explanation resources which are associated with each lexical or formal lexicon component, and perhaps those which may be associated with abstract grammatical structures. The net effect is not necessarily cumulative.

Formally, any change in the hypotheses space under this procedure is due to the introduction of new predicates, the introduction of new rules and the introduction of new individuals. Note that we are doing representational semantics, so the sources of predicates and individuals are based on the theory of representations. Nevertheless, we will still use models to avail ourselves of the tools of model-theoretic semantics, much like in Discourse Representation Theory of Kamp and Reyle (1993), in order to motivate representational decisions. So, the first question is where do the predicates and the individuals of the representations come from in the case of lexical entries?

3.2.1 Semantic form and meanings in context.

We might as well start by asking the natural question of what degree of abstraction meanings in context have.

There are a number of results from psychological investigations which suggest that processing information about objects is done in two subsystems which are to a large extent independent of one another. One subsystem is more specialized in identifying objects, i.e. establishing the identity of perceived objects across time by consulting memory, another system maps perceptually identified and stored objects and their identification routines onto the general conceptual knowledge, providing connections to other areas of knowledge with possibilities to infer different things about objects in general. One such result was reported in Warrington (1978).

Warrington conducted a series of experiments with brain damage patients with different patterns of behavior. Patients with one kind of brain damage were unable to identify an oboe when it was presented in an untypical perspective, but 'recognized it' when it was named, stating its use and properties. They were well able to identify it in the typical perspective. Other patients, with a different kind of damage, were sure that it was the same object under both perspectives, but were unable to explain properties like the purpose of its use, or to relate it to other objects in general.

If it is assumed that the perceptual system identifies whether two perceived objects are simply two views of one and the same object, and that the conceptual system defines a mapping of the schemes in the perceptual identification system to the conceptual schemata which allow to

draw inferences about objects, then, as was suggested, these observations can be explained. The relation between the systems is not quite as simple, presumably, but one important point is evident: the interpretation of words does not go as far as the identification system. But how far does it go in the conceptual system?

Searle (1980) argued that some aspects of meaning are not really linguistic in character, but belong to more general conceptual background in terms of which the meanings are made more precise in context. His example is the verb *cut*. Cutting grass, paper or cake are actually rather different activities, differing, in particular, in the instruments that are used and in the overall results. Our expectations about the outcome of cutting activities depend on this knowledge of the differences. Cutting nice patterns into grass with scissors would not usually count as grass cutting, neither would the use of a lawn-mower for cutting a cake be anticipated. Yet this knowledge does not seem to be directly relevant to the mapping of meanings to grammar. Rather, there seems to be some system of classifying all these situations as situations in which cutting something takes place, hence leading to an abstraction. This classification system is probably due as much to the linguistic needs, as to the conceptual necessity of such a classification.

Contextual meaning could therefore be argued to be a specification of some more underspecified linguistically relevant meaning which is contextually invariant. Thus, Bierwisch (1983) made the proposal that contextual variants of a verb might differ from its contextually invariant meaning and Bierwisch (1981, 1983) argued that, e.g. losing something is an event which has different conceptual descriptions depending on the kind of object lost, e.g. lose a fortune in speculations, lose (in) a game, lose consciousness, lose money from one's pocket vs. lose money on the stock market. Conceptually differentiated meanings are contextual variants of a more general representational object Bierwisch calls semantic form which describes losing in very general terms which cover all the instances. Verbs are thus related to very abstract characterizations of situations, and via these to some more detailed representations, and these relate via the perceptual system to situations in the real world. We will assume, due in part to the results of Warrington, that it is not our concern to specify how a contextual interpretation can be used to identify a situation which can verify an utterance about this situation. But must be more explicit as far as contextual dependence is concerned. We shall consider situation schemata as the most detailed representation structures associated with verbs used in the interpretation of utterances. They do possess some distinguishable features. The most prominent one is that the objects encoded in situation schemata will often correspond to what Rosch (1978) called the basic level of abstraction. At this level, for instance instruments are scissors and lawn mowers, but not instruments in general. A situation scheme may therefore encode grass and lawn mowers or scissors and paper. But no situation scheme involves the notion *instrument*. To account for this latter level of abstraction we will introduce situation types, i. e. representations which collapse a number of situation schemata. It is probably this level which corresponds most closely to the Semantic Form of Bierwisch. Nevertheless, we will reserve the term "semantic form" for entities which simply encode the semantic properties of the syntax. We will also hypothesize that situation schemata encode the core of a situation which a simple sentence with the associated verb is usually said to denote, and are therefore adequate most specific explanations which are brought into the common pool by verbs. These situation cores are cantered around events.

3.2.2 Situations and verbs

The view that sentences denote situations is quite common in semantics by now, so there is no need to introduce it. But some particulars of the view adopted here should be commented upon.

The world is in a state of flux. To be able to retain information about it, the continuous flow of information is constantly being chunked and frozen by the cognitive system. Situations in the technical sense in which we use the term here are aspects of the world frozen in such chunks. Any talk of situations in the real world is therefore of necessity fragmentary, since any attempt to chunk the world in static portions corrupts it. A theory of situations in this sense is a never-ending enterprise akin to studying the human perception of time, etc. To take entities like situations as a piece of ontology of the world is therefore probably not entirely unproblematic. The non-existence of situations as ontological entities, however, should not hinder us from using them as a figure of speech: we could talk of situations as a human way of making static pictures of a fluid world. Informally we could continue speaking of situations in the real world, though questions of the identity of situations, etc., could be then be bypassed. This is perhaps too simple a solution, yet we shall stick to it and only take up the question of situations as entities later, when discussing context.

As far as the role of situations as classification schemata for larger-scale patterns of the world are concerned, the results of Warrington (1978) are suggestive. Extrapolating these findings to the case of situations, it seems reasonable to assume that there are two subsystems involved in patterning the world into situations, too. One of them takes care of perceptually defined aspects of identifying whether the world at some particular time can be classified as some situation by reference to some similarity criteria and with respect to the identity of objects involved, the other constructs a mapping of such perceptual classifications to general conceptual systems. This analogy, if warranted, invites us to expect that frozen chunks of information extracted from the information flow and called situations will be processed by two subsystems, too. The first identifies a situation according to some criteria bound to the identifications systems for objects. The identification patterns are related to the patterns of general knowledge about them within the second system. Two immediate consequences emerge: (1) the structure of a situation in our view is based on objects and (2) there may be principles of patterning the perceptual or other knowledge which are not due to perceptual systems. .

Situations in the world (sidestepping the identificational part, which we are not interested in here) are thus represented as situation schemata (e. g. cutting grass with a lawn-mower). Situations schemata are classified in situation types (the type 'cutting situation', for instance). Situation types collapse similar situation schemata and we assume that they are mainly there due to the needs and purposes of lexicalization. Apart from these two types of representations associated with the verbs there also must be a theory (in the logical sense of the word) to the effect that different contextual and corresponding grammatical realizations wrt. the participants in a situation type are possible only in certain combinations when mapped onto syntactic relations, i. e. there must be a theory relating situation types and situation schemata to syntax via semantic forms. These three complex theories will serve as basic hypotheses spaces for the interpretation, defining the context of interpretation in general. We will not have much to say about the interpretation of nouns or adjectives here.

3.2.3 The structure of a situation type

As noted we assume that the structure of a situation scheme is tied to objects. The structure of the situation type, in contrast, is more like a cognitively defined pattern which on the one hand must fit the structure of situation scheme and on the other hand must itself serve as a structuring mechanism which rearranges these schemata into something which is more amenable to linguistic realization. We would like to distinguish the following aspects of this structure, without trying to achieve completeness.

Formal structure

The formal structure is used as a blueprint for situation schemes, i.e. a skeleton to hook all other information on. The ontology of situations, i.e. events, states, and individuals, is defined here. This is the (claim about the) ontology of our internal model of the world. Whereas there are conceivably 'linguistically pure states' like silence, states are normally states of something, i.e. state is a relative notion; in some cases it is the state of the world as an abstract entity. States are in the situation only by virtue of their being states of individuals in the situation. Similarly for events. Events are (representations of) complex patterns of change which are singled out by the cognitive system. Situation schemata introduce the entities the events and states are bound to. Situation types may moreover introduce entitles which are linguistically relevant. States are patterns of invariance within a situation connected to individuals, events are changes of, in or about the individuals. We refer to the individuals as the bearers of the events, if the changes in some of their characteristics constitute these events, and similarly for states. Events can be specified as having temporal duration by the function $\tau(e)$, their *temporal trace* function. There are different factors determining this period and relating it to the time of situation $\tau(s)$. The time of the situation is the time in the real world for which we are inclined to accept the categorization by a situation scheme. We will not follow Miller and Johnson-Laird (1976) in defining events as changes in states, however, but adopt a different conceptual structuring. We shall adopt a simple theory of events and states along the lines of Kowalski and Sergot (1986) which assumes both to be ontological primitives, cf. also Shanahan (1989, 1997). Though events are not simply changes in state, they relate to states. In particular, they always terminate and initiate states with certain antagonistic properties. Lexical information can specify these states, if required by the structure of the language in question. The need of lexical specification of the states initiated or terminated by events has been demonstrated, for example, for Russian in Demjjanow (1998).

We will follow Miller and Johnson-Laird (1976) in making another assumption, however: our cognitive system is able to distinguish change only if it can be registered as a change in the value of some cognitively definable attribute of an individual, i. e. its state. This assumption determines much of the theory of events and states. For each event there is at least one attribute of at least one individual which has different state values before and after the event (Kamp and Rossdeutscher, 1994, make a similar assumption). But for some internal processes which are patterns of behavior this default could amount to the statement that a pattern of behavior lasted an amount of time, e.g. perhaps for *sleep*. Of course, we might be more precise, and some such property might be listed explicitly , e.g. *sleep for an hour* specifies a condition on the state as the one which originated after the event of sleeping lasted one hour. Any state can be assumed by default to have been initiated by an event, so there may be implicit but unexpressed events, if a situation specifies a state. If a state is initiated, some other state is terminated. A state is taken to persist in time, if not explicitly contradicted via an event which terminates it. On the whole we expect that if an event is not explicitly or implicitly specified, it is not assumed. Hence we can

always defeasibly know if a state persists or not. We summarize below some default conventions regulating the behavior of events within a situation, following in part Shanahan (1989):

Event postulates within a situation s

- no events are assumed other than those known to occur in s
- no event can affect a state in s other than those known to do so in s
- states persist in s until some event terminates them in s

We should probably adopt another additional postulate

- every state known to hold can be assumed to have an explanation in terms of events.

Note that the term explanation is meant in the formal sense here. It is important to keep in mind that these are default conventions holding for real world applications, so to say. We are not committed to producing the state which was terminated by the big bang.

The status of the formal ontology in this paper is rather like that of a human model of the world. A formal model of this model is a set-theoretic structure which formal semantics also calls a model, in which a language is interpreted and in terms of which its truth conditions are given. Events, states and individuals have properties some of which may seem rather normative. Yet these normativeness is the price of our cognitive modeling the world. Thus, we assume for instance that all individuals in the model, like events, states and plain objects, build up a universe structured by the part-of relation. This move reflects the hypothesis that such structures are very useful in cataloging reality.

Thus, we postulate a sorted domain of discourse which contains plain atomic and plurality individuals, events and event complexes, states and state complexes[15] Every one of these sorts is a complete atomic free upper semi-lattice with a bottom element $\perp$. Thus, every sort is a set S with a partial ordering relation $\leq$ on it such that for all $X \subseteq S$ the least upper bound, l.u.b, $\bigvee X$ exists (S is complete), for all $a, b \in S$, if $\neg a \leq b$, then there exists an atom c such that $c \leq a \ \& \ \neg c \leq b$ (S is atomic), for all $a \in S,\ X \subseteq S$, if a is an atom, and $a \leq X$, then there exists a $b \in S$ such that $a \leq b$ (S is free). The binary sum operation $\oplus$ which can be defined on these structures is simply the l.u.b of the two operands.

One of the uses of this property is plural predication. We interpret pluralities either as atoms or as sums. If something is predicated of a plurality, the predication is interpreted distributively by default. Thus, suppose the constant $people$ denotes a plurality of people in context c. Then, $sing(people)$ is an expression with a predicate which has by default a particular axiom $sing(X)\&X = x \oplus y \rightarrow sing(x)\&sing(y)$. This axiom can be applied recursively, until the atomic individuals are reached. For atomic individuals, be they plural or singular, the value of the predicate is determined in the model explicitly. In general we will tacitly assume the set-theoretic apparatus introduced in Krifka (1998). Properties of the events, states, times and individuals in the model will be introduced as the need arises.

[15] We shall adopt the common practice of calling events and states eventualities and will use one sort of variable for the two, e or E, where the difference is not crucial.

We will also make use of another, different notion of structure of the situation denoted by the sentence, which we will discuss in the next subsection under the name of relational structure. Since we actually have no situations as ontological entities in the model, this structure is only reflected in representations, i. e. in the situation schemata and the situation types. This allows us to assume that a situation type is always associated with one event, which may be complex at the representational level, but an atomic event in the model.

Relational structure

Relational structure of the situation type organizes events and states in it in relations which are characteristic of a situation of this type, and endows them with their characteristic temporal properties at the level of situation schemata. A relational structure is a fundamental theory for the interpretation of a verb, and the patterns it provides must be simple enough to be coded in to language.

We will assume two basic types of simplex events, agentive and thematic, besides states. The two event types are meant to be related to the dichotomy between unergative and unaccusative clauses, cf. Perlmutter (1978), Rosen (1984). Representationally complex events are assumed to be built from at most two events and states justified by these events. If a complex event is built from simplex events, the logical possibilities for types of relations are listed in (57). The relations are always asymmetric and the first term of a relation is conceptually (and sometimes temporally) prior to the second. The first term of a relation type is listed in the first row of the table, the second in the first column. The cell with the coordinates $< row, col >$ contains the name of the relation.

(57)

	agentive	thematic	state
agentive	$doubleagent$	$trans$	$term$
thematic	$pass$	$doubletheme$	$term$
state	$init$	$init$	$\diamondsuit$

The classification is based on intuitive considerations of how situation schemes associated with verbs or adjectives relate to eventualities. In this sense it is a hypothesis about the conceptual mechanisms of humans, i. e. only a heuristic assumption, which it is impossible to prove. The symbol $\diamondsuit$ indicates that relations on states do not add up to a situation scheme.

The simple relations in the table are merely formal entities and serve as a convenient classification scheme which may be further instantiated abductively by a number of more specific relations. Consider what relations occur in Russian, tentatively. The relation $trans$ seems to be a good candidate for classifying causative structures. Following Miller and Johnson-Laird (1976) (p. 457), we may assume that many causative verbs express a relation between two events, the first of which is something that an agent does, the second an event in the theme object that his action causes. Note that we do not want to define this relation outright and endow it with general properties, but merely assume that it can be defined conceptually in some way which allows for degrees of causative involvement which depend on a particular situation type. Thus, specific agentive causative situation types will contain special cases of the relation $cause(e, e')$. Nevertheless there must be two individuals involved in each situation, at least one in each event, according to our theory of events, and this is a general property of $cause(e, e')$. There are many analyses of causation (i.e. of the concept of causation), which are insufficient, presumably, as models of the human concept, but having their uses in science. Shoham (1988) pointed out that any causation concept probably involves constructing a theory for each kind of

causation, apart from it being expressible as a predicate on events. A similar approach was taken by Kamp and Rossdeutscher (1994). The theory of the situation-specific notion of causation itself may be deferred until it is needed, but nevertheless, the relation is assumed to be specifically defined in a situation scheme. We assume therefore that $cause(e, e')$ is defined via a number of situation-scheme specific concepts, apart from possible general properties. Another candidate for an instance of $trans$ is the concept of inanimate causation, which is probably also defined in situation types.

Russian does not seem to lexicalize the $doubleagent$ relation, and though it has some analytic causal forms similar to *make him laugh* to express it, they are lexically restricted to more specialized verbs than *make*, e. g. Russian uses an equivalent of *force* in this construction.

The $pass$ relation could be interpreted as the change of perspective on the agentive/thematic event pair, i. e. this could be the relation which surfaces as passive. It is then, of course, necessary to specify the relation between $pass$ and $trans$ within the same situation, but we will sidestep this issue.

It is difficult to come up with a generalization leading to $doubletheme$ relation, perhaps because there are no interesting similarities in the relations between two thematic events which could lead to some grammaticalizaton strategies for them.

States in the specification of the relational structures play a particularly interesting role in Russian. If we specify the state which is terminated by the event, the resulting relation is often lexicalized as a prefixed verb denoting the beginning of an action, e. g. *pet'* (sing) - *za-pet'* (start to sing; the state terminated was characterized by not singing). If a state is specified as initiated by the event, the relation is also usually lexicalized as a prefixed verb, but the interpretation is that of some interesting state caused by the event. For $cause$ as one instant of $trans$ relation this post-state is usually a characteristic resulting state of the thematic change brought forth by the agentive event. The notion of result will play an important role in our developments. This much is part and parcel of many analyses of agentive causation. The reason of recapitulating it here is to make clear the position of the authors: elements of relational structures of a language are language independent, but might be arranged differently and lead to different lexicalization patterns.

3.2.4 Situation schemata in relation to situation types

Thematic structure of a situation scheme

Given that individuals are the reason for the presence of events and states in the situation scheme, these three types of entity are related within the scheme. As noted, these relations are often defined on the basic level of abstraction. Consequently, we expect a less degree of abstraction of relations, than in the situation types, since the role of the situation types is to pick out general patterns.

Suppose we have a situation schema of somebody cutting grass with a lawn-mower. It would describe this individual in a specific way of being the operator of the machine, executing some kind of program involving this instrument to achieve some change in the state of grass. This change is specified as a purpose to be achieved as part of a plan.

To indicate that fact that the predicate with an eventuality argument e might introduce a discourse referent in the discourse representation structure in the sense of Kamp and Reyle (1993) we shall

prefix it with e :. We thus have something like a name for the eventuality in a given context where it is introduced. Consider what could be in a description of the situation in which grass is being cut by a lawn mower. Let the main event of the situation be named $E : cut{-}grass{-}with{-}lawnmower(E)$. This situation scheme is an instance of the situation type of causative situations, so we expect a situation-particular causative relation $cause_E(e, e')$ to hold of at least two events in the situation. We also expect an individual entity g which is being cut in the event e'. We know it is grass, hence the name of the situation would imply the following formulas:

$$is{-}being{-}cut(g, e') \,\&\, grass(g).$$

Moreover, this situation scheme is an instance of the situation type of cutting which specifies a particular property of the instrument, i. e. that it is a lawn-mower. The following is then also implied:

$$cutting{-}\ instrument(e', lm)\ \&lawn{-}\ mower(lm).$$

We also expect to have $lawnmoweragent(x, e)$ which could be the situation-anchored relation between an individual which is the agent and the event e describing its role. We shall forgo the elaborations of what it takes for x and e to satisfy $lawnmoweragent(x, e)$ and similar theories for $cutting{-}instrument(e', lm)\ \&lawn{-}mower(lm)$ and $is{-}being{-}cut(g, e')\,\&\,grass(g)$. Note that we also need a theory of $cause_E(e, e')$, because it is not deducible from general principles of causation governing $cause(e, e')$.

Another variation on the situation scheme is the one for Searle's example of cutting paper with scissors. Again, it is obtained by considering what kind of description is tendentially true in such a situation. The scissors-cutting situation where John is cutting paper with the scissors would make (58) true. The $cause$ predicate is situation specific which we indicate again by E. This time we may attempt to give more details.

(58) $(\exists e, e1, y, x, z, s1, s2)$ $(terminates(e, s1)\&\ initiates(e, s2)$
$\&\ is{-}being{-}cut(y, e)$
$\&\ is{-}cutting(x, e1)$
$\&\ cutting{-}piece(z, e)$
$\&\ scissors(z)$
$\&\ cutting{-}change(s1, s2, y)$
$\&\ cause_E(e1, e))$

The event e is the event associated with y undergoing a transformation due to its being cut, $e1$ is the agentive event. It probably consists of manipulating the scissors. The reason the instrument is nevertheless associated with the event of being cut rather than that of manipulating the scissors is that the scissors of itself is not an instrument, unless used in the appropriate way in an appropriate event. The predicate $cutting{-}piece(z, e)$ is more specific, than a predicate which would roughly correspond to $instrument$, because we need specific information to support specific inferences in the situation of cutting with the scissors. $cutting{-}change(s1, s2, y)$ is a complex predicate which covers the necessary relationship between the two states of y which are initiated and terminated by event E, and which probably have characteristics like $s1 : whole(y)$ and $s2 : cut(y)$. The reason for its introduction is as follows: The exact definition of states like $whole(X)$ and $cut(X)$ for fingers, paper, grass, etc. in the case of scissors, is a matter of contextual specification, similar in principle to those in other cutting situations. So we just

register this with the dummy predicate $cutting{-}change(s1, s2, y)$, which can be substituted by a contextually more explicit version.

The detailed predicates in this description may be called individual thematic roles, following Dowty (1989). They are very particular, since they are defined within the situation scheme. Similarly, the two situation-particular theories $cause_E(e, e')$ are instances of the general scheme of a causative situation $cause(e, e')$ and are interpreted both in the conceptual and in the perceptual system, since they are causal theories of the particular relation which must hold in the situation.

Since there are things to some extent common to all agentive situations of cutting things with instruments, we may assume that these situation schemata are condensed to a situation type. We suppose that there is a predicate which tendentially generalizes over things being cut in all agentive cutting situations centering about the general eventuality E which is conceived as consisting of the causative chain $cause(e, e')$. Call this predicate $cutting{-}object(x, E)$. Similarly, we introduce a predicate $is{-}instrumental(x, E)$ which generalizes over instruments and a predicate $cutting{-}agent(x, E)$ to characterize all the agents in cutting situations. Then the type of situation could be specified by the description which any agentive cutting situation should tendentially satisfy, (59).

(59) $(\exists y, x, z, s1, s2)$ $cutting{-}object(x, E)$
$\& \, cutting{-}agent(x, E)$
$\& \, is{-}instrumental(z, E)$
$\& \, cutting{-}change(s1, s2, y))$

Note how we have a change of context. The situation type predicates make no reference to the original events, only to the main indexing eventuality of the situation. This means that the rules specifying the relation between the type and a scheme should keep track of the events in the causative pair which constitutes E, and perhaps of initiated and terminates states, too. Which rules should these be?

The situation of cutting with the scissors was a more specific instance of (59). So we need some kind of generalizing rules which relate the differing predicates. The relation between the predicates in the situation scheme and the predicates in the situation type would be that of logical implication, as in (60), perhaps somewhat weaker, and we assume that it can be be formalized in Poole systems with interesting results. Although it is not evident, it seems that there is no need to represent the relational structure of the situation scheme at the type level of representation in detail, which can be left implicit in the rules which should keep track of the causative relation, etc.. The rules relate two contexts, a situation scheme and a situation type, and the situation scheme has discourse referent E as its quasi-name (the subscript on $cause_E(e, e1)$ does not introduce it; we could have chosen another). We shall have more to say about contexts in a moment.

(60) $a.(\forall x, e, e1)$ $((is{-}being{-}cut(x, e1) \,\&\, cause_E(e, e1))$
$\rightarrow cutting{-}object(x, E))$
$b.(\forall x, e, e1)$ $((cutting{-}piece(x, e1) \,\&\, cause_E(e, e1) \,\&\, scissors(x))$
$\rightarrow is{-}instrumental(x, E))$
$c.(\forall x, e, e1)$ $((is{-}cutting(x, e) \,\&\, cause_E(e, e1))$
$\rightarrow cutting{-}agent(x, E))$

To obtain a Poole system from these rules we may drop the quantifier prefixes and postulate that the implications are hypotheses. Then a predicate like $cuttingagent(x, E)$ may have a potential explanation via $is{-}cutting(x, e)\,\&\,cause_E(e, e1)$ from the scheme for cutting with scissors, or via $lawnmoweragent(x, e)\,\&\,cause_E(e, e1)$ from the scheme for cutting grass with a lawn-mover, or via some other available situation scheme.

Situation types arise as generalizations over situation schemata. We assume these generalizations to comprise two things: a change of context which drops inessentials, with the context becoming more abstract, and the generalization over thematic structure. To move from a situation scheme to a situation type we drop the events of the relational structure and leave only the indexing event, which we will assume to be introduced by a verb. This is a change of context. Thus, if we had $cause_E(e, e')$ in the situation $E : cut{-}grass{-}with{-}lawnmower(E)$, we will have $E' : cut(E')$ as the new context of the situation type of cutting in general which is introduced by the verb *cut*. The expression $cause_E(e, e')$ is no longer present in the context. Note moreover that we would like $E' : cut(E')$ to be less specific, than $E : cut{-}grass{-}with{-}lawnmower(E)$.

Now we have a two-stage model of the explanation space for the interpretation of the verb *cut*. We can consider the problem of building the missing link to the syntax. Individual thematic role predicates which are similar across different situation schemata can be generalized over, giving rise to (type-of-) thematic roles. These can be further generalized, yielding what will be called theta-roles which are situation and hence verb independent. Theta roles are mapped onto semantic forms. We shall start building the interface of linking rules by discussing the nature of semantic forms and their role in the interpretation.

3.3 Semantic patterns for syntax

What are the desiderata for semantic forms? Basically there are two sources of the syntactically introduced evidence which has to be explained by interpretation. The first source are lexical entries, the second source are syntactic relations defined on syntactic objects. We will be not particularly interested in the semantics of DPs. Thus, we will assume that a noun like 'bird' introduces some predicate, say $bird(x)$ which is then interpreted by abductive inference, but will leave this part out. Determiners introduce tripartite structures, as a rule. More complex assumptions will be used for verbs. With verbs we have their lexical meanings which are predicates on eventualities[16] and the syntactic relations which have to be interpreted relative to the lexical entry of the verb: at least the subject of the sentence and the two object relations, the direct and the indirect object. We thus need relations between the arguments of the verb and the events it introduces (argument relations), and principles which map argument relations to the syntax and which are usually called argument structure, linking rules, etc.. These principles use semantic forms of grammatical relations, i. e. the counterparts of the elements of interpretable syntactic structure, which are to be interpreted by the argument relations.

To implement this we shall assume that the relevant syntactic relations are interpreted via semantic forms in two ways simultaneously: as facts about syntactic structure, and as observations about argument mappings which are to be explained. Since we are not allowed to explain facts in an abductive framework, we shall assign two predicates to an interpretable syntactic relation. One of them then contributes to facts, the other is evidence. Suppose, for instance, we have to

[16]This move is based on the familiar neo-davidsonian rendering of the verb semantics, exemplified in much work, in particular in ...

interpret the relation which holds between V^0 and its complement DP, namely $[V^0\ DP]$. We construct an abductive framework (61) which contains two expressions interpreting, $[V^0\ DP]$, $gfiobj(a,b)$ and $argiobj(a,b)$. The mnemonics should suggest that we interpret the syntactic relation which is commonly called *indirect object*. At the same time we have the eventuality predicate $||V^0||$ introduced by the verb with b the eventuality argument of the verb.

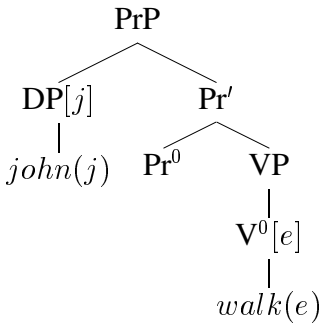
(61) $$\frac{A_{iobj} = <\Gamma = \{\ gfiobj(a,b),\ ||V^0||(b)\},\quad \Delta = \emptyset>}{explain: \qquad\qquad argiobj(a,b)}$$

The expression $gfdobj(a,b)$ is a fact within this abductive framework. We want to be able to use the information that some specified syntactic relation holds during inference. The expression $argiobj(a,b)$ is the evidence which has to be interpreted.

We would like to consider this approach to the interpretation of syntactic relations in some more detail, since it will be fairly generally applied.

Though there are no arboreal notions involved, we keep the traditional generative notation. Consider (62).

(62)



We assumed that DP *John* introduced the constant j, and the lexical entry for the verb *walks* introduced the predicate $walk(e)$, defined on eventualities, and an eventuality discourse referent e. If we ignore the fact that $DP[j]$ is phonetically realized in the position of the head of its chain after being moved there, we may consider the relation between $DP[j]$ and the $V^0[e]$ of PrP be the relation between the subject and the predicate of the predication. Let us abbreviate the occurrence of this relation by $gfsubject(j,e)$. We consider $gfsubject(j,e)$ to be a fact in the abductive framework to be constructed, and introduce a corresponding argument relation $argsubject(j,e)$ as a semantic observation which is to be formally explained. In other words, $argsubj(j,e)$ is an evidence for its explanation. The fact allows us to let syntactic information control inference. The evidence allows us to specify the need for interpretation.

We use the indices as discourse referents, following Kamp and Reyle (1993). Therefore, s will be in a sense the name of a discourse representation structure in which the abductive framework is to be applied, and e, j are discourse individuals in this structure. Since we have no quantification there are no tripartite structures. Examples (63-65) illustrate the process of interpretation. Remember that we ignored the abductive interpretation aspects of DPs, so $john(j)$ is an abbreviation of whatever we abduced.

Given the relation $gfsubject$ we construct the discourse representation structure (DRS) in (63), where the status of evidence is made explicit, and activate the abductive framework (64) which is associated with this relation. Consider the situation discourse referent s to be the name of the DRS for the moment.

(63)

$s \mid e\ j$
$john(j)$
$walk(e)$
$explain : argsubj(j,e)$

(64) $A_{subj} = < \Gamma = \{ gfsubj(x,e),\ ||V^0||(e)\},\quad \Delta = \emptyset >$

After we substitute the semantic form of the verb and the corresponding discourse referents we get (65).

(65) $A_{subj} = < \Gamma = \{ gfsubj(j,e),\ walk(e)\},\quad \Delta = \emptyset >$

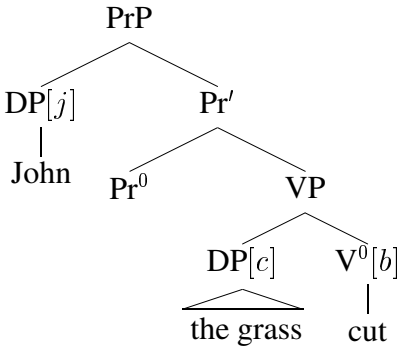
Note that we explicitly distinguish between the conditions which will have to be verified, and inferential resources in the abductive framework, duplicating conditions, if they play both roles. Why is this so? We do not want to verify $gfsubj(j,e)$, since this is a fact within the context of interpretation which is yielded by our parsing mechanism. On the other hand we have to verify $walk(e)$, but we also want it to be used in inference and therefore treat it within our abductive task as a fact, too. This latter status does not mean that we already know that $walk(e)$ is true in the situation, it merely reflects the role of the condition in the inferential interpretation.

Another interpretable relation we are interested in is that of direct object. It also introduces an abductive framework and contributes a relation to be explained to the discourse representation structure.

(66) $\dfrac{A_{dobj} = < \Gamma = \{ gfdobj(c,b),\ ||V^0||(b)\},\quad \Delta = \emptyset >}{explain : \qquad\qquad argdobj(c,b)}$

That syntactic relation which gives rise to this abductive framework is that between $DP[a]$ and $V^0[b]$ in (67).

(67)



Given the two relations, we assume that they involve different indices for different, non-coreferential DPs. But since we use the same verb, we may combine the two abductive frameworks to get (68), identifying the eventuality arguments of the verb.

(68) $\dfrac{A_{dobj} = < \Gamma = \{ gfsubj(j,e),\ gfdobj(c,e),\ ||V^0||(e)\},\quad \Delta = \emptyset >}{explain : \qquad\qquad argsubj(j,e),\ argdobj(c,e)}$

The discourse representation structure would be something in line with (69), where we ignore the contribution of the definite article.

(69)

$s \mid e\ j\ c$
$john(j)$
$grass(c)$
$cut(e)$
$explain : argsubj(j,e),\ argdobj(c,e)$

Other syntactic relations and the abductive frameworks they introduce will be discussed as the need arises.

To proceed from here to the second stage of interpretation we must recall that it involves argument relations. How do we proceed? Let us forget for the moment discourse representation structures and use semantic forms as expressions where relative scope and quantificational status of DPs is shown as usual, but in which there is no situation discourse referent. A possible representation for ***John walks*** is (70).

(70) $\exists e\ (john(j)\ \&\ argsubj(j,e)\ \&\ walk(e))$

This is almost neo-davidsonian semantics, which is quite commonly used now (cf. e. g. Krifka (1998)...), except for $argsubj(j,e)$ which is to be explained. As it was pointed out, the task of assignment principles is to explain $argsubj(j,e)$, among other things. Using the abductive framework A_{subj} which specifies the semantic form introduced by the syntactic relation of subject as a model, we can provide a similar framework to specify that the observation $argsubj(u,b)$ is to be explained by the argument relation $agent(u,b)$, assuming for the moment we know what relation this is. We could attempt to compose the two frameworks like in (68).

(71)
$$\begin{array}{l} A_{subj} = < \Gamma = \{\ gfsubj(u,e),\ ||V^0||(e)\},\quad \Delta = \emptyset > \\ \underline{A_{argsubj} = < \Gamma = \emptyset,\quad \Delta = \{agent(u,b) \rightarrow argsubj(u,b)\} >} \\ explain : \qquad\qquad argsubj(u,e) \end{array}$$

But before we proceed with constructing argument assignment principles, we must first settle another question which becomes evident. The second abductive framework in our framework pair does not mention the verb. The reason is we want argument assignment principles to be verb independent and applicable to large classes of verbs. Yet we need the connection to the verb which is registered in the framework A_{subj} to know in which eventuality the argument relation is to be situated. We may express this requirement by putting both frameworks above the line to indicate that they may be composed to explain $argsubj(u,e)$, hence b and e are to be identified. One way of viewing this problem is this: we have two contexts in which inference may be done,and we need to synchronize them, so that they talk about the same entities. We thus need some notion of context to guide inference. The notion of context we are interested in is introduced in the paper McCarthy and Buvač (1998). The paper is not a complete formal theory of contexts, but rather a collection of interesting proposals and illustrations. We feel free to use them nevertheless, though other notions of context might turn out to be more appropriate.

3.3.1 Semantic forms, contexts and situation types.

On the one hand, a context in this theory is a formal object, hence an object, and can be a value of a first-order variable. Since any statement is made in a context, it should be relativized to something like $context(x) \rightarrow A$, where A is the formula which makes a statement, and $context(x)$ fixes the context. On the other hand, a context is a generalization of the notion of a collection of assumptions which build up a kind of axiomatic base of the context. One important difference between an explicit collection of assumptions and a context, which suggests using contexts as objects instead of mere sets of assumptions, is that a context could contain a number of assumptions not known to us, i. e. we cold have only a partial knowledge of the context.

To state that an assertion $A(a_1, \ldots, a_n)$ is true in some context McCarthy and Buvač propose to use the predicate $ist(c, p)$, which means 'proposition p is true in context c'. Note that this statement is itself only true in some context, i. e. $ist(c\prime, ist(c, p))$. Similarly, the latter formula is only true in a context. This creates an infinite regress, but the latter is harmless, as the authors indicate. We call the current most general context in which which we reason *outer context*, following McCarthy and Buvač. This will mostly be the context of interpreting the whole sentence.

A useful piece of notation to indicate that our reasoning takes place in a context is to prefix all statements $A(x_1, \ldots, x_n)$ made in a context by the name of this context, i. e. to write $c : A(x_1, \ldots, x_n)$[17], e. g.

$$writing{-}a{-}letter : \text{"I fell asleep"}.$$

Another way to use contexts is to conditionalize the statement on the context assumption, e. g. to write

$$context(writing{-}a{-}letter) \rightarrow \text{"I fell asleep"}.$$

and use the context assumptions as assumptions in the sense of natural deduction, i. e. after assuming $context(writing{-}a{-}letter)$, and deriving something, we conditionalize on the context and discharge this assumption.

Inference in a given context is done by entering a context. Entering a context ct and asserting p in this context is notated using the same : prefix, cf. (72).

(72) $ct : p$

If $c : ist(ct, p)$, and we have entered context ct and inferred q from p in ct, we can *leave* this context and obtain $c : ist(ct, q)$.

Now let us turn to our problem. We not only want to synchronize the contexts, but also would like to be able to transform some important assertions in one context into assertions in another, related context. Let us consider (58), (59) and (60) as abductive frameworks with facts only, (58) and (59) introducing their own contexts, say *cut-grass* and *cut*. We repeat them as (73), (74) and (75).

[17] We have already noted the use of of $e : P(e)$ to indicate that the predicate $P(e)$ introduces a discourse referent. There will be no misunderstanding, if we explicitly state when we consider it to be entering the context or simply providing a new variable. In a sense, however, we may alternate between eventualities and contexts they create, without introducing a special notation, so the correct reading can always be coerced.

(73) $(\exists e, e1, y, x, z, s1, s2)$ $(terminates(e, s1)\& \ initiates(e, s2)$
$\& \ is{-}being{-}cut(y, e)\& \ grass(y)$
$\& \ is{-}cutting(x, e1)$
$\& \ cutting{-}piece(z, e)$
$\& \, lawn{-}mower(z)$
$\& \ cutting{-}change(s1, s2, y)$
$\& \ cause_E(e1, e))$

(74) $(\exists y, x, z, s1, s2)$ $cutting{-}object(x, E)$
$\& \, cutting{-}agent(x, E)$
$\& \, is{-}instrumental(z, E)$
$\& \, cutting{-}change(s1, s2, y))$

(75) $a.(\forall x, e, e1)$ $((is{-}being{-}cut(x, e1) \, \& \, cause_E(e, e1))$
$\rightarrow cutting{-}object(x, E))$
$b.(\forall x, e, e1)$ $((cutting{-}piece(x, e1) \, \& \, cause_E(e, e1) \, \& \, lawn{-}mower(x))$
$\rightarrow is{-}instrumental(x, E))$
$c.(\forall x, e, e1)$ $((is{-}cutting(x, e) \, \& \, cause_E(e, e1))$
$\rightarrow cutting{-}agent(x, E))$

It can be derived that

$$c_0 : \ ist(cut{-}grass, is{-}being{-}cut(y, e))$$

Clearly we would like to be able to use this information in the more general context of the situation type, i. e. to have

$$c_0 : \ ist(cut, is{-}being{-}cut(y, e))$$

But we can only do this hypothetically, since we merely assume that the situation type is instantiated by this specific situation scheme. We therefore introduce a relation on contexts which we call $specializes(c, c')$, following McCarthy and Buvač, but use it to express that c' has weaker assumptions that c but that inferences in c may be hypothetically transferred to c' (and vice versa, by abduction). We thus introduce special abductive frameworks which relate two contexts, cf. (76). Other possible specializations require similar frameworks. Here p is a proposition-valued variable.

(76) $A_{cut} \ = < \ \Gamma \ = \{specializes(cut{-}grass, cut)\& \ ist(cut{-}grass, p) \rightarrow ist(cut, p)\},$
$\Delta \ = \{specializes(cut{-}grass, cut)\} >$

Now we might put the rules in (60) into the context *cut-grass*. But note that if there are defaults and hypotheses in *cut-grass*, we loose track under importation of which consequences are hypothetical, and which not. To handle this we must import not only facts, but also hypotheses and defaults of the more specific context with the possible indication of their rank with respect to the specialization assumption. We will implicitly use this device, without writing all the hypotheses out.

Now we may take care of variable handling. Note that the variables $e, \ e1$ and E in (73), (74) and (75) cannot be instantiated differently for different predicates within the same context. Therefore, we will treat the event variables as being functionally dependent on context, i. e. a predicate

like $cause(e, e1)$ in context c should be actually understood as $cause(e(c), e1(c))$, where $e,\ e1$ are functions which introduce the events of the context. Furthermore, since E is also unique the context of interpretation of the verb, and since we introduce E as a discourse referent of the verb, we might as well use it instead of the name of the context of interpretation of the verb. Then the rules in (60), for example, would look in this context like (77).

(77) $a.(\forall x)$ $((is{-}being{-}cut(x, e1(E)) \,\&\, cause_E(e(E), e1(E)))$
$\rightarrow cutting{-}object(x, E))$
$b.(\forall x)$ $((cutting{-}piece(x, e1(E)) \,\&\, cause_E(e(E), e1(E)) \,\&\, lawn{-}mower(x))$
$\rightarrow is{-}instrumental(x, E))$
$c.(\forall x)$ $((is{-}cutting(x, e(E)) \,\&\, cause_E(e(E), e1(E)))$
$\rightarrow cutting{-}agent(x, E))$

Since these rules help to lift information in the vocabulary of a more specific context to a more general one by relating the vocabulary, we will call them *lifting rules*.

We will use a number of ways to introduce conditions on contexts. If no misunderstanding arises, we will use E : to indicate that we enter the context of verb interpretation with the event variable E. If we enter this context from the outer context, which we assume here to always be the context of situation, S, for simplicity, we write $S : E :$. A condition P on context c we enter is written as $P(c)$:, so $cut(E)$: is the context of interpretation of the verb *cut*, and $specializes(c, b)$ & $P(b)c : b$: is some context b which specializes c, and is entered from c, and must be exited therein.

There is now only one component left: the rules mapping a situation type to semantic forms. Since they are to be verb-independent, they also require lifting rules, namely those relating a particular situation type to the context of the linking rules. We will introduce them with an example in the next section.

3.3.2 Linking rules

Now let us return to (68), where we assumed that the relation $argsubject$ is interpreted by some relation like $agent$. Such relations, which we call theta roles, are part of the theory of semantic role interpretation. Their appearance in the theory is motivated by the desire to have a verb-independent part of interpretation of semantic forms. Thematic roles types were defined as abstractions over similar argument relations in situation schemata. The situation schemata are special cases of a situation type, argument relations in situation schemata are specific realizations of thematic role types. Theta roles have situation types as there specializations. The predicates of such a theory must be abductively interpretable in terms of all the situation types. They are called theta roles to reflect the fact that they mediate between thematic roles (role types) and semantic forms.

Developing such a theory is difficult, and one reason of the difficulty are well-known verb argument alternations. Syntactic relations in an alternation become associated with different arguments of the same verb as an alternative realization of these arguments. To give an illustration: the verb *cut* participates in at least two alternations, the "middle alternation" and the "instrument subject alternation" (Levin, 1993):

(78) a. John cut the paper with the knife

b. The paper cuts easily

c. The knife cut the paper

Even when we disregard some subtle meaning shifts associated with these alternative realizations of arguments, we still face a problem of how to organize the alternatives in an abductive framework. We will cover the cases (78a) and (78c) only, since (78b) involves additional difficulties which we need not go into now.

Another difficulty is how to explain the particular principles of clustering of thematic roles in theta roles. A suitable theory could borrow some clustering mechanism which are known in linguistics, too, e. g. in the theory of argument selection by Dowty. David Dowty Dowty (1991) proposed to control the assignment of grammatical functions to semantic relations by semantic clustering mechanisms. He analyzed two groups of semantic properties which he considers to be prototypical of the role of the agent and the role of the patient in the situation (79, 80).

(79) Contributing properties for the Agent Proto-Role

a. volitional involvement in the event or state
b. sentience (and/or perception)
c. causing an event or change of state in another participant
d. movement (relative to the position of another participant)
e. exists independently of the event named by the verb

(80) Contributing properties for the Patient Proto-Role

a. undergoes change of state
b. incremental theme
c. causally affected by another participant
d. stationary relative to movement of another participant
e. does not exist independently of the event, or not at all

The clustering mechanisms are a kind of categorization or grouping criteria. The choice of the syntactic realization for a semantic relation is made dependent on how many prototypical properties from the list the relation has relative to its arguments. The argument which gives rise to more implications which are on the list of proto-agent properties will be realized as the subject of an active sentence in English. If two arguments give rise to approximately the same number of implications on the list, each of them can be realized as the subject (in the nominative case) in principle. Analogously for the non-agentive arguments of a three-place relation: the one which gives rise to more implications from the proto-patient list is realized as the direct object (i. e. in the accusative). The remaining argument is then realized as a prepositional object in English, but in languages with a rich case system there are other options.

Dowty's theory of argument selection is not one of the subject of the paper. Some clustering mechanism like that of Dowty's theory could be used in two ways in our theory, though. It could underly the choice of which thematic roles in a situation types are classified as a particular

theta role, e. g. as agents, patients, themes, etc, on the one hand. And it could play a role in determining whether a particular default realization of a theta role should be adopted. The number of theta roles is presumably determined by the design decisions of the language in question and probably depends the grammatically relevant distinctions made in his language.

These two problems notwithstanding, we can settle on an exemplary course to show the feasibility of the abductive treatment of theta roles: we will show, by an example how to model the instrument subject alternation in an abductive framework.

Modeling the alternations

Remember that the theory of linking rules is a theory of lifting rules in the sense this term is used in the theory of contexts. To model alternatives within such a theory we need a way to introduce options. To be able to state interactions between related a new mechanism will be introduced in abductive frameworks, the mechanism of constraints. Constraints will mimic the use of negation as failure rule (NAF) in an abductive framework, among other things. We will use the transformed form of the defaults in Poole systems, i. e. the form which has only atomic predicates as defaults. Remember that these predicates only imply the rules which we want to make cancelable.

The basic idea of using abductive frameworks for linking rules is to be able to state alternative realizations of thematic role types in general and all at once, and let situation types control the choice of a particular possible alternation, introducing some specifics, if necessary, by manipulating the defaults.

Let us now return to (71), which we repeat here as (81) with two modifications. Interpreting it we enter the context of the verb interpretation E. We changed the status of the agentive interpretation of the subject: instead of being a default it is now an absolute prescription: if there is an agent in the situation, it is the subject in the sentence in the active voice. This choice is motivated by the fact that in the alternations in (78) in which the subject is not missing but has an interpretation different from the agentive one is impossible to refer to the agent by an adjunct. Grammatical facts like $gfsubject(j, E)$ are something which is settled in the context once and for all and is not retractable.

(81) E :

$$A_{theta} =< \Gamma = \{agent(u, E) \rightarrow argsubj(u, E)\}, \Delta = \emptyset >$$

The theme is the direct object in (78a), but not in (78b). In other words, we need a default here. We assume that we have a special predicate $themeobj(x, e)$ which we consider to be a default, and the implication it has is the rule of the default, $theme(x, e) \rightarrow argdobj(x, e)$. Which gives us (82).

(82) E :

$$A_{theta} =< \Gamma = \{ agent(x, E) \rightarrow argsubj(x, E), themedobj(u, E) \,\&\, theme(u, E) \rightarrow argdobj(u, E)\} \Delta = \{ themedobj(u, E)\} >$$

If we have an instrument which can become expressed as the subject, we need another default, $instragent(y, e)$, which states that an instrument may be a subject, cf. (83).

(83) E :

$$A_{theta} =< \Gamma = \{ \; agent(x,E) \rightarrow argsubj(x,E), \; themedobj(u,E) \,\&\, theme(u,E) \rightarrow argdobj(u,E) \; instragent(y,E) \,\&\, instrument(y,E) \rightarrow argsubj(y,E)\} \; \Delta = \{ \; themedobj(u,E) \; instragent(y,E)\} >$$

We need two more defaults. One for the possibility that an instrument may be a real instrument, under which interpretation it is realized probably as an adjunct. In this case we assume that some relation cmt is introduced as a semantic form. And one for another possibility, under which there is no agent in the situation type, and the theme becomes the subject. The (almost) complete example theory is given in (84).

(84) E :

$$A_{theta} =< \Gamma = \{ \; agent(x,E) \rightarrow argsubj(x,E), \; themedobj(u,E) \,\&\, theme(u,E) \rightarrow argdobj(u,E) \; instragent(y,E) \,\&\, instrument(y,E) \rightarrow argsubj(y,E) \; realinstrument(z,E) \,\&\, instrument(z,E) \rightarrow cmt(z,E) \; themesubject(w,E) \,\&\, theme(w,E) \rightarrow argsubject(w,E)\} \; \Delta = \{ \; themedobj(u,E) \; instragent(y,E) \; realinstrument(z,E) \; themesubj(w,E)\} >$$

To complete the theory we need only to introduce the weak negations of the corresponding default predicates to be able to state their so-called negation as failure, NAF. The negation as failure rule runs like this (Nilsson and Maluszyński, 1990): it is allowed to assume that the negation of a predicate is present, if no contradiction can be deduced from the assumption. Such a negation is retractable, if an explicit contradiction occurs, but has the main property of the real negation otherwise: it contradicts the positive instances of the predicate. This rule can be modeled in an abductive framework (Dung, 1991). The modeling of NAF is done in Poole systems by means of constraints. A constraint is a formula which can be used to reject an explanation, but which cannot be used in deduction, e. g. to augment explanations. The definition of an explanation in an abductive framework with constraints, defaults and hypotheses is given in (85).

(85) $\Gamma \cup P \cup D$ *explains* ϕ if and only if
$(i) \Gamma \cup P \cup D \models \phi$
$(ii) \Gamma \cup P \cup D \cup C$ is consistent

where $D,\ P$ are ground instances of formulas from the set of defaults Δ and hypotheses Π, and C are ground instances of the set of constraints $\mathcal{C}$. An abductive framework is then a quadruple

$$A =< \Gamma,\ \Pi,\ \Delta,\ \mathcal{C} >$$

We may now state that a certain pair of predicates is contradictory, but we cannot use this contradiction to deduce that either one or the other holds. However, since NAF predicates are

constantly present in the background, they are modeled as permanent hypotheses in any framework. Therefore we shall not write them out explicitly. Any predicate $p(x)$ can have a NAF version, which will be notated as $\sim p(x)$. We may now tentatively propose a theory of linking rules.

(86) E :

$$
\begin{array}{lll}
A_{theta} =< & \Gamma = \{ & agent(x,E) \rightarrow argsubj(x,E), \\
 & & themedobj(u,E) \,\&\, theme(u,E) \rightarrow argdobj(u,E) \\
 & & instragent(y,E) \,\&\, instrument(y,E) \rightarrow argsubj(y,E) \\
 & & realinstrument(z,E) \,\&\, instrument(z,E) \rightarrow cmt(z,E) \\
 & & themesubject(w,E) \,\&\, theme(w,E) \rightarrow argsubject(w,E)\} \\
 & \Delta = \{ & themedobj(u,E) \\
 & & instragent(y,E) \\
 & & realinstrument(z,E) \\
 & & themesubj(w,E)\}, \\
 & \mathcal{C} = \{ & agent(x,E) \,\&\, \sim agent(x,E) \rightarrow \perp \\
 & & theme(u,E) \,\&\, \sim theme(u,E) \rightarrow \perp \\
 & & instrument(z,E) \,\&\, \sim instrument(z,E) \rightarrow \perp \\
 & & \ldots \text{for all other predicates} \\
 & & themedobj(x,E) \,\&\, themesubject(x,E) \rightarrow \perp \\
 & & instragent(y,E) \,\&\, realinstrument(y,E) \rightarrow \perp\} >
\end{array}
$$

Note that the last two constraints may be called *uniqueness of realization*, for obvious reasons. Another point worth mentioning: we must explain a number of relations *simultaneously*, which amounts to explaining a conjunction. The net effect under the definition of explanation is that constraints must be used for all explanations to check their explainability, defaults as well. This has as a consequence that we always have a choice between a default and its negation by failure, if the defaults is present. Assuming a negation as failure hypothesis in one part of the explanation of a conjunct blocks any positive instance of the default which might be needed in the other part.

Before we see how this theory works we have to say something about the situation type *cut*. The working hypothesis is that the situation schemata of cutting allow only the agent to be ignored, and the situation type requires the theme to always be realized, either as a direct object, or as a subject, disjointly. The subject realization is only allowed under special condition peculiar to all middles, but which we shall ignore for simplicity here. We use a small ad hoc theory for this case. We let *cut* be subcategorized for the direct object. If the subcategorization requirement is not met, the classical negation of the corresponding predicate is put the list of facts reflecting role of syntax. In this case the NAF of defaults is used to explicitly reject some default interpretations.

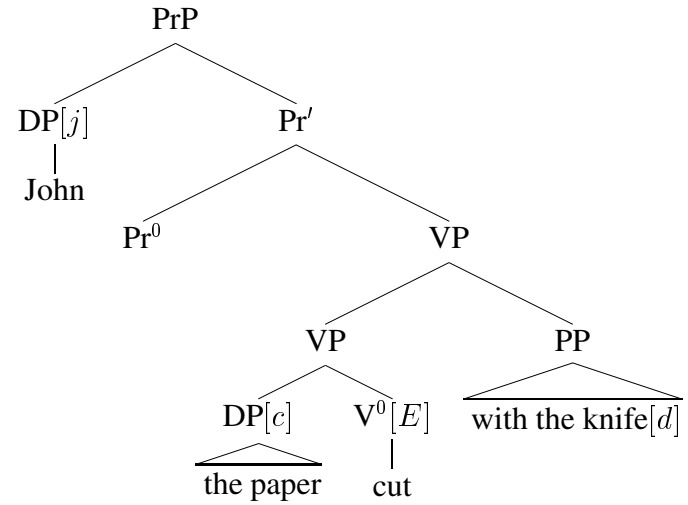
We enter the context of interpretation of the verb E. Note that different variables in a formula allow different discourse referents instantiate them in this formula simultaneously. This is required.

(87) $cut(E)$:

$$
\begin{array}{lll}
A_{cut} =< & \Gamma = \{ & cutagent(x,E)\,\&\,cutting{-}agent(x,E) \rightarrow agent(x,E) \\
 & & cuttheme(x,E)\,\&\,cut{-}object(x,E) \rightarrow theme(x,E) \\
 & & cutinstr(x,E)\,\&\,is{-}instrumental(x,E) \rightarrow instr(x,E)\} \\
 & \Delta = \{ & cutagent(x,E) \\
 & & cuttheme(x,E) \\
 & & cutinstr(x,E)\}, \\
 & \mathcal{C} = \{ & \neg gfdobj(x,E)\,\&\, \sim agent(w,E) \rightarrow \perp \\
 & & \neg gfdobj(x,E)\,\&\, \sim instrument(z,E) \rightarrow \perp\} >
\end{array}
$$

Now let us trace out the interpretation of (78a) to see how the theory works. The structure of(78a) is basically (88).

(88)



We have an abductive task (89) with syntactic facts and relations to be explained. We specify that S is the outer context, and E is the starting context of interpretation. The relation $adjunct(d,E)$ gets interpreted via the semantic form $cmt(d,E)$.

$$
(89)\quad S:E:\ \frac{\begin{array}{ll} A_{dobj} =< & \Gamma = \{\, gfsubj(j,E),\ gfdobj(c,e),\ adjunct(d,E) \quad cut(E)\},\\ & \Delta = \emptyset > \end{array}}{\begin{array}{ll} explain: & argsubj(j,E),\ argdobj(c,E),\ cmt(d,E) \end{array}}
$$

The relations $argsubj(j,E)$, $argdobj(c,E)$ and $cmt(d,E)$ can be interpreted according to (87)via

- $agent(j,E) \rightarrow argsubj(j,E)$
- $themedobject(c,E)$
- $realinstrument(d,E)$

Let us check whether this is indeed so. There is only one lifting rule applicable in case of $cmt(d,E)$, $realinstrument(d,E)$. We must choose it to be able to produce an explanation later. This blocks the explanation of $argsubj(j,e)$ via $instragent(j,E)$, by the uniqueness of realization. We still have two options, via $agent(j,E) \rightarrow argsubj(j,E)$ and via $themesubject(j,E)$. However we have only one option to explain $argdobj(c,e)$, i.e. via $themedobject(c,E)$. By uniqueness we cannot use $themedobj(j,E)$. So we must use $agent(j,E) \rightarrow argsubj(j,E)$.

Consider now (78b), and ignore the adverbial. On entering the context of the verb E we have now

(90) $S : E :$ $\begin{array}{l} A_{dobj} = < \ \Gamma = \{ gfsubj(c,E),\ \neg gfobject(x,E),\ adjunct(d,E) \quad cut(E)\}, \\ \qquad\qquad \Delta = \emptyset > \\ \hline explain: \quad argsubj(c,E) \end{array}$

Three options are present here: agentive reading, instrumental reading and thematic reading. Remember that we assumed that any situation scheme of cutting has some predicate which gets lifted to $cut{-}object(x,E)$. So we must enforce the use of $cuttheme(c,E)$ in any explanation. The theme is either an object or a subject. If there is no object, all alternative realizations of the subject are blocked via the constraints, since these enforce the use of NAF-contradictories during checking consistency. We are left with only one possible interpretation of the subject.

Consider now (78c). We have an object here, hence the theme is realized. One of the two possible interpretations of the subject is via the instrument default.

These examples were intended to show the work of the third component of the interpretation. With this we may proceed to explore the semantics of secondary predication in Russian.

4 The semantics of secondary predication in Russian: case studies

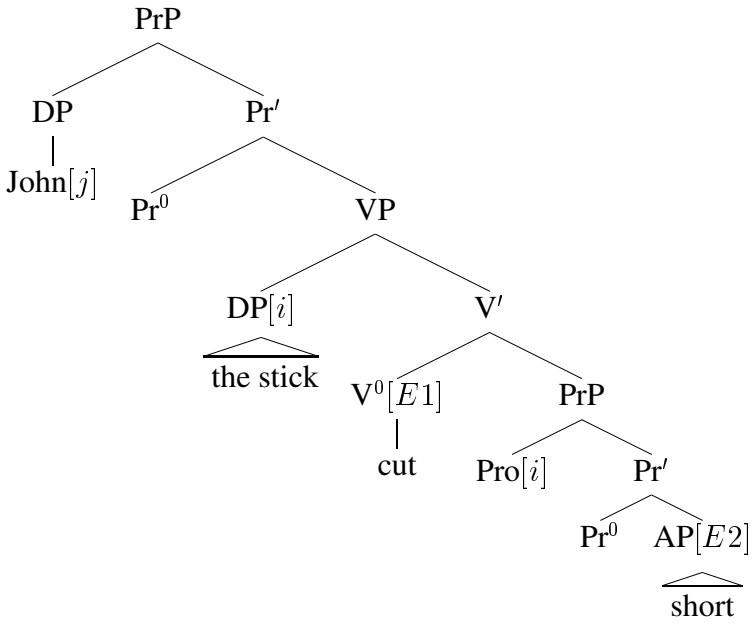
4.1 Basic semantics of SP and the absence of resultatives in Russian

There are a number of proposals concerning the formal semantic structure of secondary predication. We consider the analysis proposed by Rothstein (Rothstein, 2000, 2001) in a series of papers to be the most promising. In the first subsection we will introduce it and sketch a proposal of explanation of the absence of resultatives in Russian in the next section.

Recall that resultative secondary predication like (91) is exhibited by structures like (92), cf. Bowers (1997).

(91) John cut the stick short.

(92)



These structures suggest that resultative-SP are complex predicates. There are two basic variations on this theme: the complex resultative predicates are formed in the lexicon or they are formed in the syntax. The first line is exemplified by the work of Kaufman and Wunderlich (Kaufmann and Wunderlich, 1998; Wunderlich, 1997), the second by the work of Rothstein cited above and Winkler (Winkler, 1997). We consider Bowers' proposal at least compatible with the second line of analysis.

4.1.1 Rothstein's analysis of resultatives and Russian

Rothstein considers the relation between the primary and the secondary predicates be based on the generalized conjunction proposed by Laserson (Laserson, 1992). This is in line with our intuitive catalog of the properties of secondary predication from section 1.1. Given two predicates, $\lambda x \lambda e P(x, e)$ and $\lambda y \lambda s Q(y, s)$ generalized conjunction yields

$$\lambda x \lambda e \exists e1, e2\ (e = e1 \oplus e2\ \&\ P(x, e1)\ \&\ Q(x, e2))$$

according to Rothstein. But the operation of secondary predication is not pure conjunction, and is subject to additional requirements. First, the temporal course of the event $e1$ must be included in the temporal course of $e2$. Second, $e1$ and $e2$ must share one participant. Given this, (93)

(93) John drove the car drunk

gets the interpretation in (94), where $exp(e) = x$ is something like *x is the bearer of state e*.

(94) $\exists e, e1, e2(e = e1 \oplus e2\ \&\ drove(e1)\ \&\ ag(e1) = john\ \&\ th(e1) = thecar$
$\&\ drunk(e2)\ \&\ exp(e2) = john\ \&\ \tau(e1) \leq \tau(e2))$

Resultatives differ from depictives insofar as the secondary predicate, though conjoined with the matrix event, refers rather to its culmination, i. e. the relation is $\lambda x \lambda e \exists e1, e2(e = e1 \oplus e2\ \&\ P(x, e1)\ \&\ Q(x, e2\ \&\ \tau(cul(e1)) \leq \tau(e2))$. Note that cul is a structuring function: given e, either there is a unique $cul(e)$ or it is undefined. Whenever it is defined, there are at least two events which may be referred to by the summing operation. Rothstein, however, does not want to postulate two different constraint conditions on generalized conjunction, one for depictives and one for resultatives. She suggests that the occurrence of cul in the constraint condition is implicit: that this argument can be either the whole event or its culmination is because we only have two events available in the structure of the primary predication event: the activity event and the culmination of the main predication event she calls the becoming event. The activity event can only give rise to the depictive reading which is equivalent to the depictive reading based on the primary predication event itself, according to Rothstein. So the real difference is between the case where the constraint mentions the temporal trace of the culmination the matrix event and the one where the temporal trace of the the whole matrix event is relevant. Example (95) then has the interpretation in (96).

(95) John cut the stick short

(96) $\exists e, e1, e2(e = e1 \oplus e2\ \&\ cut(e1)\ \&\ Ag(e1) = john\ \&\ Th(e1) = thestick\ \&\ short(e2)$
$\&\ stateof(e2) = thestick\ \&\ \tau(cul(e1)) \leq \tau(e2))$

Two questions are to be asked before we can proceed. First, how does the generalized conjunction gets access to the culmination of the main predication event? Second, how does the result interpretation come from the mere conjunction?

Rothstein assumes that the structure of events which give rise to resultative interpretation of secondary predication is given by $\exists e, f1, f1(e = f1 \oplus f2 \,\&\, cul(e) = f2 \ldots)$, where $\ldots$ specify the relation between $f1$ and $f2$. The requirement for the generalized conjunction seems to be that it picks out some event predicate which is available in the VP. A technical solution is in order here, because verbs which support resultatives are not usually taken to be predicates of three event variables. Suppose we have found a solution. How do we get the result reading in (96)? For that matter, what is a result reading and what is a result?

We want to make as few assumptions and make them as uncontroversial as possible. On a pretheoretical level a result is an eventuality (an event or a state, but in our case clearly a state) which has at least the following three characteristics, in our understanding:

(97)
- (a) it is initiated by an event
- (b) the association between the event and the result has some systematicity
- (c) there is some (not just statistic) connection between the two

These characterization is very weak, of course, but it allows us to make two tentative assumptions. First, the (b) and (c) aspects can be reflected presumably at the level of situation scheme, but hardly at the level of situation type. Second, the (a) aspect gives us a formal structure of results which can be reflected in situation types.

(98) A result is a state $P(s, x)$ such that
$\exists e[Q(e) \,\&\, init(e, s) \,\&\, P(s, x)]$
provided (97b) and (97c) hold

Here x is the individual by virtue of which the state referent is in the situation scheme at all. We are specifically interested in event discourse referents which originate as arguments in situation schemata and situation types. We thus have two options: the e in (98) comes either as the event argument of the verb in the context of verb interpretation, or as one of the event arguments in the context of situation scheme. In the first case it is introduced as a sole argument of the verb, and therefore the predicate $P(s, x)$ expressing the result could be found in the syntax and have roughly the semantic form $\lambda e(init(e, s) \,\&\, P(s, x))$. In the second case the predicate would only be part of a situation scheme description because the initiating event is unavailable as a syntactic index. Since we see no reason to prohibit it, we opt for the first part of the alternative. Notice that $init(e, s)$ is the *abstract* representation of a result. It is not yet a result, since there might be pairs $< e, s >$ satisfying the predicate $init(e, s)$ where we would hesitate that the state is a result of the event. Take, for instance, Newton's apple. It is the description of the situation scheme instantiating the type that provides the missing factors which are therefore implied by $init(e, s)$ within the situation scheme. We restrict ourselves only to the level of situation types at this point, however.

Since Rothstein does not use $init$, let us switch to her terminology. The fact that $cul(e) = f2$ holds in $\exists e, f1, f1(e = f1 \oplus f2 \,\&\, cul(e) = f2 \ldots \,\&\, \tau(f2) \leq \tau(s))$, where s is a state, does not necessarily express that s is a result of e. We have to infer also in Rothstein's treatment that

s is not just any state which happens to temporally contain the temporal trace of the culmination of e, but a special state. Now what makes it special? The fact that $cul(e)$ is defined is due to the structure of the predicate in the extension of which e is asserted to be. The predicate should be telic (the property, which we will discuss in the next subsection). The culminations of the events of such predicates manifest the states of their respective arguments which come about as consequences of the events. Therefore, culminations should be instantaneous, or at least coincide with the beginning of the resulting state. But that the state expressed by the secondary predicate is asserted to be the resulting state must be due to the tacit assumption that the temporary trace inclusion between a culmination and a state *is always interpreted as asserting a result state*. We can then try to convert this reasoning to our framwork.

The structure $\exists e, f1, f1(e = f1 \oplus f2 \,\&\, cul(e) = f2 \ldots \,\&\, \tau(f2) \leq \tau(s))$ plays the role similar to our $init(e, s)$. The resultative aspects of both of these relations must be stated somewhere else. Though we avoid using the notion of culmination, we can express the resulting states of the same events. If there are other uses for cul, they play no role in the semantics of secondary predication, so we consider the two approaches to be equivalent here. We see therefore no reason converting the analysis of Rothstein for our purposes to be able to use $init(e, s)$.

Now what consequences does this treatment have for Russian, where resultatives do not occur? We have potentially two approaches to the absence of resultative secondary predicates in Russian:

- the $init(e, s)$ relation is not accessible for interpretation at the syntactic position of verb argument in Russian
- the inference to $init(e, s)$ at this position, although available in principle, is blocked for some semantic or pragmatic reason.

We do not want to assume that the syntactic construction is unavailable for syntactic reasons, since Russian knows argument small clauses of the kind *I consider him a fool*. And we see no reasons to maintain that there is a syntactic feature which blocks the access to culminations or prohibits the occurrence of $init(e, s)$, respectively. Rather, we think that structures of secondary predication occurring in Russian at the position where they may get this interpretation simply do not get it. Given Rothstein's view that resultative secondary predication is actually complex predicate formation, it can refer to the structure of the main predication event. Therefore we think that actually only the second way of explaining the absence of resultatives in Russian remains. In other words, something blocks one interpretation of a perfectly legitimate construction.

4.1.2 On the absence of resultative secondary predicates in Russian

We offer the following explanation of how this happens: Russian, but not English or German codes results of events in situation types. This coding is therefore lexical in Russian. It is also used by verbal prefixation. Verbal prefixation of simplex verbs (which are imperfective in Russian) produces telic predicates expressing results. Prefixation provides additional information about the results, and this information is associated with specific verb classes. Resultative secondary predication in English is not coded in the situation types and does not depend on the verb class. This distinguishes between complex predicate formation and prefixation. Prefixed

verbs in Russian are already resultatives, with class-specific semantics. Imperfective verbs in Russian cannot be made telic via quantization, since they induce a particular sense shift of their arguments which are in general not quantized. Since they remain atelic the culmination function is not defined for them and no structure supporting a resultative reading arises. Thus, if the interpretation of the syntactic frame of secondary predication could be made resultative via complex predicate formation in Russian, it would compete with the prefixation interpretation strategy for telic (perfective) verbs and fail for the simplex imperfective verbs. The prefixation interpretation strategy would win, since it plays an additional role for each verb class. Hence the interpretation of resultative SP is mostly blocked in Russian. And since it is mostly blocked, it is of very limited value for this language. We will expand this argument point by point now.

In order to give this argument we must first distinguish between telic predicates in general and resultative predicates. The literature on the notion of telicity is by now too vast to be reviewed here. The notion is believed to play a great role in describing the semantics of verb phrases and a number of grammatic reflexes of this semantics in various languages, (Krifka, 1989, is a good reference). The crucial point about the events of telic predicates is, to speak with Krifka (1998), that "... they require some time till they are completed." Any event in the extension of such a predicate reaches the point of completion. And there are different kinds of such points. Krifka (1998) notes that it does not make sense to classify events themselves into telic and atelic since one and the same event may be in the extension of both a telic and an atelic predicate. Thus, one and the same event may be described as *running*, i. e. by an atelic predicate, or by *running a mile*, i. e. a telic predicate which is true only of events which are events of running a mile. It is rather predicates or event types which have the property of telicity, (99).

(99) $\forall X \subseteq U_E[TEL_E(X)$
$\leftrightarrow \forall e, e' \in U_E[X(e)\ \&\ X(e')\ \&\ e' \leq e \rightarrow INI_E(e', e)\ \&\ FIN_E(e', e)]]$

An event predicate is telic, if it applies only to events e such that all the parts of e that fall under X are initial and final parts of e. Of course, we do not 'see' how the events in the extension of a telic predicate are completed, but if we have a suitable *description* of completion, the events do indeed group into a predicate. So, conceptually, each telic predicate must be associated with such a description. Note that the state in which this description holds true is a result state in our terminology. In Krifka's example above, providing a spatial bound on events amounts to such a description. One result of running a mile is a state in which the mile has been covered.

One point should be emphasized here. Krifka (1998) intends the algebraic structures used as models "... to be attempts to capture certain properties of the way we see the world, not as attempts to describe the world how it is" (p. 198). So, at least in principle, two different languages may "see the world" somewhat differently, but at least on a larger scale equivalently to the degree which excludes that one of them is a selectional hazard, evolutionary speaking.

Consider the question whether resultatives are telic under (99) on our approach. Suppose we postulate that if an event e with the bearer x initiates the state s so that our intuitive description of results is satisfied, does this state constitute the completion description of a telic predicate? Consider building a house until it is finished. If we allow only the temporally maximal events of building a house until completion to be in the extension, we have a telic predicate. If we also allow temporally non-maximal events, we violate the definition. Yet why should we not take the event of working on this house which does not contain the initial part of the maximal event, but contains its culmination and declare it also to be an event of building a house until

it is completed? One could answer that this is cheating, since we leave out a piece of work. But perhaps the resort to the maximality condition is dictated not so much by justice as by linguistic regimentation. So, if some language grammaticalizes telicity, the result predicates must be defined only on maximal events to qualify as telic[18]. Can it happen that non-maximal events are nevertheless useful?

Consider one way English expresses telicity. The pattern is well-known: a verb denotes a cumulative predicate which may become telic if the thematic argument of the verb is quantized. Thus, *John walked* and *John walked a mile* exhibit exactly this distinction: *walked* is atelic, *walked a mile* is telic. *John ate two apples* is telic, *John ate apples* is atelic. This can be proved, and since we shall need the proof in a moment, let us introduce some definitions and show the proof (they are from Krifka (1998)). Part-structures are latices as defined in section 3.2.2.

(100) X is cumulative in a part-structure P:
$\forall X \subseteq U_P[CUM(X)$
$\leftrightarrow \exists x, y[X(x)\ \&\ X(y)\ \&\ \neg x = y]\ \&\ \forall x, y[X(x)\ \&\ X(y) \rightarrow X(x \oplus y)]]$

(101) X is quantized in a part-structure P:
$\forall X \subseteq U_P[QUA(X) \leftrightarrow \forall x, y[X(x)\ \&\ X(y) \rightarrow \neg x < y]]$

Krifka has long since proposed that English, and German, and perhaps many other if not all languages define the incremental theme relation between an event and its bearer as a bijection which preserves the part-of structure. An incremental theme is something which is subjected to or undergoes a change part by part under he mereological part-of relation. If this is accepted, then we can prove that *John ate two apples* is telic. Here is the proof, which is based on the important assumption that the predicate $2apples$ is quantized.

- assume the contrary, i.e. that there are entities $x,\ e,\ e1$ such that $\exists y[2apples(y)\ \&\ EAT(x, y, e)]$ and $\exists y[2apples(y)\ \&\ EAT(x, y, e1)]$ and $e1 < e$.
- we introduce the corresponding objects a and b, obtaining $[2apples(a)\ \&\ EAT(x, a, e)]$, $[2apples(b)\ \&\ EAT(x, b, e1)]$
- since the relation between the second and the third arguments is a bijection for fixed x which preserves the part-of structure, we have $\exists z[z < a\ \&\ EAT(x, z, e1)]$
- again by the fact that it is a bijection we have $z = b$
- hence $b < a\ \&\ 2apples(a)\ \&\ 2apples(b)$
- This contradicts our assumption that $2apples$ is quantized.

Now let us return to Russian and consider example (102)

(102) džon jel jabloko
John ate-imperf apple-acc
John ate/was eating an apple

[18] We should, of course, be able to provide a solution to the imperfective paradox: *John is painting the hose red* does not necessarily imply that the result state is achieved.

Russian seems to behave similarly, with a slight variation that it has two big verb classes, the simplex verbs called imperfective (we mark with *imperf*) and the prefixed verbs, which are considered to be perfective, (we mark with*perf*). Simplex verbs are usually treated as atelic (cumulative), prefixed verbs as telic. Yet there are some disturbing dissimilarities as far as their behavior is concerned compared to English. This difference is reflected in the double translation of the verb in the above examples.

Russian imperfective *bežat'* (run) is indifferent to the addition of a path description. *Džon bežal (odnu) milu* (John ran a mile) does not become telic and does not really entail that John finished running a mile after having ran a mile. He could have perfectly well stopped in the middle, and the sentence would remain true. What counts is the description of the event: John must be running with the intention of covering a mile. Russian imperfective simplex verbs in the past form often behave similarly to English progressive, though they definitely not have the same semantic constraints on their use in discourse[19] This kind of behavior is general in the combination of a *imperf*-verb with the quantized theme argument. In English, the predicate *eat an apple* is telic, similarly to *eat two apples*, in Russian *est' jabloko* is not: it is unspecified, whether the eater consumed the apple, or even whether s/he intends to do it. What is important is that the event of eating be located 'within the bounds of an apple'. True enough, imperfectives cease to be cumulative with quantized arguments. But they do not become telic. Thus, quantization makes no prediction about the result, and imperfectives do not show resultative interpretation with quantized arguments.

But quantization of the arguments fails to always produce telicity even under prefixation, though it is often assumed that Russian verb prefixation produces verbs which are telic. Demjjanow (1998), p. 80 noted that simplex verbs when prefixed with *po-* (the so-called *pofective*) are not cumulative, but remain divisive, i. e. true of the parts of the event, if true of the event itself. Hence they are not telic. They also display the behavior of imperfective verbs. Filip (2000) gives the following general description of the meaning of this prefix: "The prefix *po* contributes to the verb the ... meaning of a small quantity or a low degree < of the event - Dem./Str. > relative to some expectation value...." The paper contains a thoroughgoing discussion of the observation that

> In sharp contrast to most perfective verbs, *po*-verbs are not acceptable in time-span adverbials, and they behave like imperfective verbs in that they freely co-occur with durative adverbials.

The reason for the divisivity is clear: any part of the event which is a small amount of, e.g., walking is also a small amount of walking. Filip comes to the conclusion that the semantics of perfectivization in Russian, though connected with telicity, is not based on the same mechanisms as in English. Similarly, Demjjanow (1998) concludes that it is impossible to identify the perfective/imperfective partition of verbs in Russian with telicity/atelicity.

We may tentatively conclude that similarity in the deviations from the telic/atelic pattern with quantized/homogeneous arguments and under prefixation by some prefixes in Russian both indicate that Russian somehow deviates from English in its view on the reality. What is the difference?

[19]Thus, it is common to hear *Ty čtal etu knigu?*, but it is strange to translate this with *Were you reading this book?*. The normal interpretation would be like *Have you read this book?*. But in Russian *Da, no ne do konza – Yes, but not to the end.* – is a felicitous answer.

A closer inspection of the proof of the quantization property of the cumulative predicate with a quantized argument above suggests that we could give up cumulativity of the base predicates, the homomorphism condition on the incremental theme relation, or quantization condition for nominal predicates. We see no reason to give up the first two. So the only assumption to go is the quantization assumption for nominal predicates like *two apples*. It could be substituted for by the following assumption which we call *Finite bounds*. The move seems worth while exploring [20]:

(103) **Finite bounds**:
In Russian, countable nominal predicates of objects treat objects in the context of imperfective verbs as small finite bounded lattices with the top element being the object itself, and apply to the parts, if they apply to the top element.

Two remarks could be useful in this connection. First, there is a kind of non-compositionality present here. But actually it is spurious, because is can be regarded as a sense shift (or regular polysemy), cf. Apresjan (1973), Nunberg (1995), Copestake and Briscoe (1995) and Strigin (1998). Second, we obtain an elegant way of expressing incompleteness if we allow parts of the object be potential, in the sense that they can be realized in some course of development of the present situation, but are not realized yet. Note that under this assumption an object x on this reading of nouns is a lattice which has a top element. We can therefore use $TOP(x)$ as a function denoting this element.

The *finite bounds* assumption makes it impossible for the imperfective verbs in Russian to have quantized arguments. We thus account to the fact that for most imperfective verbs there is no implication that only the whole object, i. e. the top element of this finite lattice is meant to undergo the change expressed by the verb. Eating an apple in Russian is eating only its parts as much as eating the apple itself. So *est' jabloko* (eat-imperf apple) means to eat pieces of apple, and only *perhaps* the whole apple. Building a house encompasses building its parts, and only *perhaps* the whole structure. Washing a dish is washing its parts, and perhaps the whole dish. Unless the verb requires the whole object (i.e. the top of the part structure), we are free to assume that we may be dealing with its parts only. With this assumption (102) is explained.

The *finite bounds* assumption is however only the beginning. Pragmatic constraints on the use of imperfectives are needed for *finite bounds* to function properly. Thus, for instance, eating two apples can seldom be described as being in the process of eating simply parts of two apples, and the combination of *dva jabloka* (two apples) with an imperfective *est'* (eat) sounds somewhat odd. But it is OK, if the eating of the two apples is conceivable as being done simultaneously. Also, if we explicitly express he idea that no top elements are involved, the imperfective is possible, cf. (104).

(104) on jel dva jabloka i ni odno ne dojel
he ate two apples but not one not finished eating
He was eating/ate? two apples, but did not finish even one

There is another, related, observation which could be perhaps explained using *finite bounds*. A *perfective* verb like *sjel* (ate up) can be used in *sjel jabloko* (ate up an/the apple) with the object

[20] Under the definition of part structures, a structure with a finite number of elements always has the top element, which is the sum of all the parts of the structure.

in the accusative case, or sometimes with the object in the genitive case, *sjel (nemnogo) jabloka* (ate up - a bit of - an apple). The latter form indicates that only part of the apple has been eaten up[21]. Genitive case with the imperfective, e. g. **jel jabloka* is unacceptable, unless the verb is negated *ne jel jabloka*. It can be assumed that genitive in this use always signals the exclusion of the top of the finite object lattice[22] and this would support our hypothesis that imperfective is normally associated with the objects which are not required to be the top of the finite object hierarchy: genitive with the imperfective is in general redundant.

Let us now return to the question of results. If the addition of a quantized argument to a verb denoting a cumulative predicate fails to produce a resultative reading of this verb, how does Russian go about expressing results at all, if there are no resultative secondary predicates either?

Demjjanow (1998) suggested that the important notion in the semantics of Russian verbs is that of a state which is either terminated or initiated by the event (in our present terminology). Her main idea is as follows: any of the 28-30 verbal prefixes introduces either one of these states or even both of them as its formal, underspecified meaning, or sometimes as a presupposed characteristics, together with some other aspects which constitute the lexical meaning of the prefix. The specification of this formal meaning depends on the prefix and on the verb class[23]. Demjjanow assumed that the relation which we now call either *init* or *term* is one single, weakly causative relation. Though we now think that the terminated and the initiated states differ in their status, we would like to keep this intuitive characteristics of *init*. The connection to telicity arises because the inclusion of the terminated or initiates state produces a telic predicate *on the assumption that the whole object is affected*.

In terms of our present model of semantics, if a situation scheme contains any relation which implies *init* or *term*, the latter must appear in the situation type and they appear there by virtue of a prefix. The verb becomes perfective. Roughly, a prefix introduces an additional condition on the event argument, perhaps in terms of its bearer, i. e. something like $\ldots \,\&\, init(E, s) \,\&\, s : P_{prefix}(TOP(x))$, where x is related to E in some way, P_{prefix} a condition to be specified under a particular prefix, and $TOP(x)$ is the lowest upper bound of x, i. e. the whole object. So, if prefixation concerns the theme, we have an analogue of the telic predicate. Prefixation quantizes nominal predicates.

Since verb prefixation in Russian is word formation and, consequently, happens outside of the syntax proper (a standard opinion), the variables of the prefix should be the same as the relevant variables in the verb interpretation context. Thus, prefixation is context specialization, i. e. we get a *new* context of verb interpretation. There may even be a number of such contexts for some verbal prefixes in Russian. Demjjanow (1998) argues that the additional meanings of the terminated or initiated states which depend on the verb are specified for these contexts relative to classes of verbs, and not so much for single verbs, though some verbs may themselves specify these meanings for particular prefixes, ignoring the class specification. Thus, the verb ***s**jest'* (eat up) could specify its additional semantics for the prefix **s** via a class of food consumption verbs.

[21]The academic Grammar of the Russian Language (Vinogradov et al., 1952) gives the following characterization of this use: a direct object can be marked with genitive case, if only part of the object is affected by the process expressed by the verb. In this function it is called genitive of the part or partitive genitive. Curiously enough the grammar does not mention that it can occur only with the imperfective.

[22]The genitive of negation

[23]Filip (2000) also notes this contextual dependency "...the basic accumulative and attenuative meanings $<$ of the prefixes *na* and *po* - Dem./Str. $>$ are manifested in a variety of ways, depending on the lexical semantics of the classes of base verbs with which *na* and *po* combine, and on the linguistic and extra-linguistic context.", p. 48

The meaning of **s** is very general, probably simply requiring the incremental theme of the verbs be TOP, hence the whole object consumed. As there are not so many such verbs which take *s*, it is also conceivable that they have direct connection to the prefix, an not via some special class. On the other hand Demjjanow (1998) showed that the prefix *pere-* is sensitive to at least three different classes of verbs, specifying its core semantics depending on the class.

Let us return to our example (95) and its Russian counterpart in (105).

(105) Petr **u**-rezal palku
Peter shorter-cut-perf stick
Peter cut the stick shorter

The Grammar of Modern Russian Literary Language (Švedova, 1970) names "to diminish (itself) by the action named by the motivating verb" among the eight plus meanings of the prefix **u**. Which is the meaning it is used here, making the Russian sentence correspond pretty closely to the English counterpart. The verb *rezat'* has here the same meaning, as *cut*, but is in the perfective, with the resultative interpretation that the stick became shorter as the result of cutting. This can be characterized by an abductive framework like (106). We consider this to be the context in which **u** has the "lessening" meaning, and call it $u[less](s)$. This context must be entered from the verb interpretation context, and exited therein.

(106) $specializes(E, c)\,\&\,u[less](c)E : c :$

$$
\begin{aligned}
A_u =< \quad \Gamma = \{ \quad & makesmaller(x, E, s, s1)\,\&\,\&\,term(E, s1)\,\&\,init(E, s)\,\&\,theme(x, E) \\
& \rightarrow theme(TOP(x), E), \\
& s : \mu(TOP(x)) = a, \\
& makesmaller(x, E, s, s1) \rightarrow init(E, s), \\
& s1 : \mu(TOP(x)) = b, \\
& makesmaller(x, E, s, s1) \rightarrow term(E, s1), \\
& a > b\} \\
\Delta = \{ \quad & makesmaller(x, E, s, s1)\} >
\end{aligned}
$$

The measure μ depends on the verb class, on the individual verb, and on the dimension of the object which the operation of cutting is applied to. We may assume that specializing contexts are only useful, if their defaults are used. Therefore we made $makesmaller(x, E, s, s1)$ a default. If this default is not applicable, the context is dropped and unavailable for interpretation.

The representation, and most of the properties of the Russian verb *rezat'* are similar to those of *cut*, so we may use the same situation type, i. e. consider (87) to be the abductive framework for *rezat'*, too. Any verb can be taken to specialize a verbal prefix context, so the application of the prefix results in the component-wise unification of the two abductive frameworks, i. e. the conditions on the contexts, the hypotheses and the facts. The interpretation by default is that the whole object of cutting becomes smaller as a result of cutting.

Now, according to our explanation proposal, the interpretation option which is available in English, the one via secondary predication, is blocked in Russian. In order to be able to compare the interpretation strategies for resultatives in Russian and in English we need an abductive framework for English resultative secondary predication. But since we already discussed the proposal by Rothstein, we will simply use its intuitive adaptation here, and reformulate it in the next section, where depictives are treated. We assumed that the resultative interpretation needs one more addition to the semantics proposed by Rothstein. This addition is rendered in (107).

(107) $E : s : Q(E, x)\ \&\ \tau(cul(E)) \leq \tau(s)\ \&\ s : P(x) \rightarrow init(E, s)$

What does his mean for Russian? If this is the requirement for resultative secondary predication, it is clear that $cul(E)$ is undefined for imperfective verbs, because there is no requirement that their themes be restricted to TOP. Hence the resultative interpretation for them would be impossible. For perfective verbs $cul(E)$ is defined, but then we have two interpretations which entail results. The prefixed interpretation explains $init(E, s)$ by an internal hypothesis of the verb interpretation, since exiting the context of prefixation we are again in the context of the situation type. The secondary predicate interpretation,which is also hypothetical, like any other interpretation, is an add-on from the syntax.

From here it is possible to argue that since prefixation is applicable in cases where secondary predication is not, viz. the case of imperfective verbs, and for prefixed verbs it can potentially lead to conflicts with the meaning of a prefix, hence of limited use, prefixation wins the competition. A more detailed explanation could probably be attempted in terms of bidirectional optimality theory Blutner (2000). This appears to be a promising direction of research. Alternatively, we may speculate on some ranking measure for explanations in abductive frameworks which could adequately express the above argument. But this seems at present to be a more distant perspective. We hope to be able to examine both directions in later work.

With this we may no turn to Russian specific instances of secondary predication. Remember that Russian has depictives, so for them the basic semantics is the one proposed by Rothstein.

4.2 Russian-specific instances of secondary predication

4.2.1 Basic semantics of SP: depictives in Russian

We thus use the idea of Susan Rothstein (Rothstein, 2000) that secondary predicates introduce a new eventuality (more like a state than like an event) which has at least one participant in common with the participants of the event of the modified clause. Moreover, the temporal trace of the event in the main clause should be included in the temporal trace of the eventuality introduced by the secondary predicate. In transforming this proposal into an abductive framework we should keep in mind that the semantics of secondary predication must be partitionable in two parts: the internal semantics of the predicative and the external semantics of the adjunct relation. The latter relates the internal semantics to the semantics of the modified clause. We assume this external semantics to be associated with the syntactic construction and not with any particular lexical item. But it is certainly possible to chose an implementation which ties the external semantics to some syntactic feature in the predicative adjunct.

It may probably be assumed that the adjunct relation is standardly interpreted as generalized conjunction, so this will be the constructional or external meaning of the secondary predication. We must then take care of the two additional constraints which characterize the semantics of SP on Rothstein's view. The common participant arises automatically via the control of the Pro-subject from the matrix clause, and therefore need not be postulated in the syntactic model we've chosen. The temporal inclusion relation between the temporal traces of the eventualities should be postulated. This seems to be indeed the hallmark of the secondary predication.

Let us consider the external semantics first. The generalized conjunction conjoins clauses, i. e. takes two event contexts, and produces a new context with a new event discourse referent. The

predication phrase PrP is not selected. This can be reflected in its status, e. g. with the help of some feature. Assume this feature is sp. It is interpreted as the temporal inclusion for temporal trace functions, and we can also use it to the context of the SP interpretation of the generalized conjunction. We also need the semantic form predicate, which interprets the syntactic adjunct relation. Call this predicate again $adjunct$. But this predicate has now an argument which introduces a marked context sp, so we have a three-place predicate $adjunct(E, E1, E2)$ and the name of the context $sp(E2)$. Thus, the secondary predication adjunct is interpreted by the following abductive framework.

(108) $specializes(E1, E) \;\&\; specializes(E2, E) \;\&\; sp(E2)\; E : E1 : E2 :$
$A_u =< \Gamma = \{ \quad spconjunction(E, E1, E2) \rightarrow E = E1 \oplus E2 \;\&\tau(E1) \leq \tau(E2)$
$spconjunction(E, E1, E2) \rightarrow adjunct(E, E1, E2)\},$
$\Delta = \{ \quad spconjunction(E, E1, E2)\} >$

The importing conventions will ensure that the abductive frameworks of $E1$ and $E2$ will be imported component-wise. This is the external semantics of the secondary predication.

The internal semantics depends on the nature of the secondary predicate and on the antecedent of the subject. The choice of the antecedent is the semantics of control.

4.2.2 The semantics of Pro and the hypothesis of Jakobson.

It seems that there are two factors which influence the choice of the discourse referent which is to be the referent of Pro. The first factor are the standard mechanisms of syntactic control of PRO, e. g. the c-command condition. We will abbreviate this case by the predicate $commands(x, u)$ computable on syntactic representations. The second factor is the membership in the group of discourse referents which are not mapped to the close syntactic environment of the verb. We would like to speculate that, unless something prohibits it, any discourse referent of this group may be the referent of Pro. This case will be abbreviated by $INSTR$, and we will have more to say about it in a moment. In both cases the core of the semantics of Pro is simply an equation between discourse referents, e. g. (109).

(109) $sp(E)\; E :$
$A_u =< \Gamma = \{ \quad gfsubject(u, E),$
$sempro(u, x, E) \;\&\; commands(x, u) \;\&\; argsubj(u, E) \rightarrow \;\&\; x = u,$
$\sim sempro(u, x, E) \;\&\; INSTR(x) \;\&\; argsubj(u, E) \rightarrow \;\&\; x = u\},$
$\Delta = \{ \quad sempro(u, x, E)\} >$

Note that the context of E must be marked as sp. This requirement would not allow the eventuality variable of the main verb to be picked up, after the resources of the context are imported into a broader context of verb interpretation.

This solution may be called *implicit control*. Normally, a discourse referent which stands in some thematic relation with the verb is realized overtly by a DP. DP adjuncts, if these exist, are not taken to stand in thematic relations with the verb. The idea formalized in (109) is as follows: a discourse referent which is thematically related to the verb may sometimes be not realized overtly, i. e. mapped to a DP, but can nevertheless be an implicit antecedent of Pro.

What seems to be a thematically non-related adjunct DP is actually a predicate of a thematically related discourse referent.

The first implication of the abductive framework A_u states that as long as discourse referent x introduced by a DP which $c-command\ Pro.$ it may be its antecedent. But the second clause involves this curious set of discourse referents $INSTR$ which are visible phonologically only via their predicates. According to the second implication they may also serve as antecedents of $Pro.$ As long as the secondary predicates follow the observation of Jespersen and pattern with the primary predicates, the result is actually semantically equivalent to the case when these discourse referents are realized by their own phonologically visible DP. Things become difficult for the hypothesis of implicit control when the DPs in the secondary predication construction are predicates which do not occur felicitously in primary predication construction. These are, e. g., strong quantifiers like *every* (Partee, 1987, contains the hypothesis explaining this behavior which we endorse here). We would like to retain Jespersen's generalization that secondary *predicates* are no different from primary predicates. We will discuss this property while reviewing the uses of Russian instrumental.

Now what are the discourse referents with the property $INSTR$?

Jakobson (1936) (reprinted in Jakobson (1984)) divides all case forms of Russian into two groups which he termed full case and peripheral case (Jakobson, 1984, p. 78).

> "'...I will call the I<nstrumental> and the D<ative> peripheral cases and the N<ominativ> and the A<ccusativ> full cases, and for the opposition between the two types I will use the designation **status-correlation** [*Stellungskorrelation*] in what follows. A **peripheral case** indicates that its referent occupies a **peripheral status** in the overall semantic content of the utterance, while a **full case** indicates nothing about such a status. A periphery presupposes a center; a peripheral case presupposes the **presence of a central point in the content of the utterance**, which the peripheral case helps determine... I would like to emphasize that what is specific to the peripheral cases is not that they indicate the presence of the two points in the utterance, but only that they render one peripheral with respect to the other."'

We will not attempt to explicate notions like *Stellungskorrelation* or *periphery*, but only use the partitioning. What is important in this partition is that the distinction is based not so much on the semantic properties of arguments, as on their status in the semantic representation, so that if they are important at all, then as a semantic or a pragmatic motivation for being classified in either way. It should be emphasized that according to Jakobson, if an argument gets assigned, e. g. *instr* instead of *nom*, this assignment is made sometimes in accordance with the point of view of the speaker on the entire situation, i.e. the assignment can depend on the conventionalized intention of the speaker to make some referent peripheral, if there is a choice. We therefore will assume that the speakers of Russian partition the discourse referents of the situation scheme characteristics into two groups: the core and the periphery. Secondary predication characterizes one part of the periphery.

We will say that a case is assigned to some discourse referent, if there is an explanation of the semantic form of the sentence by which it is associated with the syntactic position marked by the case. Full cases are assigned by hypothetical reasoning basically to the terms of the argument relations. But the instrumental is a peripheral case, and is assigned mostly to non-arguments.

Which means that we have a classification of the cases as a – perhaps formal – part of the semantic-syntactic interface, cf. (110). Here we explicitly mention the N(egation)A(s)F(ailure)-hypothesis $\sim fullcase(x)$.

(110) $A_{case} = (\Gamma, \Delta)$

$$\Gamma = \left\{ \begin{array}{l} \text{NOM}(x) \rightarrow fullcase(x) \\ \text{ACC}(x) \rightarrow fullcase(x) \\ argsubj(x,e) \rightarrow \text{NOM}(x) \\ fullcase(x) \;\&\; \sim fullcase(x) \rightarrow \bot \end{array} \right\}$$

$$\Delta = \left\{ \begin{array}{l} \sim fullcase(x) \\ \sim fullcase(x) \rightarrow \text{INSTR}(x) \\ argobj(x,e) \rightarrow \text{ACC}(x) \end{array} \right\}$$

This is a small case assignment theory. It works as follows. Both NOM and ACC are full cases represented as predicates based on feature sets which are due to the effects of syntactic operations. This classification of these predicates is a fact, i. e. it cannot be dropped or changed in the task of explanation. But we also need a default to the effect that full cases are only those which are explicitly classified as such. To do this we hypothesize that all the cases are peripheral, unless something contradicts it. The prefix $\sim$ here is a kind of negation, because the predicates $fullcase(x)$ and $\sim fullcase(x)$ are incompatible, as stated in $fullcase(x) \;\&\; \sim fullcase(x) \rightarrow \bot$, i. e. their conjunction implies the (always) false proposition $\bot$. But it is a special kind of negation, called *negation as failure* or NAF [24]. Moreover, it is an abductive formulation of NAF (Kakas et al., 1995). It functions as a default and is always applied, unless there is an explicit positive case. Now the case $fullcase(x) \;\&\; \sim fullcase(x)$ can never occur, because $\sim fullcase(x)$ is only a hypothesis which cannot be applied when there is a positive statement, i. e. a full case is present. Furthermore, we do not want to exclude the state of things when there are other peripheral cases, and therefore we assume that $\sim fullcase(x) \rightarrow \text{INSTR}(x)$ is only a default, too. What we now achieved is that the individual arguments x of $argsubj(x,e)$ or an $argobj(x,e)$ never belong to the periphery. Other thematically related discourse referents are there simply by exclusion from the group which is assigned to the full cases. Note that, e. g. $\text{ACC}(x)$ is not the name of the case, but only a mnemonically suggestive predicate. If a direct object gets partitive case assigned, it need not necessarily fall under this predicate. If we would like to consider this, we should make the assignment of accusative predicate a default, and perhaps be more explicit is the definition of our syntactic relations. Though we made the assignment of accusative to the direct object argument a default, we do not want do deal with genitive case here, and therefore use the $argobject$ predicate.

According to this theory, all the discourse referents x which are introduced in the situation which are not $argsubject(x,e)$ or $argobject(x,e)$ can in principle occur in the instrumental, e. g. a means of transport referent in a situation which allows for some means of transport, a path referent in a situation where the verb requires a path, a temporal specification, etc., but also a referent which denotes an instrument. The hypothetical character of the case assignment rule does not require that they must occur in the instrumental, however. There may be other case assignment rules or adjunct realizations which compete.

The rest of the paper intends to show how this core semantics may be used in accounting for other cases of instrumental. We restrict ourselves to basic illustrations and refer the readers to

[24] Cf. Clark (1978), Nilsson and Maluszyński (1990).

our papers Demjjanow and Strigin (2000b), Demjjanow and Strigin (2000a) and Demjjanow and Strigin (2001) for more. In particular, we will skip the derivations and use the DRT format to represent their results.

4.2.3 Simple adjunct-like SP: path and transport

With this basic semantics we can easily account for two simple uses of instrumental, namely the instrumental of path in (15l), and the instrumental of means of transport in (15o).

The instrumental of transport is probably the easiest case. If a situation characterized by the sentence contains the referent for the means of transport, this referent can be hypothetically taken to be the implicit antecedent of Pro in (109).

(111) On exal poezdom
He drove train-instr
He was going by train

(112)

$s \mid t_s\ now$	$u\ e\ e1\ e2\ z\ ls\ lg\ w$
$before(t_s, now)$	$he(u)$
$e = e1 \oplus e2$	$move(e1, u, ls, lg)$
	$theme(e1) = u$
	$msoftransport(e1, z)$
	$z = w$
	$e2:\ train(w)$

Here t_s is the time of the situation, ls, lg are the source and the target locations of the path along which the movement proceeds, $msoftransport(e, z)$ specifies that the situation type implicitly contains a referent for the means of transport. Russian seems to usually treat this referents as a member of the periphery of the eventuality description. The proposal predicts that the reading is only possible with situations which already have the appropriate referent. We can check this prediction in (113).

(113) *On spal poezdom
He slept train-instr
He slept while being transported by train

The sentence is unacceptable. It is of course quite possible to characterize the situation with the help of a locative PP.

(114) On spal v poezde
He slept in train
He slept on the train

The reason for the difference under our theory is the difference in the interpreting relations: locatives relate events within the situation to a location, whereas the instrumental of transport merely marks a predicate which may or may not characterize a means of transport.

We already noted that the problems with the predication theory for the predicates in the instrumental might start where the predicational status of the DP is concerned. The two adjunct-like uses under discussion are actually a confirmation of our hypothesis in this respect. If a quantified distributing DP is put into predicational *instr*, the result is unacceptable, cf. (115). If we manage to indicate that there is a need for the wide scope of *každym poezdom*, as in (116), the sentence becomes acceptable.

(115) *On exal každym poezdom
He went every train-instr
He drove on every train

(116) On exal každym poezdom dva časa
He went every train-instr for two hours
He drove two hours on every train

Similar effects are known for copula structures in English where quantifying-in gives some sentences an acceptable interpretation[25].

The treatment of the instrumental of path is essentially the same. However, some new points of interest arise. We have (119) as a partial representation of (118).

(118) On šel dorogoj
He went road-instr
He was going on the road

(119)

$s \mid t_s\ now$	$u\ e\ e1\ e2\ z\ ls\ lg\ w$
$before(t_s, now)$	$he(u)$
$e = e1 \oplus e2$	$move(e1, u, ls, lg)$
	$theme(e1) = u$
	$path(e1, z)$
	$z = w$
	$e2 :\ road(w)$

The availability of the path discourse referent in the representation of the situation is a necessary prerequisite, as the pair (120) and (121) shows.

(120) On šel asfaltovoj dorogoj
He went asphalt road-instr
He was going on the asphalt road

[25] Partee (1987) proposed a number of type-shifting operations to account for the semantic NP-type ambiguities. None of them would allow a distributive generalized quantifier like *every* to be a predicate. Examples like (117) seem to contradict it.

(117) This house has been every color

They motivated Partee to propose that nouns like *colour* are predicates of those properties which are among the entities of the domain of type e of individuals and (117) are cases of quantifying-in into contexts forming predicates out of properties.

(121) ??On spal asfaltovoj dorogoj
He slept asphalt road-instr
He was sleeping on the asphalt road

Although the example (122) seems to contradict this generalization.

(122) On spal dorogoj
He slept road-instr
He was sleeping on the road/way

it can be argued that *dorogoj* (way-$_{instr}$) is an adverb. The semantics of this adverb is a generalization of the part of any situation of movement which contains the referent for the path.[26] The accommodation of such an adverb in case of (122) can proceed by extending the representation of any situation which allows some participant to undergo movement simultaneously with the main eventuality of the situation. The extension is with that part of the movement situation which is associated with the adverb.

Quite in parallel to the use of instrumental to mark means of transportation, distributive quantification with narrow scope is bad with the instrumental of path, but not in general for paths, as (123) and (124) show.

(123) ??On projexal každym gorodom
He went through every town-instr
He went through every town

(124) On projexal po každomu gorodu
He went through upon every town-dat
He went through every town

4.2.4 The temporal use of the instrumental

The three temporal use of instrumental we would like to distinguish - the fourth type of Nichols, (13) illustrated in (14) and (125), the one illustrated in (14e), (15m), and that of (15n) present more difficulties.

Let us start with the forth type of Nichols. We assumed that the default mode of combination of a $PredP$ with the matrix sentence is that of generalized conjunction. The difficulty in (125) is that although the predication is of the subject, as with depictives, the sentence does not always assert the simple conjunction of the matrix sentence and the predicate expressed by the DP_{instr} together with the temporal restriction on their temporal traces. Intuitively, (125) does not mean that at some time in the past he was a child and ill, but rather that when he was a child there was a time or were times when he was ill.

[26] Isačenko (1962) noted that, although traditional Russian grammar theory often describes uses of nouns in the instrumental case as adverbs and speaks of adverbial derivation, in his opinion this kind of derivation does not really allow to form new adverbs. He proposed to characterize the process of forming occasional adverbs as *entstehung* (coming into being, emergence) rather than derivation. Some uses of DP_{instr} do gradually become adverbialized, hence reanalyzed syntactically and semantically. Such development is a separate topic of investigation, however.

(125) Reb'onkom on bolel
Child-instr he ill-past
He was ill as a child

What happens is we seem to restrict our attention to the time at which the secondary predicate is true, i. e. restrict the situation time to that time, and then assert the matrix sentence relative to this restricted situation. This assertion relative to a time satisfies the temporal inclusion condition. Nevertheless, we need to consider the information partition status of the secondary predicate in addition. There are some facts clearly suggesting that this is so.

First, note that from the fact that a person was ill as a child it follows that he was ill at some time. Now let us add a quantifying adverb to the sentence, e. g. (126).

(126) Reb'onkom on často bolel
Child-instr he often ill-past
He was often ill as a child

Clearly, (126) without the secondary predicate does not follow from (126): if someone was often ill as a child under the circumstances, he need not have been often ill in general under these circumstances. One view of what is going on is this: the quantificational adverb needs a restrictor; we seem to implicitly change the condition which restricts the quantificational adverb *často* (often) when we drop the secondary predicate. Therefore we must conclude that the temporal instrumental somehow goes into the restrictor clause in the quantificational structure of the sentence. But is this structure due to the adverb?

Suppose we use a different temporally dependent noun.

(127) Direktorom on bolel
Director-instr he ill-past
He was ill as a director/whenever he was a director

There may be several periods when the *he* of (127) was a director which are separated by times when he was not. Now, what (127) may mean is that at least some times when he was a director he was ill, but may also mean that each time he was a director he was ill. The second reading is no longer a conjunction, but rather a conditional. We seem to relativize the assertion that he was ill to either some or to all relevant periods during which he was a director.

Now we may unify the two kinds of quantification to produce (128).

(128) Direktorom on často bolel
Director-instr he often ill-past
He was often ill as a director/whenever he was a director

(128) has a reading on which the person was often ill each time he was a director. So the quantificational structure which is relevant in the case of the secondary predicate is introduced by this predicate. We may conclude that the secondary predicate may indeed serve as a temporal restriction in addition to it being a conjunct. The tripartite conditional structure appears, if we assume that the secondary predicate is a finite lattice, and the matrix clause assertion distributes on this lattice. It should be noted at this point that until this example we did not consider

abduction on tripartite structures. This extension is very important but complex. Therefore we will proceed in a more or less intuitionist way, assuming the formalization will give the results desired.

Second, there is a certain pragmatic implicature in case of (125). This sentence is perfectly OK *only when* the person referred to by *he* is not a child at the time of utterance! Otherwise it is infelicitous. Thus, (129) is odd on the "actual state of things"–reading, but OK in the *narrative present* use in which the restriction does not coincide with the time of utterance .

(129) Reb'onkom on často boleet
Child-instr he often ill-pres
He is often ill as a child

This implicature is unexpected, if we have to do with a simple conjunction. But it can be explained by pragmatic factors, if we assume that the temporal interval provided by the predicate in the instrumental should play a role different from the one played by the time of the utterance or the time of the situation which we assume to be simply a context. If we assume that it restricts the time of the situation, then, given the time of utterance, it is pragmatically superfluous to restrict the time of the situation to the time of utterance in Russian, since this is the default interpretation of the present tense.

The temporal restriction by a SP-DP_{instr} is a kind of presupposition. A denial of the assertion still refers to the period when the person was a child (130).

(130) On reb'onkom ne bolel
He child-instr not ill was
He was not ill as a child

This fact is reminiscent of Frege's argument about existential presuppositions of proper names. Frege argued that if the names were not presupposing their bearers, but rather asserting their existence, the denial of

(131) Kepler discovered Neptune

would have been equivalent to

(132) Kepler did not discover Neptune, or there was no Kepler.

which is usually not the intended meaning. Similarly with (130) or (133).

(133) On diektorom ne bolel
He director-instr not ill was
He was not ill as a director

The normal interpretation is the one which denies that he was ill when he was a director, and not the disjunction of the negations.

To develop a representation which may combine the two pieces of evidence we may partition the situation representation in the restrictor or presupposition part and something like scope or

assertion part. We adopt insofar the position discussed in Hajičova et al. (1998) and consider that our representations "... involve an operator with two arguments one of which (the Restrictor) serves in a sense as contributing (part of) the domain relative to which the other argument (the Nuclear Scope) is interpreted.". Though we do not want to definitively describe such an operator, we assume a bipartite structure reflecting a restriction and a scope.

This gives us a quantifier-like discourse representation structure for the representation of a proposition. We reflect it by partitioning he representation into two "boxes". The restrictor is the left sub-box, the predication is the right sub-box.

(134)

$s \mid u\ now\ E\ e1\ e2$	
$before(\tau(E), now)\ E = e1 \oplus e2$	$he(u)$
$e2 : child(u)$	$tau(e1) \leq \tau(e2)\ \ be{-}ill(e1)$ $theme(e1) = u$

If the secondary predicate can distribute over several time spans, we should have the representation in (135).

(135)

$s \mid u\ now\ E\ e1\ e2$	
$E = e1 \oplus e2\ \ he(u)\ before(\tau(E), now)$	
$e3$ $e3 : director(u)\ e3 \in e2$	$\rightarrow$ $e4$ $be{-}ill(e4)\ e4 \in e1$ $theme(e1) = u\ \ tau(e4) \leq \tau(e3)$

The represented reading is "every time he was a director, he was sometimes ill during this time". The addition of the adverbs like *často* (often) is straightforward: the tripartite structure introduced by the adverb replace the box to the right of the implication arrow.

The second temporal use of instrumental illustrated in (136) is representable as (137).

(136) Letom on bolel
Summer-instr he ill
He was ill this summer/in summer

(137)

$s \mid u\ now\ E\ e1\ e2$	
$E = e1 \oplus e2$	$he(u)\ before(\tau(E), now)$
$e2 : summer(e2)$	$tau(e1) \leq \tau(e2)\ \ be{-}ill(e1)$ $theme(e1) = u$

The somewhat unexpected, but perfectly justifiable assertion $summer(e2)$ simply states that the second eventuality is characterized as summer. A supporting evidence for this move is the fact that in Russian nominal sentences like *Leto.* (Summer.) or *Večer.* (Evening.) are quite OK. This can be treated as a present-tense copula sentence with a null subject which gets the event of the sentence as its interpretation.

The third temporal use of the instrumental, illustrated here by (138)

(138) Časami on čital
Hour-instr he read
He was reading for hours on end

is connected with the measure use of the instrumental. Measure instrumental was treated in Demjjanow and Strigin (2001), to which the reader is referred.

5 Summary

The paper made two contributions to semantic typology of secondary predicates, and proposed a model of semantic interpretation which allowed these contributions to be formulated in the first place.

It assumed a clausal syntax for the secondary predication in Russian. It also considered the instrumental case on the secondary predicate to be a reflex of the presence of predication phrase, around which this clause is built, following a number of researchers. The subject of the predication phrase is considered to be phonetically null, and controllable from the matrix clause.

Starting from these assumptions, the paper developed parts of a semantic model in which the meaning of the sentence is computed in the context through the use of hypothetical inference techniques known as abduction.

As a first contribution to the typological research the paper provided with the help of this model an explanation of the fact that Russian has no resultative secondary predicates. We proposed that English (and German) differ from Russian in the expression of telicity. English uses quantization of the thematic arguments to express telicity and telicity to express results. Russian does not quantize its thematic arguments in the imperfective, and uses the representation of results to express telicity in the perfective aspect. It was shown that the two strategies can be formalized in the proposed framework. What remains to be done is to provide criteria and the mechanism of strategy selection which would yield to other applications.

The second contribution of the paper to the typological studies was that it related depictive secondary predicates in Russian, which usually occur in the instrumental case, to various other uses of the instrumental case in Russian. It could be shown that inferential contextual specification of an underspecified meaning can help us to redefine the bounds of secondary predication in Russian, thus establishing a typological difference in the interpretability of a uniform syntactic structure in between languages like German and English o the one side and Russian on the other side. The core difference was proposed to consist in the fact that Russian speakers can reserve secondary predicates in the instrumental to characterize a special part of the eventuality structure which we called the periphery of the situation scheme, following Jakobson. In principle, SP in the instrumental can be predicated of any of these referents via the control of the null subject in the secondary predicate clause.

The proposals seem viable, but more work is required on their ingredients, in particular on the implications of these assumptions for other domains of research.

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