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

Measure instrumental in Russian*

Abstract

We will argue that some seemingly adverbial free DPs in the instrumental in Russian which are traditionally termed *measure instrumental* are best understood as secondary predicates. We present the relevant syntactic assumptions and propose a semantics of this use of DPs in the instrumental. This proposal bears on the distinction between adjunct modification and secondary predication.

1 Introduction

Russian displays a curious use[1] of non-argument (i.e. free) NPs in the instrumental case illustrated in (1). The use requires a NP in plural (we use DP in the following).

(1) a. On pil   vino stakanami
     He drank wine glasses-instr
     He drank wine by the glass

   b. *On pil   vino stakanom
     He   drank wine glass-instr

This use is sometimes subsumed under *instrumental of manner*. But we consider this use to be exemplified also by (2), where there is a measure-DP in the instrumental hence we shall call it *measure instrumental*.

(2) a. On pil   vino litrami
     He drank wine liter-instr
     He drank wine by the liter

   b. *On pil   vino litrom
     He   drank wine liter-sg;instr
     He drank wine by the liter

Intuitively we measure some object of discourse in terms of a unit of which there must be more than one with a possible additional implication sometimes, that the result is rather bigger then expected. The difference between (1) and (2) disappears, if we assume that *glasses* can serve to denote measure units by the process of metonymy. Another curious property of measure instrumental is that it disallows numeric specification, cf. (3).

---

(3) *On pil   vino p'at'ju litrami
     He   drank wine five   liter-instr
     He drank wine by five liters

It seems that if we treat the instrumental use of the instrumental case (i. e. when a DP in the instrumental is used to denote an instrument) as a DP- adjunct and semantically an adverbial, i. e. a predicate on events, the best solution would be to treat the measure instrumental as an adjunct and an adverbial, too. However, this use is not really instrumental, since even if we conjure up some obscure kind of instrumentality to be involved in the reading, a real instrumental allows singular whereas the measure use does not, though singular measure DPs are perfectly OK in other contexts, cf. (4).

(4) a. On razbil okno   stakanom
        He broke the window glass-instr
        He broke the window with the glass

    b. On otmeril   odin litr
        He measured one liter-acc
        He measured off one liter

Some other interesting things about measure instrumental can also be summed up by the statement that if we treat this use as a manner adverbial expressed by a DP-adjunct and measure the event directly, we will experience difficulties.

First, we need a derivative measure on events, since we actually measure some quantity of other stuff. We measure the stuff quantity which is expressed by the direct object in (2). We cannot directly encode what objects are the base of the measure though, because the use allows to measure quantities of different objects of discourse, cf. (5,6,7,8).

(5) On nedel'ami   čital etu   knigu
     He weeks-instr read this book
     He was reading the book for weeks

We measure the quantity of time which is associated with the temporal course of the situation described by the sentence.

(6) On xodil kilometrami   (peškom)
     He went kilometers-instr (on foot)
     (He used to walk kilometers and kilometers on foot)

Here we measure the spatial quantity of each of the *different* walks (i.e. paths traversed) which are involved in interpreting the iterative use of the verb.

(7) Jajca pokupalis' des'atkami
     Eggs bought-refl tens-instr
     Eggs were bought by tens

In this sentence we measure the number of the entities denoted by the plural subject of the passivized sentence.

(8) Ludi   sxodilis' tolpami
People went-refl crowd-instr
People were gathering in crowds

This is a very loose measure on human pluralities applied to the plurality denoted by the subject. In general, the measure should just make sense intuitively, i. e. there seems to be a fair amount of reasoning involved cf. (9).

(9) Bumagu   tratili   kilometrami
Paper-acc squander-3pers-pl kilometer-pl-instr
The paper was squandered/they squandered the paper by the kilometer

The second difficulty in the adverbial treatment of this use of DPs is that some syntactic constraints on the reading seem to be operative, too, since the reading is unavailable wrt. *indirect objects* or prepositional phrase adjuncts, cf. (10,11,12).

(10) My davali im   den'gi$_i$ pačkami$_i$
We gave   them money pack-instr
We gave them money in packs

(11) *My davali im$_i$ den'gi tolpami$_i$
We   gave   them money crowds-instr
We gave them money (and they were) in crowds

(12) *My xranili   arbuzy   pod   krovat'ami$_i$ des'atkami$_i$
We   preserved water-melons under beds   tens-instr
We preserved the watermelons under beds (and the beds were) in tens

On the other hand there are also semantic constraints on the verb, which require that the verb is imperfective or allows an iterative reading, cf. (13,14,15), so that we might conjecture that the structure of the event plays some role, too.

(13) *Policija arestovala   demonstrantov$_i$ sotn'ami$_i$
Police   arrested-perf demonstrators   hundreds-instr
The police arrested the demonstrators by the hundred

(14) Policija arestovyvala demonstrantov$_i$ sotn'ami$_i$
Police   arrest-imperf demonstrators   hundreds-instr
The police was arresting the demonstrators by the hundred

(15) *Ja pročital   etu   knigu   nedel'ami
I   read-perf book weeks-instr
I (have) read the book in weeks/during weeks

(16) *Ja vypil   vino   stakanami
I   drank-perf wine-acc gasses-instr
I drank (have drunk) the wine out by the glass

Such constraints seem to be in agreement with the hypothesis about the adverbial status of measure instrumental DPs. What are then the syntax and the semantics of these DPs? Are they DP-adjuncts, modifying the event, or are they something else?

We propose a syntax and a semantics of this use which treats plural DPs in instrumental case which denote measure units as secondary predicates. We adopt the proposal by Bowers and Bailyn that they are syntactically adjuncts with a specific structure: a functional category of predicates ($PredP$) constituting a small clause of sorts. We will also provide a semantics for them which is based on Krifka's notion of θ-role homomorphism (Krifka, 1998). Under this treatment a NP in the instrumental is a secondary distributive predicate with the intrinsic meaning "more than one" provided by the plural. This accounts for the lack of singular in this use. The secondary predicate introduces an event which is distributive and measures the event introduced by the main clause via the θ-role homomorphism. Thus, the restriction on the imperfectivity can be met. The distribution takes place because the event of the main clause and the event introduced by the second predicate share a participant. We suggest that measuring the event is semantically lowered to measuring any entity in the core part of the event. In other words, measuring it gives a characterization of an event in terms of its participants. We assume that the semantics involves the notion of inferential interpretation of an underspecified semantic structure relative to other possible interpretations. The interpretation leading to the measure instrumental consists in (a) employing the intrinsic meaning of the plural (more than one) to make an assertion and (b) to weakly measure the event in terms of its homomorphic characteristic discourse objects, if measuring can be done. The assertion is that the event is distributed according to the measure with the unit given by the predicate. The interpretation also specifies what the basis of measurement for the event distribution is in terms of the core discourse referents (i.e. what is measured). The discourse referent which is measured is syntactically constrained, so we have reasons to believe that this is indeed a secondary predicate in terms of the model of predicative structure of Bowers and Bailyn. The theory we propose allows us to draw a distinction to the temporal use of instrumental in (17).

(17) Letom   on často bolel
     Summer-instr he often be-ill
     In summer he was often ill

2   The Syntax of Secondary Predicates in Russian

We consider the majority of uses of instrumental case DPs in Russian to be secondary predicates (Demjjanow and Strigin, 2000a,b). We want to exploit this idea in the present case too, and consider measure instrumental to have the same syntax as depictive adjectival predicates, which also occur in the instrumental.

As far as the syntax of secondary predication in Russian is concerned, we shall treat secondary predicates in Russian as linguistic constructs sui generis. In other words, these are syntactically specialized constituents with an associated interpretation. This section deals with the syntax of secondary predication in Russian, the next one with the semantics of secondary predicate measure instrumental.

The brand of the syntactic theory used here[2] assumes that syntactic trees are binary. Granted the usual semantic definition of a predicate secondary predicates (SP, also for *secondary predication*) could potentially vary in the following two parameters:

---

[2]Chomsky (2000) is the latest development.

1. the secondary predicate is a separate constituent vs. is always embedded into some other constituent;

2. the secondary predicate or the constituent which embeds it is itself a complement or an adjunct.
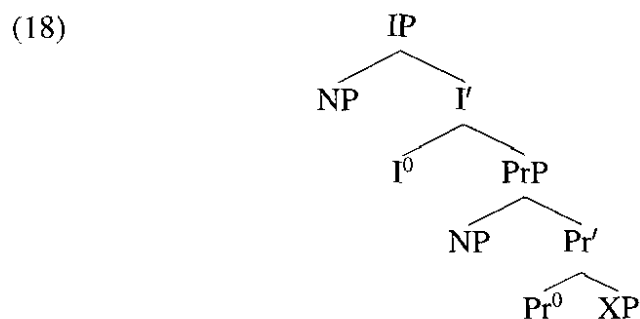
We will proceed on the following assumption of categorial uniformity:

Categorial Uniformity of SP

In all cases a secondary predicate is embedded in a uniform predication structure, i.e. a constituent of one characteristic type. The predication structures are distinguished according to their status: a primary predication structure is selected by a functional category providing temporal interpretation, say T, for definiteness, whereas a secondary predication structure is an adjunct to a category or a complement of a verb.

We consider however the second variation parameter to be free at least inasmuch as the position of an adjunct in the syntactic structure may vary, perhaps accompanied by some variation in the semantics, too.

As far as we know, the assumption concerning the syntax was first made by Bowers (1993)[3]. According to him any English sentence has at least one (i.e. primary) predicative constituent, as in (18). Bowers uses I in the cited paper, and T in Bowers (2001). We shall keep the notation of the examples.

(18)

```
                 IP
                /  \
              NP    I'
                   /  \
                 I⁰    PrP
                      /   \
                    NP     Pr'
                          /  \
                       Pr⁰   XP
```

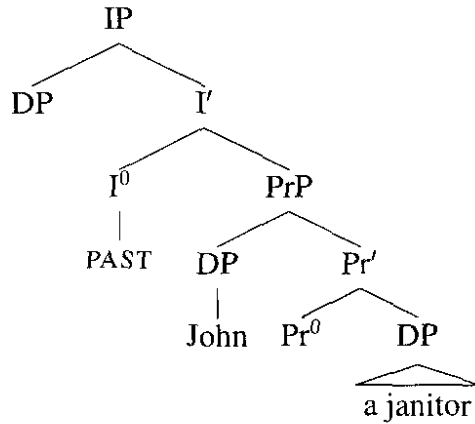The *XP* constituent in this scheme can be any major constituent with head in *V, A, N, P*, according to Bowers.

A simple copula sentence like (19) could have a partial syntactic structure like in (20). We shifted from *NP* to *DP*.

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

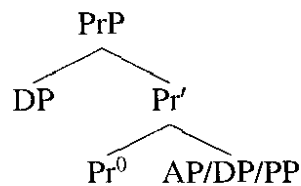[3]His use of the terms *primary predication* and *secondary predication* in the Appendix of the paper does not coincide with ours!

(20)

```
                        IP
                 ╱            ╲
              DP               I'
                          ╱          ╲
                        I⁰            PrP
                        │         ╱        ╲
                      PAST      DP          Pr'
                                │        ╱      ╲
                              John     Pr⁰       DP
                                              ╱‾‾‾‾‾╲
                                             a janitor
```

Secondary predicates have then the structure in (21).

(21)

```
              PrP
           ╱       ╲
         DP          Pr'
                  ╱      ╲
                Pr⁰    AP/DP/PP
```
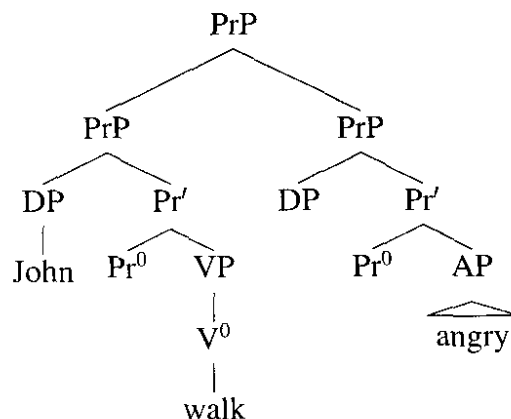
Consider the possibilities of secondary predication in English opened up by Bowers' syntactic model. We have three questions to answer. First, what is the syntactic site at which secondary predication phrase occurs, second what is the nature of the subject of the secondary predication phrase and third what is the relation between the host (i. e. subject of the secondary predication) and the subject of the predication phrase.
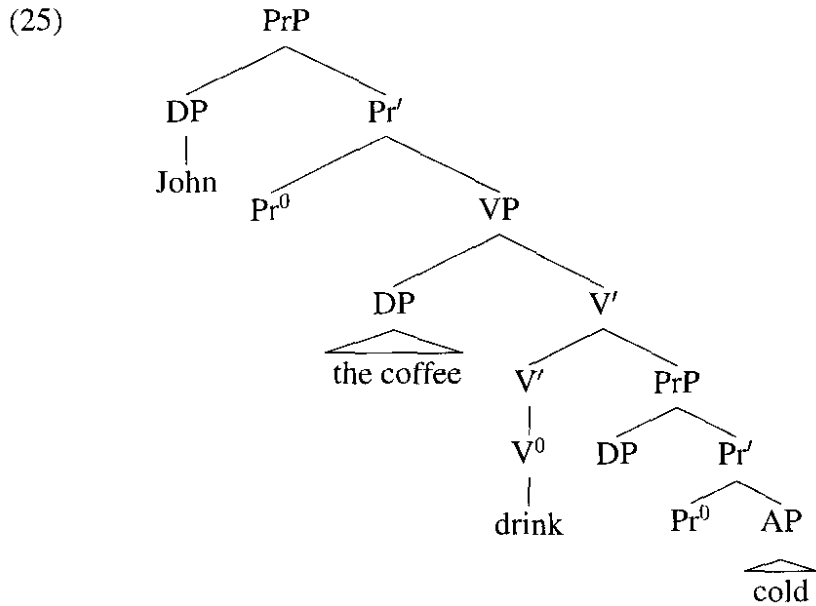
Depictive secondary predicates are treated in Bowers (2001) as small clause adjuncts. The sentence (22) gets the relevant structure in (24), sentence (23) that in (25).

(22) John walked angry.

(23) John drank the coffee cold.

(24)

```
                            PrP
                    ╱                  ╲
                 PrP                    PrP
             ╱        ╲             ╱         ╲
           DP          Pr'        DP           Pr'
           │        ╱      ╲                ╱      ╲
         John     Pr⁰      VP             Pr⁰       AP
                           │                     ╱‾‾‾‾╲
                           V⁰                    angry
                           │
                          walk
```

(25)

```
                         PrP
              ┌───────────┴───────┐
             DP                   Pr′
              |            ┌───────┴────────┐
            John         Pr⁰               VP
                              ┌────────────┴────────┐
                             DP                     V′
                          ⎰‾‾‾‾⎱          ┌──────────┴──────────┐
                         the coffee       V′                   PrP
                                          |          ┌──────────┴─────┐
                                         V⁰          DP              Pr′
                                          |                      ┌────┴────┐
                                        drink                   Pr⁰       AP
                                                                        ⎰‾‾⎱
                                                                        cold
```
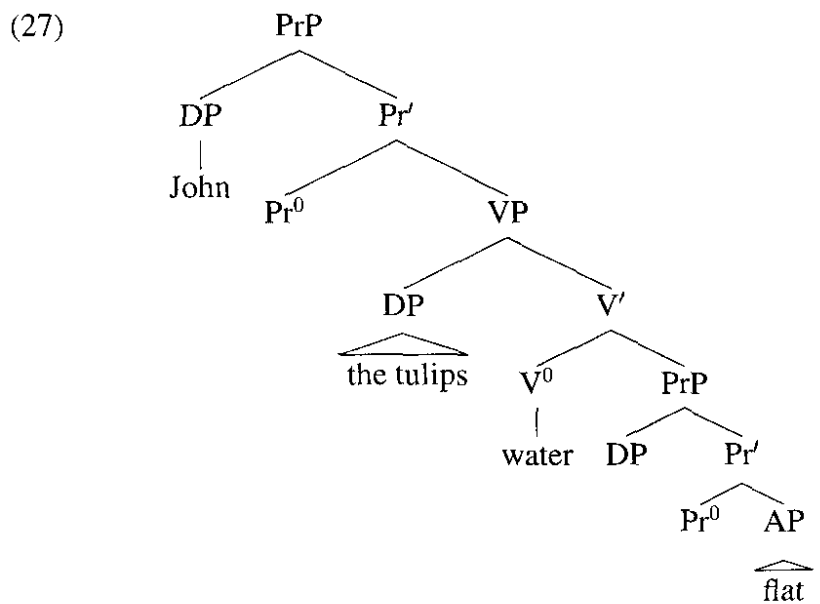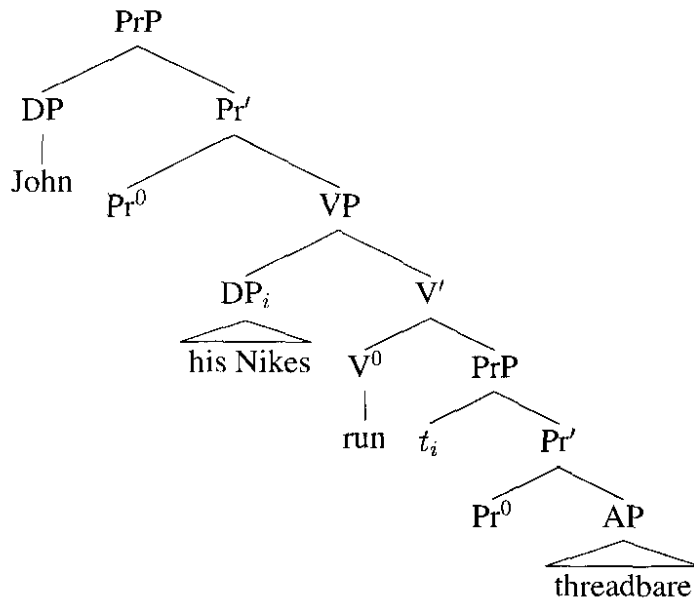
Resultatives are usually subdivided into weak and strong, cf. (Wunderlich, 1997). Weak resultatives have a secondary predicate which characterises the resulting state of the object of the verb, strong resultatives characterise the state of an argument which only is acceptable in the secondary predication construction and the verb is not sucategorised for it in the normal environment. Weak resultatives, e. g. (26), receive the relevant structure in (27), strong resultatives, e. g. (28), that in (29).

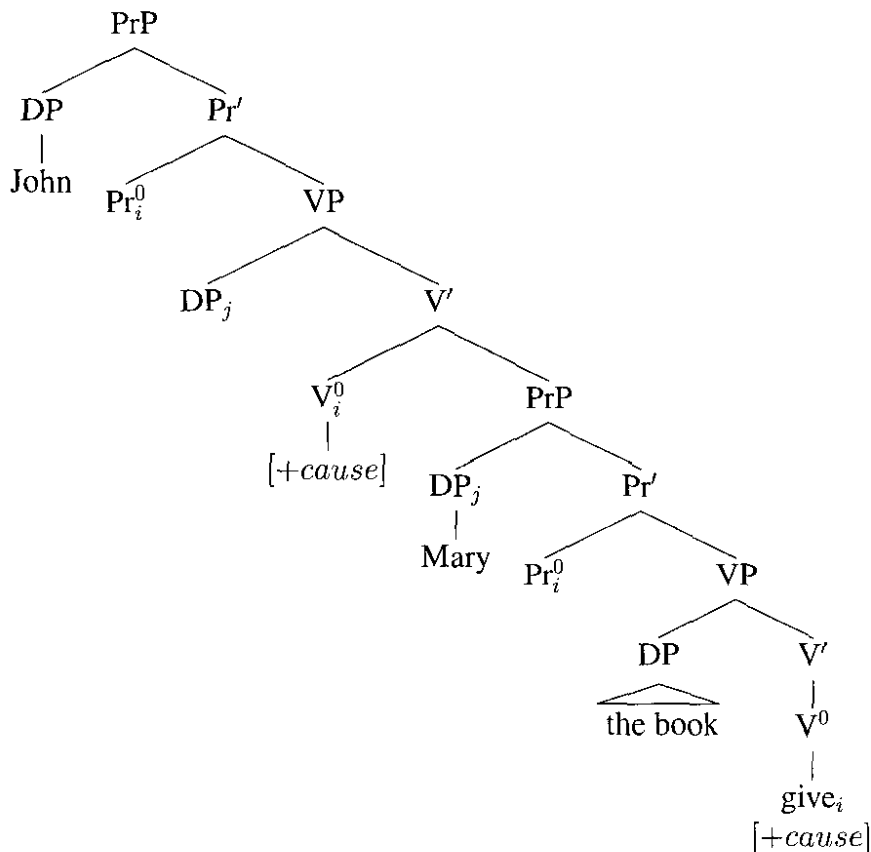(26) John watered the tulips flat.

(27)

```
                         PrP
              ┌───────────┴───────┐
             DP                   Pr′
              |            ┌───────┴────────┐
            John         Pr⁰               VP
                              ┌────────────┴────────┐
                             DP                     V′
                          ⎰‾‾‾‾⎱          ┌──────────┴──────────┐
                         the tulips       V⁰                   PrP
                                          |          ┌──────────┴─────┐
                                        water        DP              Pr′
                                                                ┌─────┴────┐
                                                               Pr⁰        AP
                                                                         ⎰‾‾⎱
                                                                         flat
```

(28) John ran his Nikes threadbare.

(29)

```
              PrP
            /     \
          DP       Pr'
          |       /   \
         John   Pr⁰    VP
                      /    \
                   DPᵢ      V'
                  /‾‾‾\    /   \
              his Nikes V⁰    PrP
                        |    /    \
                       run  tᵢ     Pr'
                                  /    \
                                Pr⁰     AP
                                      /‾‾‾‾\
                                    threadbare
```

Some verbs have three arguments. Bowers distinguishes verbs which take both a direct and an oblique object from verbs which take two direct objects at a first glance. An oblique object is simply the complement of V. This structural positioning will be important in a moment. The quasi-ditransitive verbs on the analysis given by Bowes are actually syntactically complex predicates, i. e. they are embedded in a second predicative phrase. Bowers codes this characteristics of such verbs by assigning them a special *syntactic* feature which he terms [+CAUSE] and which should be checked in the appropriate environment. The verb *give* is an example, cf. (30). Note that there is no syntactically reflected semantic decomposition, we have only a feature, which however is probably usually assigned to causative verbs.
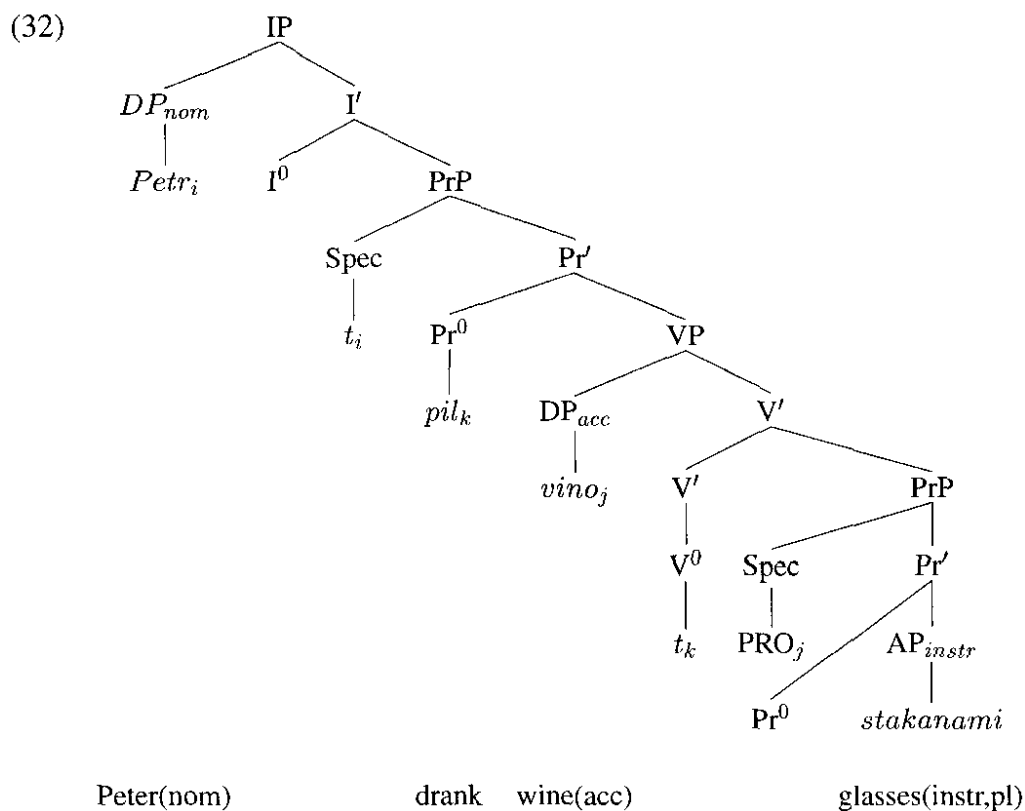
(30) a. John gave Mary the book.

b.
```
              PrP
            /     \
          DP       Pr'
          |       /   \
         John   Pr⁰ᵢ    VP
                      /    \
                   DPⱼ      V'
                          /   \
                        V⁰ᵢ    PrP
                        |     /    \
                    [+cause] DPⱼ    Pr'
                             |     /    \
                           Mary  Pr⁰ᵢ    VP
                                        /    \
                                      DP      V'
                                    /‾‾‾\     |
                                 the book    V⁰
                                             |
                                          giveᵢ
                                          [+cause]
```

76

To obtain the surface word order, the verb *give* moves to the head of the chain indexed with i via the intermediate positions to check the feature [+CAUSE], and the DP *Mary* moves to the head of the chain indexed with j. This characterizes the DP as the subject of one predication and the direct object of another. The necessary condition is, of course, that the semantics of the verb marked [+CAUSE] decomposes in this way.

We will adopt this structure for our purposes, but will have to say something about Russian, of course. Bailyn (1995) and Bailyn and Citko (1999) are two proposals to treat secondary predication in Russian. Russian does not have the resultative interpretation of SP, but does have depictive predicates. The AP-predicate is either in the instrumental or has the case congruent to that of its host. Bailyn assumes the structure proposed by Bowers for the start and suggests that the instrumental case is assigned by the Pr^0 head of the predicate phrase to a case-bearing predicate.

(31)

I(nom)   found   him(acc)   drunk(instr)
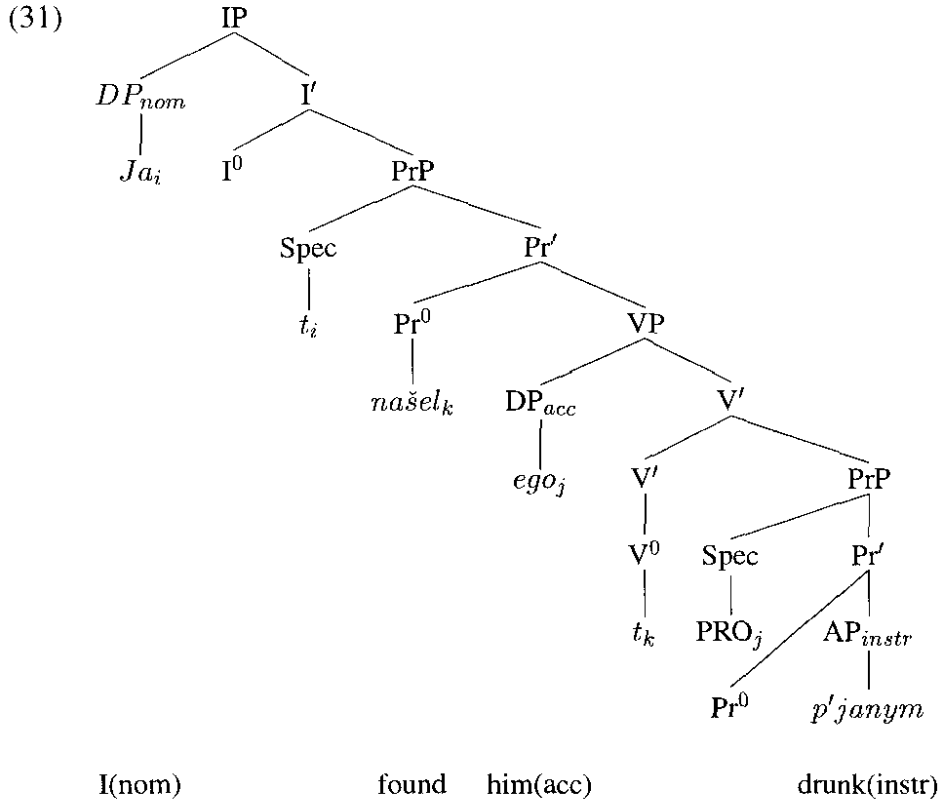
Russian has several other uses of DPs in the instrumental, including the use as measure instrumental we are now discussing. We will assume that measure instrumental is a further example of the structure which is assigned to depictives. This will answer the first question about the adjunction site.

(32)

```
                        IP
                   ╱         ╲
             DP_nom           I'
               │          ╱        ╲
            Petr_i     I⁰            PrP
                              ╱           ╲
                          Spec            Pr'
                           │          ╱        ╲
                          t_i      Pr⁰           VP
                                    │        ╱        ╲
                                  pil_k   DP_acc        V'
                                           │        ╱        ╲
                                        vino_j     V'           PrP
                                                   │             │
                                                  V⁰  Spec      Pr'
                                                   │    │      ╱    ╲
                                                  t_k  PRO_j  ╱   AP_instr
                                                              ╱        │
                                                           Pr⁰    stakanami
```

Peter(nom)   drank wine(acc)   glasses(instr,pl)

We must now say (provisionally) something on the status of *DP* in the secondary *PrP* here. According to Bowers it 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*). Given the standard assumption that the controller of PRO should be the closest c-commanding element we immediately obtain the syntactic restriction of the use of measure instrumental: neither the oblique object, which is a sister to V^0, nor the DP in the adjunct prepositional phrase are able to control PRO. There are, of course, many more things to be said about this design decision which we relegate to the footnotes here, however, as points to be discussed[4].

To answer the third question about the relation between the host and the secondary predicate, we should note that PRO-control is not usually supposed to cover the path and the temporal hosts of secondary predicates. We will assume that in Russian implicit controllers of PRO are possible, if they are consistent with the syntactic constraints. We must provide a formalization of this implicit control, of course.

The interpretation of the SP construction is thus an important point.

---

[4]Following Borer (1989) and Huang (1992), fn. 2, we do not distinguish between *PRO* and *pro*, and consider the whole predication constituent to be anaphoric, rather than the PRO-element, although we stick to the terminology of the quotations. We therefore consider the null subject of a small clause and the null subject of a null-subject finite sentence to be the same element. The proposal that depictives are 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. Both Franks and Hornstein (1992) and Huang (1992) seem to envisage the small clause with the *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, as in primary predication, either. The term *controlled predicate* is ours.

3 The Interpretation of the Predication Terms

3.1 The Predicate: the semantics of the measure instrumental

In discussing our views on the semantics of the measure instrumental we will use the representational format of the Discourse Representation Theory, DRT, (Kamp and Reyle, 1993). We adopt the view that an interesting theory of measure instrumental should at least attempt to explain the apparent diversity of uses of the DPs in the instrumental by reference to some common core. We take this common core to be the semantic relation of predication accompanied by different contextual accommodations. This approach takes therefore the measure DP in the instrumental to be a predicate.

It is impossible to recapitulate the whole DRT here, and we simply sum up the main technical conventions in the appendix. But some general remarks are in order. We postulate a sorted domain of discourse which contains individuals, atomic and plurality, events and event complexes, states and state complexes[5], and abstract measure units. Every one of these sorts including that of measure units 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 $\neg a \subseteq b$, then there exists an atom c such that $c \subseteq a \ \& \ \neg c \subseteq b$ (S is atomic), for all $a \in S$, $X \subseteq S$, if a is an atom, and $a \in X$, then there is 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. We shall use the convention that discourse referents which are in capitals get only pluralities (i. e. sums) as values. 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 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 the value of such predicates is determined in the model explicitly. Thus, if we have a predication like in (33), we can immediately go to (34), i. e. distribute via a conditional.

(33)
$$\begin{array}{|l|}
\hline
E \ X \\
\hline
E : predicate(X) \\
\hline
\end{array}$$

(34)
$$\begin{array}{|l|}
\hline
E \ X \\
\hline
\begin{array}{|l|} \hline x \ y \\ \hline X = x \oplus y \\ \hline \end{array} \Rightarrow \begin{array}{|l|} \hline e_1, \ e_2 \\ \hline E = e_1 \oplus e_2 \\ e_1 : predicate(x) \\ e_2 : predicate(y) \\ \hline \end{array} \\
\hline
\end{array}$$

To spell out the assumptions encoded in (33, 34) we should note that *predicate* is an event predicate. Moreover, we follow Krifka (1989) and assume his *Ereignis*homomorphism, i. e. that the structure of events mirrors the structure of the complex individuals which are the participants

---

[5]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.

in the event. Hence the distribution of the events parallel to the distribution over the parts of the complex individual. Similarly for states. As far as measure units are concerned, they were said to also form a complete atomic semi-lattice with a bottom element. This is a non-standard approach to measure functions and should be commented upon more extensively.

3.1.1 Measure functions.

A measure function[6] is a function with values which can be interpreted as a result of measurement which uses the measure function. The function $litres$, for example, maps quantities measurable in liters onto the set of real numbers. The function $bags$ maps quantities measurable in bags onto natural numbers. We need more abstract entities than natural or real numbers, however, for our purposes. Therefore we would like measure functions to be supplemented by measure quantities. We let a measure function map objects of measurement to mesure units via abstract measure quantities. Measure quantities can be defined as the results of measuring indexed by name of the function and the object which is measured. Then each abstract measure quantity provides a unique result of measurement. In other words, a measure quantity is a triple $< mq_1, mq_2, mq_3 >$ where the first coordinate is the name of the function, the second coordinate is the object measured and the third coordinate is the result of measurement, i. e. $mq_3 = mq_1(mq_2)$. Nouns like 'liters'introduce predicates which may thus be true of any plurality of measure units of the measure function $litres$, i. e. of measure quantities such that $mq_1 = litres$, and 'three liters' is a predicate true of measure quantities which measure three liters. The most common use of measure nouns is when they are modified by a noun denoting the measured stuff, and in such cases we are tempted to reinterpret such nouns as denoting the stuff itself. Three liters wine is any measure quantity $< mq_1, mq_2, mq_3 >$ with the second coordinate of mq_2 being a quantity of wine, and which has $mq_1 = litres$ and $mq_3 = 3$. But by metonymy three liters wine may be thought to be a quantity X of wine such that $litres(X) = 3$. However, we still need that three liters wine is an object consisting of three-liter-quantities, since we say things like *Three liters are more than two liters*. Thus, we consider any representative of the equivalence class of measure quantities with $litres$ as the first coordinate and 3 as the third coordinate to be a quantity of three liters. A process of metonymy must allow the indefinite plural noun 'liters' to denote a sum of quantities of the corresponding measure function for liquids and simultaneously a sum of objects which are measured, i.e. a volume of a liquid. We shall use $litre$ to denote the indexing measure function of liter measure quantities in the sequel. This function will have values in abstract liter quantities, if applied to a volume of something. Thus, $litre(x) = < litre, x, n >$. We also postulate, that whenever $X = x \oplus y$ and $3d(liter(X)) = n$, then $n = 3d(liter(x)) \oplus 3d(liter(y))$, if the two objects x, y are disjoint; $3d$ is the third coordinate of the triple. Similar principle is true of the measure quantities: $X = x \oplus y$, x, y disjoint, and $3d(liter(X)) = n$ implies $M_X = m_x \oplus m_y$, where M_X, m_x m_y are measure quantities associated with the objects.

3.1.2 Measure nouns as predicates

To develop the idea of the metonymic use of bare measure nouns, we will simply leave it open in the lexicon which variable is abstracted on. The two representation possibilities of the semantics of the noun 'liters' can be then summed up in (35). Note that since only two discourse referents are listed as plural only they can be the basis of the plural predicate.

---

[6]For a discussion of the use of measure functions in the semantics of natural languages, see Krifka (1998)

(35)

$$\boxed{\begin{array}{l} M \; m_1 \; m_2 \; X \; z \; w \\ \hline M = m_1 \oplus m_2 \\ X = w \oplus z \\ litre(w) = m_1 \; litre(z) = m_2 \end{array}}$$

We now have the option of taking either Ms or Xs be the denotation of the noun, depending on the context. In a similar vein we may have a predicate which refers to M or to X as its abstracted variable. However, there is a problem with this approach as far as primary predication is concerned. Consider the sentences in (36).

(36) a. These are liters.

b. These are three liters.

c. *The wine is/are (three) liters.

Of these three, (36a) is appropriate in a context where someone is shown a measure vessel and gets the scale on the vessel explained; (36b) is also possible in this context. It can also be used in a context where someone is shown a flask of wine. But (36c) is not acceptable in this context. In fact it seems there is no context whatsoever where this sentence is acceptable. One explanation is that the metonymic process is restricted to some grammatical contexts, and is not available in the context of primary predication. The context we are interested in and where it is available is that of secondary predication.

We have to define what secondary predication is semantically. For the purposes of this paper we consider the semantic relation of predication to hold between a case-bearing category which is the complement of Pr^0 (the predicate) and its specifier Pro (the subject). Given that agreement holds between the two elements, the interpretation of Pro is a plural individual variable, if the predicate is defined for pluralities (what Kamp and Reyle call a complex individual; we use the term 'plurality discourse referent' equivalently). We assume that the default internal interpretation of plural secondary predication is simply a distributive universal quantification with substitution-like equalities. Thus, (37) denotes a set of complex individuals which are measured in liters.

(37)

$$\boxed{\begin{array}{l} X \\ \hline \boxed{\begin{array}{l} x \; y \\ \hline X = x \oplus y \end{array}} \Rightarrow \boxed{\begin{array}{l} M \; m_1 \; m_2 \; Y \; z \; w \\ \hline M = m_1 \oplus m_2 \\ Y = w \oplus z \\ litre(w) = m_1 \; litre(z) = m_2 \\ x = w \; y = z \end{array}} \end{array}}$$

Since there are no further constraints on X except that it is a complex individual, the predicate measure noun *can* be interpreted as denoting a predicate on individuals. We now have the PrP-internal interpretation of the secondary predication relation. Yet the semantics of the secondary predication in general is far from complete.

3.2 The Semantics of the PrP-adjunct.

We explore 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 time course (run time) of the event in the main clause should be part of the time course of the eventuality introduced by the secondary predicate. The semantics of secondary predication falls thus in two parts: the internal semantics of the predicative adjunct and the external semantics relating 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. We will not discuss this alternative here, since it is not the main problem of the paper.

The first part of Rothsteins idea concerns the eventuality which is associated with a complex individual, and (38) is its implementation.

(38)

$$
\begin{array}{|l|}
\hline
E\ X \\
\hline
\left[
\begin{array}{|c|}
\hline
x\ y \\
\hline
X = x \oplus y \\
\hline
\end{array}
\right]
\Rightarrow
\left[
\begin{array}{|c|}
\hline
M\ m_1\ m_2\ Y\ z\ w\ e_1\ e_2 \\
\hline
M = m_1 \oplus m_2 \\
Y = w \oplus z \\
e_1 \subset E\ :\ litre(w) = m_1 \\
e_2 \subset E\ :\ litre(z) = m_2 \\
x = w\ y = z \\
\hline
\end{array}
\right] \\
\hline
\end{array}
$$

The idea is that the abstract event or state of measurement of a complex individual consists of states of measurement of its parts. Note that we explicitly assign structure to the eventuality via individual states assigned to the parts of the complex individual using kind of homomorphism which follows the proposal of Krifka (1989), as noted earlier. We have to specify how this representation is integrated with the representation of the modified sentence. This is the second part of the interpretation of measure instrumental, the external part.

The interacting discourse objects are an eventuality and an individual. Given that the modified clause already introduced an eventuality we have to specify which relation holds between the eventuality of the main clause and the eventuality of the second predicate. According to Rothstein and a number of other researches the time course of the eventuality of the main clause should be within the time course of the secondary predication eventuality. The specifics of the proposal of Rothstein is that the two should form a sum. This treatment follows the proposal of Laserson on the nature of conjunction. A conjunction of two sentences denoting eventualities e_1 and e_2 denotes the sum e of the two, i. e. $e = e_1 \oplus e_2$. We might assign the summing operation as the interpretation of the SP adjunct structure itself. Another condition of Rothstein, namely that the two eventualities should share one participant is automatically taken care of due to the fact that Pro requires a controller within the discourse domain set up by the discourse representation of the main clause. Note that the distinction between the event of the primary and the event of the secondary predication is still preserved in the temporal condition.

Now, assume the representation of the main clause of (2a) without a secondary predicate in the instrumental is like in (39). We skip the temporal information for the moment, and employ a more explicit format.

(39)

$$\begin{array}{|l|}
\hline
e_m\ j\ v \\
\hline
he(j) \\
drink(e_m) \\
agent(e_m)\ =\ j \\
theme(e_m)\ =\ v \\
wine(v) \\
\hline
\end{array}$$

The format of the verbal information specifies the type of the situation which provides the object of measurement $(drink(e_m))$ and lists the agent and the theme of the event $(agent(e_m)\ =\ j$, $theme(e_m)\ =\ v)$. Then the final representation of (2a) should be something like (40.)

(40)

$$\begin{array}{|l|}
\hline
E_\oplus\ E\ e_m\ j\ v\ X \\
\hline
\tau(e_m)\ \subset\ \tau(E) \\
E_\oplus\ =\ e_m\ \oplus\ E \\
he(j) \\
drink(e_m) \\
agent(e_m)\ =\ j \\
wine(v) \\
theme(e_m)\ =\ v \\
v\ =\ X \\
\\
\begin{array}{|l|}
\hline
x\ y \\
\hline
X\ =\ x\ \oplus\ y \\
\hline
\end{array}
\ \Rightarrow\
\begin{array}{|c|}
\hline
M\ m_1\ m_2\ Y\ z\ w\ e_1\ e_2 \\
\hline
M\ =\ m_1\ \oplus\ m_2 \\
Y\ =\ w\ \oplus\ z \\
e_1\ \subset\ E\ :\ litre(w)\ =\ m_1 \\
e_2\ \subset\ E\ :\ litre(z)\ =\ m_2 \\
x\ =\ w\ \ y\ =\ z \\
\hline
\end{array} \\
\hline
\end{array}$$

Here, $\tau(e_m)\ \subset\ \tau(E)$ means the time course of the first event is in the time course of the second event. As noted already, we do not necessarily specify the sort of the eventuality, partly to avoid the controversy over the status of measurements.

The difficult piece of the proposal is how to ensure that the correct controller is chosen. We might assume that as far as explicit arguments are concerned Pro is controlled in accordance with general principles of control, i. e. its discourse referent is constrained by some discourse referent of a DP which c-commands it.

But for the proposal to function properly we should also admit non-standard cases of control where the referent is implicit, i. e. not realized overtly. This is not the kind of control which is characteristic of infinitives, though we have some similarities in the case of explicitly realized arguments, and we need a theory of implicit control.

4   Implicit control

4.1   Abduction as a mechanism of control

The theory of inferential interpretation which we propose is based on hypothetical inference.[7] Inference is a process by which consequences are derived from assumptions. The derivation

---

[7]Strigin (1999) contains more on the theory, cf. also Hobbs et al. (1993).

proceeds in steps which are justified by rules of inference. A rule of inference is based on a set of propositional patterns (premises) and a set of consequences. Whenever a set of propositions matches the assumption pattern, consequences corresponding to the rule can be drawn. An inference rule is sound if whenever the premises are true the consequences are also true, i. e. the consequences follow logically (in the sense of classical logic) from the assumptions (Genesereth and Nilsson, 1987). Deductive inference uses only sound rules.

The situation with hypothetical inference is different. If we have a set of propositions which matches the pattern of *consequences* of some sound rule, we could *assume* that the premises are satisfied, too. If there are alternative sets of premises which imply the consequences, we could speculate which of these are better assumptions given the task in question. This use of the rules of inference underlies the hypothetic or abductive inferencing. Suppose we take *modus ponens* in (41).

(41)

$$\frac{p \quad p \to q}{q}$$

If we have p and $p \to q$, *modus ponens* allows us to infer q. Now suppose that what we have is q and use the rule in the reverse direction. We get p, if $p \to q$ obtains. We know that p implies q relative to $p \to q$ and we thus move to a smaller set of models in which not only q, but also p holds. This can be a hasty decision, of course, and our assumptions may turn out to be wrong, given more knowledge. The rule *modus ponens* used backwards is therefore not sound. Moreover, we would probably want to specify what rules are usable, so as e. g. not to derive q by hypothesizing it, since $q \to q$ always holds, or not to use conditionals with always false antecedents, since we want our hypothetically derived knowledge to be consistent. To do this we might select some qs as admissible hypotheses.

C. S. Peirce was the first to take abduction seriously. The following quotation (42) is taken from Peirce (1992).

> "If μ were true, π, π', π'' would follow as miscellaneous consequences.
(42) But π, π', π'' are in fact true
∴ Provisionally, we may suppose that μ is true.

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

> If μ is true, π, π', π'' are true
μ is true
∴ π, π', π'' are true."

A simple formalization of this idea Poole (1988) is as follows: a subset P of ground instances[8] of the set of some possible hypotheses Π is an explanation for ϕ, according to (43).

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

---

[8]Ground instances are basically substitution instances of formulae 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 (43ii) is violated.

(44) A_{birds} $=$ (Γ, Δ)

       Δ $=$ $\{\ bird(X) \to flies(X)\ \}$,

$$\Gamma \;=\; \left\{ \begin{array}{l} (\forall X)(ostrich(X) \to bird(X)), \\ (\forall X)(ostrich(X) \to \neg flies(X)), \\ ostrich(polly), \\ bird(tweety) \end{array} \right\}$$

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

How to use abduction?

We construct an abductive framework which we then use as the mechanism of implicit control. To do this we specify a set of hypotheses to the effect what discourse referent is available as an implicit controller of Pro in SP-PrP. Since we use this kind of control in a certain context, we include reference to the situation which provides the context. In our case this situation is satisfactorily identified by the eventuality E provided by the SP. This is rendered by the notation E :. this notation is intended to restrict the availability of the hypotheses to a certain context, i. e. we use contextually restricted reasoning.

(45) A_{instr} $=$ (Γ, Π)

       Π $=$ $\{E : X = y\ \&\ \|[_{PrP}\ldots DP_{instr}\ldots]\|\,(E, X)\}$

The variable X is the interpretation of Pro in $\|[_{PrP}\ldots DP_{instr}\ldots]\|$, which is the interpretation of the secondary predication adjunct. We use (E, X) to denote the occurrences of these arguments in the expression. Any contextually specified interpretation of the predication relation is obtained by abductively specifying the choice of the predication term X in situation which introduced E. Any explanation hypothesis is then a substitution instance of $Cntrl$ which we use here instead of y in $X = y$. Thus, if we choose the temporal coordinate t as a substitution instance of $Cntrl$, we get the reading in (46). Choosing the implicit path referent gives us a path measurement.

(46)

$$\boxed{\begin{array}{l} E\ X \\ \hline \begin{array}{l} X = Cntrl \\ \boxed{\begin{array}{l} \boxed{x\ y} \\ \hline X = x \oplus y \end{array}} \Rightarrow \boxed{\begin{array}{l} M\ m_1\ m_2\ Y\ z\ w\ e_1\ e_2 \\ \hline M = m_1 \oplus m_2 \\ Y = w \oplus z \\ e_1 \subset E\ :\ hour(w) = m_1 \\ e_2 \subset E\ :\ hour(z) = m_2 \\ x = w\ y = z \end{array}} \end{array} \end{array}}$$

Abduction will help us to use logical inference to narrow the range of available implicit referents for the measure instrumental in the next section.

4.2 Jakobsons theory of the Russian instrumental

Jakobson (1936) (reprinted in Jakobson (1984)) divides all case forms of Russian into two parts 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 *instr* instead of *nom* assigned, 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 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 situation characteristics represented by the semantic form of a sentence into two groups: the core and the periphery. Secondary predication characterises one part of the periphery, and logical inference plays a role in this.

4.3 Assigning instrumental

Since we noted that case assignment to a semantic argument can sometimes reflect intentions of the speaker, we may assume that case assignment can have both semantic and pragmatic aspects. We are therefore almost forced to consider case assignment of other cases in our theory of case assignment of the instrumental, though it is naturally impossible to consider all questions of case assignment in one paper. The reason is that an abductive explanation uses formulae which can be used to reason both ways: from an observation to its explanation to explain the observation,

and from its explanation to the prediction, but to a hypothetical prediction only. When treating case assignment in this inferential theory, we have something like an interpretation of the case form in this first case, whereas in the second case we have a case assignment rule. So case interpretation and case assignment are closely related in the theory of abductive interpretation.

We may assume that all the verb arguments are introduced into the semantic interpretation of a verb by means of argument relations like $argsubject(x, e)$, stating the requirement for a subject, or $argsubject(y, e)$, stating that an object is required by the verb. With the two relations we have therefore a very rough and underspecified characteristics of the semantic behavior of the verb which is valid for a large verb class of transitive verbs. These argument relations are treated as pendents to the syntactic subcategorisation frame of the verb. The status of the argument relation in the abductive framework associated with the verb is that of evidence which is to be explained. The computed syntactic relations are used as constraints and facts.

We will now assume that full cases in Jakobson's terminology are assigned by hypothetical reasoning basically to the terms of the argument relations. But the instrumental is a peripheral case, and is only assigned to non-arguments. Which means that we have a classification of the cases as part of the semantic-syntactic interface, perhaps as in (47).

$$(47) \quad A_{case} \quad = \quad (\Gamma, \Delta)$$

$$\Gamma \quad = \quad \left\{ \begin{array}{l} \text{NOM}(x) \to fullcase(x) \\ \text{ACC}(x) \to fullcase(x) \\ argsubject(x, e) \to \text{NOM}(x) \\ argobject(x, e) \to \text{ACC}(x) \\ fullcase(x) \ \& \ \sim fullcase(x) \to \perp \end{array} \right\}$$

$$\Delta \quad = \quad \left\{ \begin{array}{l} \sim fullcase(x) \\ \sim fullcase(x) \to \text{INSTR}(x) \end{array} \right\}$$

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. The 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 $fullcase(x) \ \& \ \sim fullcase(x) \to \perp$, i. e. their conjunction implies the (always) false proposition $\perp$. But it is a special kind of negation, called *negation as failure* or NAF [9]. 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 $\sim fullcase(x) \to \text{INSTR}(x)$ is only a default, too. What we now achieved is that the individual arguments x of $argsubject(x, e)$ or an $argobject(x, e)$ never require a realization in the instrumental. It could be that this requirement is too strong for Russian, but we leave it at that here.

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

---

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

means of transport referent in a situation which allows for some means of transport, a path referent, a referent which denotes an instrument, a temporal specification, etc.. 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 which compete.

Thus, the assumption that the dative in Russian is a structural case of the indirect object is plausible, cf. Bailyn (1995), but Jakobson considered the dative also to be a peripheral case. What are then the ways to choose between the two?

It can be assumed that the case assignment of two different peripheral cases is based on the specificity criterion. Anything more specific that pure predication about a peripheral individual will have a realization different from the instrumental, if Russian provides one. These specific properties are additional semantic constraints and must then be associated e. g. with the dative or with some preposition. One linguistically minded application of the specificity criterion as a criterion for the choice of hypotheses is to be found in Strigin (1998). With this addition the rules for the assignment of the instrumental would be like in (48), $R(y, e)$ ranges over the relations in the situation description.

$$(48) \quad A_{case} \quad = \quad (\emptyset, \Delta)$$

$$\Delta \quad = \quad \left\{ \; R(y, e) \; \& \; y = x \; \rightarrow \; (\sim fullcase(x) \rightarrow \text{INSTR}(x)) \; \right\}$$

Any more specific mentioning of a relation would override this assignment, so if dative is associated with some additional information, it will win by specificity. An alternative to this could be to assign a subset of discourse referents to the dative outright, on the basis on some explicit property, and make these assignments facts. This would block both the assignment of the instrumental, and the assignment of the status of a prepositional object, but allow for the dative assignment to the indirect object of the verb.

Note that it is actually the empty pronominal *Pro* which gets instrumental syntactically assigned (or checked) by the Pr^0, and not the discourse referent which requires it according to the case assignment rules given above. Since there are no positions which check instrumental within the structure of the modified sentences, it gets checked indirectly via *Pro*.

It would be an insurmountable task to discuss both the principles of assignment of all the possible peripheral cases and those of the prepositions. Therefore we will leave the question open here, though we may remark that we would expect the solution be based on the specificity criterion.

The position of the paper is that only peripheral implicit arguments are available as implicit controllers. But since full case arguments are available via syntactically based standard control, we have exactly the cleavage which excludes the indirect object and the prepositional phrases. However, if we accept our assumption that the arguments of the verb receive full cases, then it is impossible to explain, why they sometimes receive dative instead of the accusative. The complex predication structure cases like (30) is not observed in Russian, since the two quasi-accusatives are distinct case forms, the accusative for the argument corresponding to *the book* and the dative for the argument corresponding to *Mary*. But we might modify the theory of Jakobson in the direction of postulating two functions of dative: the case for the third argument and the case for the adjuncts. Then the dative is chosen on the basis of some more specific semantic constraints which override the instrumental, if the dative is the adjunct case, and it does not qualify as a controller via syntactically licensed control. Alternately, all the DPs in the dative can probably be analyzed as peripheral arguments, so specificity accounts for all occurrences of the dative in opposition to the instrumental. This question requires more research.

But can we have double instrumental? Since instrumental is assigned to peripheral discourse referents, there should be in principle no problem with that. However, in general measure instrumental does not refer to another instrumental via implicit control. If we assume that the standard realization of the instrument is in instrumental, the second, measure instrumental should be possible, but is not. Similarly, if path is realized by an instrumental DP, it should be possible to use this referent as a measure base, but it it impossible, cf (49) and (50).

(49) *Oni stučali   molotkami   des'atkami
       They knock-past-pl hammer-instr-pl ten-instr-pl
       They knocked with the hammers by tens/in tens

(50) *Oni šli   dorogami   sotn'ami
       They go-past-pl road-instr-pl hundred-instr-pl
       They went hundreds of roads

We think that this is a matter of pragmatically caused competition between ways of expressing things. Our motivation is due to the observation that the intended meaning is expressed by the numeral measure phrases in the instrumental, cf. (51) and (52).

(51) Oni stučali   [des'atkami   molotkov]$_{instr}$
       They knock-past-pl ten-inst-pl hammer-gen-pl
       They knocked with the hammers by tens/in tens

(52) *Oni šli   [sotn'ami   dorog]$_{instr}$
       They go-past-pl hundred-instr-pl road-gen-pl
       They went hundreds of roads

5 Further applications

There are some interesting problems with the temporal use of the instrumental case. The most interesting one from the current point of view is that of a certain class of singular temporal nouns in the instrumental. We call these nouns distributive temporal predicates, for reasons which will immediately become obvious.

A noun like *leto* (summer) is predicated of a temporal discourse referent. We consider this referent to be the reference time of the situation, i.e. a temporal anchor of the situation.

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

That the sentence is acceptable is puzzling on the assumption that we have a measure instrumental here, too. It might be expected that some rather similar temporal uses of nouns denoting temporal measure units in the instrumental singular are impossible, and indeed, this is so.

(54) *Časom   on čital
       Hour-instr he read
       He was reading for an hour/this hour

What is the the specifics of these predicates? To determine this we need some comparisons with other temporal adverbial elements.

If the temporal measure is used in the accusative singular, the sentence is OK with the durative reading of the DP_{acc}. But the plural of the accusative temporal unit phrases are impossible, cf. (56), unless we use a numeric specification of the time, in which case the measure noun modifies the numeral in the accusative, cf. (57).

(55) Čas   on čital
     Hour-sg-acc he read
     He was reading/read for an hour

(56) *Časy   on čital
     Hour-pl-acc he read
     He was reading/read for hours

(57) P'at'   časov   on čital
     Five-acc hour-gen-pl he read
     He was reading/read for 5 hours

As was mentioned in the introduction, measure units in plural in the instrumental are OK, on the contrary, *unless* used with a numeric specification. Let us assume that a sentence refers to a situation, if used in an assertion, which is classified as belonging to the situation type characterized by the sentence. Then the accusative of a numeral with the unit specification in the genitive gives the duration of the event(s) in the situation. The measure instrumental, on the contrary, only measures something. The anchoring use of the temporal distributive singular predicates anchors the situation temporally, but is not really durative, cf. (58).

(58) a. Letom   on bolel p'at'   dnej
       Summer-instr-sg he ill   five-acc day-gen-pl
       He was ill two days this summer/in summer

    b. *Sem'   dnej   on bolel dva   dn'a
       Seven-acc day-gen-pl he ill   five-acc-sg day-gen-pl
       He was ill five days seven days

The intended interpretation of (58b) - *he was ill for five days in seven days* - is not available. Duratives proper are ruled out, if doubled.

Consider the following line of reasoning suggested to the authors by Manfred Krifka. The accusative case is used to mark arguments which are incremental themes. In this function it 'measures out' the event, using th terminology of Tenny (1994) producing at least in English and in German a telic predicate by delimiting the event. The temporal use of the accusative picks up this semantic function in the temporal domain. The bare plural cannot express the delimitation, due to its semantic property of divisivity, hence (56).

The case with distributive temporal predicates in singular is ambivalent. Thus, e. g. *den'* (day), can be used in two ways, as a temporal anchor in the instrumental and as a durative singular temporal predicate in the accusative. It can also be used as a plural genitive in the numeral temporal phrase base on the accusative. The first two uses may be teased apart, formally. Only in the first use, which requires the instrumental, such words cannot be modified by *celyj* (whole).

(59) on čital (*celym)   dnem
      He read (*whole-instr) day-instr
      He was reading (*the whole day) at some time of the day

(60) on čital (celyj)   den'
      He read (whole-acc) day-acc
      He was reading for a (whole) day

Assuming that the adjective constructs a delimiting adverbial of sorts, the instrumental becomes unavailable, because this is the function of the accusative. Our inferential theory of case assignment codes that whatever appears in the full case cannot appear in the instrumental. This implies a somewhat more precise picture of the periphery, of course.

We also obtain the authentic measure instrumental of distributive predicate, which admits of *celyj*, cf. (61), but this only supports the intuition that *celyj den'* in (60) is a measure unit.

(61) on čital (celymi)   dn'ami
      He read (whole-instr) day-instr-pl
      He was reading (whole) days on end

So what do we have now? We proposed that singular DP_{instr} in (59) are situation restrictors, i. e. anchors. The accusative is then the case which is reserved for duratives, and duratives do not anchor situations, but simply specify the duration of the events in the situation. In other words they are pure modifiers and, presumably, adjuncts.

There is a substantial semantic difference between the two kinds of temporal phrases. The ones we call distributive predicates are really divisive. Any part of summer is summer. Units are quantized, e. g. no part of a week is a week. The modifier *celyj* (whole) disallows distribution, since no part of a whole day is the whole day. The interesting question is why the distributivity of the predicate is required in the anchoring use[10]. We would like to assume that the anchoring function of temporal predicates (i. e. their functioning as restrictors) is to facilitate a unique identification of the temporal location of the situation in time, and time is divisive, if unmeasured. Then the anchoring function requires the preservation of the potential for distributivity, so temporal units in the instrumental singular are excluded in the anchoring use.

However, one may think that if temporal units are pluralised, they should acquire the ability to distribute, if the theory of plural in Krifka (1989) is assumed. This seems to be born out at first, because temporal unit nouns in plural can be used in free instrumental. The plural creates cumulative predicates, so distribution is allowed as an option of the interpretation of predication with such predicates.

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

---

[10]The distributivity/divisivity seems to be in general a property of the class of temporal adverbials which Kamp and Reyle (1993) call *locating adverbials*, e. g. *on Sunday, on May, 27*, because every part of Sunday is still Sunday and every part of May, 27 is May, 27. But Kamp and Reyle do not comment on this property. Locating adverbials are called temporal anchors in this paper.

What we have here is our measure instrumental. Is there then a difference between temporal singular distributive predicates and temporal measure instrumental?

It seems there is. A plural temporal unit in the measure instrumental is best regarded as predicated of the event or state which characterizes the situation, and not of its reference time. To be more precise, the distributive predicates are predicated of the time course of the whole complex situation and locate it in time, the measure instrumental predicate is predicated of the time course of the event introduced by the verb and characterizes it as measured in some way.

This can be easily shown. Perfectivizing the verb immediately blocks the interpretation with the plural unit, but not with distributive temporal predicates in singular.

(63) *Časami   on pročital knigu
        Hour-instr he read   the book
        He read the book in hours

(64) Večerom   on pročital knigu
        Evening-instr he read   the book
        He read the book (to the end) in the evening

The complex [*event : state after it*] which is characteristic of Russian perfectivization is not distributive. It should be, however, because of the homomorphic requirement associated with the distributive nature of the temporal referent of *časami* (hours-instr), as was discussed in section 37. This homomorphism is the cornerstone of the theory in Krifka (1992), and was adopted by us, too. No homomorphism is required by the temporal noun anchors, which are singular and distribute on conceptual demand, and not as a matter of grammar, since they refer only to the temporal course of the situation and not to temporal characteristics of its constituent parts, like events, etc.. Thus, (65) is OK, (66) is out, but if we let *dvaždy* (twice) have scope over *nedel'ami* (weeks-instr), the sentence becomes OK with a kind of durative reading for *nedel'ami*,(67).

(65) Letom   on dvaždy bolel
        Summer-instr-sg he twice   ill
        He was twice ill this summer/in summer

(66) *Nedel'ami   on dvaždy bolel
        Weeks-instr-pl he twice   ill-past
        For weeks he was twice ill

(67) On dvaždy bolel   nedel'ami
        He twice   ill-past weeks-instr-pl
        He was twice ill for weeks.

The same operation can be done on *Letom* in (65), cf.(68).

(68) On dvaždy bolel   letom
        He twice   ill-past *summer-instr-sg*
        He was twice ill in summer.

92

The interpretation is however that he was twice ill in summer (different summers perhaps), but not that he was twice ill during the whole summer (different or same), whereas (67) requires that he be ill some weeks every time. The relative interpretation is a matter of scope, but the core interpretation remains still the same: letom locates something like a time course of a situation, and measure instrumental of unit phrases measures some other temporal referent, perhaps the time course of the event. In fact temporal units in plural instrumental can measure the event by reference to time in different syntactic positions, cf. (69), which is parallel to (9).

(69) Vrem'a tratili časami
Time-acc squander-3pers-pl hour-pl-instr
Time was squandered/they squandered time by the hours

We cautiously conclude that a distributive temporal predicate characterizes the reference time of the situation, and that this time is not identical with the time of the event of the situation. The durative meaning is associated with the accusative and is predicated on the event argument of the situation, whereas temporal measure instrumental measures the event in terms of some of its properties which are associated either with one of its participants or with its temporal course.

6 Conclusion

We proposed a syntax and a semantics of the measure instrumental. We treated plural DPs denoting units of measurement in instrumental as secondary predicates. Syntactically they are adjuncts with a specific structure: a functional category of predicates ($PredP$) constituting a small clause of sorts, as proposed for the English adjectival secondary predication by Bowers and for the Russian by Bailyn. We also provided a semantics for this use. Under this treatment a NP in the instrumental is a secondary distributive predicate with the intrinsic meaning "more than one" provided by the plural. This accounts for the lack of singular in this use. The secondary predicate introduces an event which is distributive due to the plural noun and the θ-role homomorphism proposed in Krifka (1998). The event of the small clause also measures the event introduced by the main clause, hence requires it to be distributive. The distribution takes place because the event of the main clause and the event introduced by the secondary predicate small clause share a participant, due to the control mechanism involved in the interpretation of the empty pronominal Pro, which is the subject of the small clause $PredP$. We suggested, similar to Krifka, that measuring the event is semantically lowered to measuring any entity in the core part of the event. In other words, measuring it gives a characterization of an event in terms of its participants. We assumed that the semantics also involves the notion of inferential interpretation of an underspecified semantic structure, in our case of Pro. The interpretation leading to the measure instrumental consists in (a) employing the intrinsic meaning of the plural (more than one) to make an assertion and (b) to weakly measure the event in terms of its homomorphic characteristic discourse objects, if measuring can be done, where the objects measured are inferred with the help of abductive inference. The interpretation therefore specifies what the basis of measurement for the event distribution is in terms of the core discourse referents (i.e. what is measured), and is used to assign the instrumental case. The discourse referent which is measured is syntactically constrained, so we have reasons to believe that this is indeed a secondary predicate in terms of the model of predicative structure of Bowers and Bailyn. The theory we proposed allowed us to draw a distinction to the temporal use of instrumental in (70).

(70) Letom   on často bolel
     Summer-instr he often be-ill
     In summer he was often ill

The distinction we made referred to a different use of the instrumental as a temporal anchor of the situation which is takes to verify the sentence. The upshot of the treatment is the conclusion that the model of measure instrumental which takes it to be a $PredP$-adjunct possesses explanatory adequacy for a number of diverse phenomena. Thus, we have argued that if secondary predicates are adjunct small clauses one use of Russian instrumental can be well accommodated.

A   Appendix. The Semantic Basics of DRT

For the sake of better integration of the results of this work into general semantic theory we present a small portion of the discourse representation theory, DRT. The main references are Kamp and Reyle (1993), Kamp and Rossdeutscher (1994), Cooper et al. (1994), Asher (1993). The exposition here follows mostly Cooper et al. (1994). The definition of the part of a language of DRT used in this paper is given in (71). In general we let small variables in the definitions denote both simple and complex DRs, if it makes no difference in the context.

(71) The vocabulary of a simple DRS language consists of
 (i) a set $Cons$ of individual constants, e. g. now
 (ii) a set Ref of five different sorts of discourse referents
    $Ind = \{x_1 \ldots x_n, X_1 \ldots X_n\}$, a set of individual and group or plurality referents
    $Time = \{t_1 \ldots t_n\}$, a set of referents for times
    $Event = \{e_1 \ldots e_n, E_1 \ldots E_n\}$, a set of event referents
    $State = \{s_1 \ldots s_n, S_1 \ldots S_n\}$, a set of state referents
    $Units = \{m_1 \ldots m_n, M_1 \ldots M_n\}$, a set of abstract units of measurement
 (iii) a set $Pred$ of predicate constants including $\subset$, $\subseteq$
 (iv) a set $Func$ of function symbols, e. g. τ, $\oplus$, $agent$, $theme$
 (v) a set Sym of logical symbols, e. g. $=, \Rightarrow$
The set of terms is $Terms = \{Const \cup Ref \cup \{t | t = f^n(t_1 \ldots t_n)\}$
where f is a function symbol of arity n, and t_i a term.

A discourse representation structure (DRS) is essentially a set of discourse individuals (the universe of DRS) with a set of conditions on them which are required to hold in a situation modeled.

(72) DRSs and DRS conditions are usually defined by simultaneous recursion.
 (i) if U is a (possibly empty) set of discourse referents $x_i \in Ref$,
    CON a (possibly empty) set of conditions con_j,
    then $< U, CON >$ is a DRS and U is its universe
 (ii) if $x_i, \ldots x_j \in Ref$, then $x_i = x_j$ is a condition
 (iii) if $c_i \in Const$ and $x_j \in Ref$, then $c_i = x_j$ is a condition
 (iv) if P is an n-place relation name in $Pred$ and $t_1, \ldots t_n \in Terms$,
    then $P(t_1, \ldots, t_n)$ is a condition
 (v) if P is an n-place event relation name in $Pred$, and $e, t_1, \ldots t_n \in Terms$,
    then $e : P(t_1, \ldots, t_n)$ is a condition
 (vi) if x, $x_1 \ldots x_n \subseteq Ref$, then $x = x_1 \oplus x_a$, $f^n(x_1, \ldots, x_n) = x$ are conditions
 (vii) if K_1 and K_2 are DRSs, then $K_1 \Rightarrow K_2$ is a condition

DRS are defined in (i), atomic conditions in (ii)-(vi). Complex conditions in (vii). There are more logical symbols used in the examples which do not occur in the definition of a condition, $\&$, $\sim$, $\bot$ and $\rightarrow$. They are not needed in the standard development of the DRT. We use them in their standard logical meaning or explain them only to compute the semantic representations and do not want to use any of the deduction rules of the DRT for this purpose. The move is harmless, but since we do not attempt to integrate the logical terminology, we simply take care that standard modell-theoretical notions of DRT are defined on DRS which contain the results of abductive inferencing and no expressions containing $\&$ and $\rightarrow$.

In the model theory of this fragment of DRT we represent the world by a total model $\mathcal{M} = <$ $\mathcal{U}, \mathfrak{S} >$ with $\mathcal{U}$ the domain of individuals of $\mathcal{M}$ and $\mathfrak{S}$ the interpretation function of $\mathcal{M}$, which maps constants in $Const$ into elements of $\mathcal{U}$, n-ary function names into the set of functions $\wp(\mathcal{U}^n) \to \mathcal{U}$ and n-ary relation names in $Pred$ into elements of the the set $\wp(\mathcal{U}^n)$. A total model evaluates all sentences of the language we model as either true or false. We want a discourse representation structure (DRS) $K = < U, CON >$ to come out true in $\mathcal{M}$, if its discourse referents $u \in U$ are mapped into the elements of $\mathcal{U}$ in such a way that under this mapping all the conditions $con_i \in CON_K$ come out true in $\mathcal{M}$. Let $g\,[y]\,f$ be an extension g of f, i. e. a function such that $Dom(g) = Dom(f) \cup y$

(73) (i) $h \models_{\mathcal{M},g} < U, CON >$ iff $h\,[U]\,g$ and for all $con_i \in CON$:
              $\models_{\mathcal{M},h} con_i$

       (ii) $\models_{\mathcal{M},g} x_i = x_j$ iff $g(x_i) = g(x_j)$

       (iii) $\models_{\mathcal{M},g} c_i = x$ iff $\mathfrak{S}(c_i) = g(x)$

       (iv) $\models_{\mathcal{M},g} P(t_1, \ldots, t_n)$ iff $< g(t_1), \ldots, g(t_n) > \in \mathfrak{S}(P)$

       (v) $\models_{\mathcal{M},g} e : P(t_1, \ldots, t_n)$ iff $< g(e), g(t_1), \ldots, g(t_n) > \in \mathfrak{S}(P)$

       (vi) $\models_{\mathcal{M},g} X = x_1 \oplus x_2$ iff $g(X) = \bigvee \{g(x_1), g(x_2)\}$

       (vii) $\models_{\mathcal{M},g} f^n(t_1, \ldots, t_n) = x$ iff $\mathfrak{S}(f^n)(g(t_1), \ldots, g(t_n)) = g(x)$

       (viii) $\models_{\mathcal{M},g} (K_1 \Rightarrow K_2)$ iff for all h such that $h \models_{\mathcal{M}} K_1$ there
              exists a k such that $k \models_{\mathcal{M},h} K_2$

A mapping from K to $\mathcal{M}$ like in (73) is called *a verifying embedding of K into $\mathcal{M}$*.

(74) A DRS K is true in a model $\mathcal{M}$ with respect to an assignment g
     iff there *exists* a verifying embedding h for K in $\mathcal{M}$ with respect
     to g. In mathematical terms, $\models_{\mathcal{M},g} K$ iff $h \models_{\mathcal{M},g} K$.

References

Asher, Nicholas (1993): Reference to Abstract Objects in Disourse, Kluwer, Dordrecht.

Bailyn, John F. (1995): Configurational Case Assignment in Russian Syntax, The Linguistic Review, 12 315–360.

Bailyn, John Frederik and Barbara Citko (1999): Case and Agreement in Slavic Predicates, in: Katarzyna Dzwirek, Herbert Coats and Cynthia Vakareliyska (eds.), *Workshop on Formal Approaches to Slavic Linguistics: The Seattle Meeting, 1998*, 17–37, Michigan Slavic Publications, Ann Arbour.

Borer, Hagit (1989): Anaphoric AGR, in: Osvaldo Jaeggli and Keneth J. Safir (eds.), *The Null Subject Parameter*, 69–109, Kluwer, Dordrecht.

Bowers, John (1993): The Syntax of Predication, Linguistic Inquiry, 24 591–656.

— (2001): Predication, in: Mark Baltin and Chris Collins (eds.), *The Handbook of Contemporary Syntactic Theory*, 299–333, Balckwell, Cambridge, Mass.

Chomsky, Noam (2000): Minimalist Inquires: The Framework, in: Roger MArtin, David Michaels and Juan Uriagereke (eds.), *Step by Step: essays on minimalist syntax in honor of Howard Lasnik*, 89–155, The MIT Pres, Cambridge, Mass.

Clark, K. (1978): Negation as failure, in: H. Gallaire and J. Minker (eds.), *Logic and Data Bases*, 293–322, Plenum, New York.

Cooper, Robin, Dick Crouch, Jan van Eijck, Chris Fox, Josef van Genabith, Jan Jaspars, Hans Kamp, Manfred Pinkal, Massimo Poesio and Steve Pulman (1994): FraCaS: A Framework for Computational Semantics, Deliverable 8: *Describing the Approaches* LRE 62-051, Centre for Cognitive Science, Univ. of Edinburgh.

Demjjanow, Assinja and Anatoli Strigin (2000a): Case Assignment to Conceptual Structures: the Russian Instrumental, in: Marcus Kracht and Anatoli Strigin (eds.), *Papers on the Interpretation of Case*, volume 10 of *Linguistics in Potsdam*, 75–107, University of Potsdam, Potsdam.

— (2000b): Real Adjuncts in Instrumental in Russian, in: Cathrine Fabricius-Hansen, Ewald Lang and Claudia Maienborn (eds.), *Approaching the Grammar of Agjuncts*, volume 17 of *ZAS Papers in Linguistics*, 1–26, Zentrum für Allgemeine Sprachwissenschaft, Sprachtypologie und Universalienforschung, Berlin.

Franks, Steven and Norbert Hornstein (1992): Secondary Predication in Russian and Proper Government of PRO, in: Larson et al. (1992), 1–50.

Genesereth, Michael R. and Nils J. Nilsson (1987): Logical Foundations of Artificial Intelligence, Morgan Kaufmann, Palo Alto.

Hobbs, J.R., M.E. Stickel, D.E. Appelt and P. Martin (1993): Interpretation as Abduction, Artificial Intelligence, 63 69–142.

Hornstein, Norbert and David Lightfoot (1987): Predication and PRO, Language, 63(1) 23–52.

Huang, C.-T. James (1992): Complex Predicates in Control, in: Larson et al. (1992), 109–147.

Jakobson, Roman (1936): Beitrag zur allgemeinen Kasuslehre, TCLP, VI.

— (1984): Contribution to the general theory of case: general meanings of the Russian cases, in: Linda R. Waugh and Morris Halle (eds.), *Russian and slavic grammar*, number 106 in Janua Linguarum, series maior, 59–104, de Gruyter, Berlin.

Kakas, A., R. Kowalski and F. Toni (1995): The Role of Abduction in Logic Programming, Oxford University Press, handbook of Logic in Artificial Intelligence and Logic Programming.

Kamp, Hans and Uwe Reyle (1993): From Discourse to Logic, Kluwer, Dordrecht.

Kamp, Hans and Antje Rossdeutscher (1994): Remarks on Lexical Structure and DRS Construction, Theoretical Linguistics, 20 97–164.

Krifka, Manfred (1989): Nominalreferenz und Zeitkonstitution, Wilhelm Fink Verlag, München.

— (1992): Thematic Relations as Links between Nominal Reference and Temporal Constitution, in: Ivan A. Sag and Anna Szabolcsi (eds.), *Lexical Matters*, 29–53, CSLI.

— (1998): The Origins of Telicity, in: Susan Rothstein (ed.), *Events and Grammar*, 197–235, Kluwer.

Larson, Richard K., Sabine Iatridou, Utpal Lahiri and James Higginbotham (eds.) (1992): Control and Grammar, Kluwer, Dordrecht.

Nilsson, Ulf and Maluszyński (1990): Logic, Programming and Prolog, Wiley, Chichester.

Peirce, Charles Sanders (1992): Reasoning and The Logic of Things, Harvard University Press, Cambridge, Mass., edited by Kenneth Laine Ketner.

Poole, David (1988): A Logical Framework for Default Reasoning, Artificial Intelligence, 36 27–47.

Rothstein, Susan (2000): Secondary Predication and Aspectual Structure, in: Cathrine Fabricius-Hansen, Ewald Lang and Claudia Maienborn (eds.), *Approaching the Grammar of Adjuncts*, volume 17 of *ZAS Papers in Linguistics*, 241–264, Zentrum für Allgemeine Sprachwissenschaft, Sprachtypologie und Universalienforschung, Berlin.

Strigin, Anatoli (1998): Lexical Rules as Hypothesses Generators, Journal of Semantics, 15 163–190.

— (1999): Lexical meaning by hypothetical inference in context, Habilitationsschrift, HU Berlin, Berlin.

Tenny, Carol (1994): Aspectual Roles and the Syntax-Semantics Interface, Kluwer, Dordrecht.

Švedova, N. Yu. et al. (ed.) (1980): Russkaja Grammatika, volume I, II, Nauka, Moskva.

Winkler, Susanne (1997): Focus and Secondary Predication, Mouton de Gruyter, Berlin.

Wunderlich, Dieter (1997): Argument Extension by Lexical Adjunction, Journal of Semantics, 14 95–142.