Lexically modifying binding restrictions: Case for a variable-free binding theory

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1   Introduction: the form of the binding theory

All binding theories are developed with a relatively simple and more or less practical aim — to account for the distribution of anaphoric pronouns in natural languages. However, if we want to achieve this goal, that is, to set up a binding theory, we must implement several different (and possibly complicated) components. Of course, in any theory we must have lexical entries for pronouns themselves. We must also have some apparatus for describing restrictions on pronoun distribution: if there were no such restrictions, we would not need a binding theory. Just some means for describing restrictions is not enough, however, because we need also to connect our formulated restrictions with the specific pronouns of some language. Thus, we need to implement some mechanism that would allow to impose our restrictions on the actual pronouns.

Consider the most standard variant of the Binding Theory by Chomsky (1981) and Reinhart (1983)[1]. Under this variant (henceforth, "the standard theory"), lexical items are divided into several classes. One class is formed by "normal" lexemes, and several other classes contain only anaphoric pronouns. The membership in an anaphoric class may be implemented via the use of features like [+reflexive] and [+pronominal]. The restrictions on pronoun interpretation are implemented through filters ("principles of the binding theory"). The general form of a filter is "an expression from class A is subject to restrictions l, m, n". The actual restrictions are formulated using the c-command relation, the coindexing relation, and the set of "distance" relations (for instance, we may use such relations as "to be together in a minimal finite clause" or "to be together in a minimal non-finite clause"). In such a system we may express, for instance, a filter forbidding members of some referential class when there is an expression that is in the coindexing relation with the expression in question, and also in the

[1]Though it is now clear that these theories need serious amendments to account for the actual natural language data, they will do as an example of the binding theory of a certain form. Since it is the form of possible binding theories that we are interested in, we are not concerned with with the specific properties of specific implementations.

c-command relation and in some distance relation with it — that would be a prototypical filter for a natural language pronominal.

Thus, lexical items for pronouns contain the information about their class, and restrictions on binding are directly assigned to pronoun classes. What will be of main concern for us in this paper is that there is an important consequence of choosing this form for our binding theory: because binding restrictions are imposed on pronoun classes, and the membership in these pronoun classes is assigned to lexical items, nothing that happens after we insert the needed lexical items into numeration (as we would say under the descendants of the framework in which the standard theory was formulated) may change the binding restrictions of a pronoun. Or, to put it differently, the binding restrictions of a pronoun embedded in a constituent A cannot differ from the binding restrictions of the same pronoun embedded in a constituent B that includes the constituent A. Under the standard theory, a lexical item in a structure may never affect the binding restrictions of another lexical item.

The structure of this paper is as follows. Our Section 2 first reviews Russian anaphoric system and Russian *sam* 'himself' intensifier system, and then presents new data on pronoun complexes of the form [pronoun + *sam*]. Such complexes are analogous to the complex pronouns of, e.g., Norwegian, but are closer to free word combinations than those. The problem with these complexes is that the binding restrictions of pronouns in them are different from the binding restrictions of 'bare' pronouns. Thus, it is a counterexample to the theories like the standard Binding Theory, in which lexical items may never affect binding restrictions of other lexical items, and therefore we are in need of some other binding theory that can account for the Russian pronoun complexes (and, desirably, for complex pronouns of other languages as well).

However, in Section 3 we do not immediately depart for the journey of finding such a theory, but take a different perspective. Namely, we describe a major problem of the variable-free binding theory of Jacobson (1999): this theory nicely accounts for much problematic binding data in natural language, but does not provide an account for restrictions that are imposed on individual pronouns and not on binding as such (in other words, those restrictions that are captured by the binding principles of the standard theory)[2].

Then in Section 4 we start to build a foundation on which our proposal about pronouns will rest: we argue that intensifiers denote predicates of a specific kind — dynamic predicates. We then propose a rough sketch of a variant of D(iscourse) R(epresentation) T(heory) with dynamic predicates accommodated into it.

Finally, in Section 5, we propose that pronoun meanings contain dynamic predicates just as intensifiers do. An important difference between the two types of linguistic expressions is that while intensifiers use purely "discourse" dynamic predicates, anaphoric dynamic predicates usually use certain syntactic relations in their update rules. This proposal can account for the problematic Russian pronoun complexes de-

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[2]Recently, Jacobson herself put forward a proposal to this aim in Jacobson (2005). The main idea of Jacobson's proposal is that a pronoun that is subject to the principle B constraint shifts the usual denotation of the verb it combines with. While the normal denotation of a transitive verb is a set of pairs that contain some pairs of the form A×A, the shifted denotation will preserve all pairs where the arguments are not equal, but will not include any A×A pairs. Of course, it may be easily extended to a more general case. We leave an accurate comparison of our account and Jacobson (2005)'s account for future work.

scribed in Section 2, and provides a possible extension to the variable-free theory of Jacobson (1999) allowing it to maintain its main achievements while accounting for the binding restrictions on specific pronouns.

Section 6 concludes the paper.

2 Pronoun complexes in Russian

2.1 Russian anaphoric pronouns

Russian has two (main) anaphoric pronouns[3]: an anaphor *sebja* 'himself' and a pronominal *on* 'he'. The binding domain for the reflexive *sebja* 'himself' is the minimal finite clause. *sebja* 'himself', like the English reflexive *himself*, must have a c-commanding antecedent[4] DP inside of *sebja* 'himself' binding domain, but, unlike *himself*, it has strict subject orientation: *sebja* 'himself' may be bound only by regular (Nominative) subjects, and not just by any commanding DP in the domain, (1b)[5]. The fact that the binding domain for *sebja* 'himself' is the minimal *finite* clause ensures that when a reflexive is embedded in a non-finite clause, it may be bound both by the non-finite clause subject (the closest subject to it) or by the subject of the finite clause in which the non-finite clause of the reflexive is embedded, (1c).

(1) a. Petja$_i$ skazal, što Vasja$_j$ uvidel sebja$_{*i/j}$.
       Petja told that Vasja saw himself.

     b. Petja$_i$ pokazal Vasje$_j$ sebja$_{i/*j}$.
       Petja showed Vasja himself.

     c. Petja$_i$ poprosil Vasju$_j$ [PRO$_j$ nalit' sebe$_{i/j}$ čaju].
       Petja asked Vasja PRO to-pour himself tea.

The binding domain for the Russian pronominal *on* 'he' is different from the binding domain of *sebja* 'himself' — it is the minimal clause, not the minimal finite clause. *on* 'he', as pronominals always do, must be free in its binding domain — that is, its antecedent cannot be a c-commanding DP that is inside of its binding domain. However, since the binding domain of *on* 'he' is its minimal clause, it may be bound by the subject of the matrix clause in examples like (2c).

(2) a. Petja$_i$ skazal, što Vasja$_j$ uvidel ego$_{i/*j}$.
       Petja told that Vasja saw him.

     b. Petja$_i$ pokazal Vasje$_j$ ego$_{*i/*j}$.
       Petja showed Vasja him.

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[3]There are several other anaphoric pronouns in Russian, but they will not be relevant for our discussion.

[4]We use "to have an antecedent" as a cover term for the terms "to be bound" and "to be coreferent". Sometimes we also loosely use "to be bound by A" as a synonym for "to have an antecedent A", when the difference between binding and coreference is not relevant.

[5]The actual data is a bit more complicated, since there is a number of constructions with non-canonical subjects in Russian. For instance, *nužno* 'need' has a "Dative subject", which may bind reflexives. The questions of what is the subject in Russian and what properties of subjects and almost-subjects make them relevant for binding are intriguing, but are definitely beyond the scope of this paper.

    c. Petja$_i$ poprosil Vasju$_j$ [PRO$_j$ nalit'   emu$_{i/*j}$ čaju].
       Petja asked   Vasja PRO to-pour him   tea.

Since the antecedent of *on* 'he' cannot be in the same minimal clause with it, it is impossible to directly test whether this pronoun has anti-subject orientation or not. However, there is a class of sentences where the pronoun is contrastively focused (here and below we indicate focusing by the use of SMALL CAPITALS), and there is an antecedent for it in a higher clause, while there is also a definite description that is anaphoric to the same antecedent. In this case the pronoun and the c-commanding DP in its clause may end up coreferent, though it happens not because the DP binds the pronoun, but because they are co-bound by the same DP. Of course, such configuration, in the general case, must be forbidden by the binding theory, not only because it violates Principle C, but also due to the fact that if such configuration would be allowed, we would have to accept as grammatical many sentences that are actually illicit, see, e.g., Reinhart (2000) for discussion. Regarding the data in (3), we do not want to say that this restriction on covaluation should be dispensed with; moreover, both examples in (3) are not perfect, so we assume that this restriction actually works. However, while it is somehow possible to get the relevant reading when the direct object and the pronoun are co-bound, (3b), it is absolutely impossible, despite heavy stressing, when it is intended that the subject and the pronoun are co-bound, (3a). It would be possible only if there was some other constraint, besides the constraint on covaluation, that makes (3a) worse than (3b). We conclude that *on* 'he' indeed has antisubject orientation.

(3)   Vasja$_i$ prišel k Petje$_j$, i...
      Vasja came to Petja, and...

    a.   * ...Petja$_j$ pokazal Vasje$_i$ EGO$_j$.
        ...Petja showed Vasja him.

    b.   ? ...Petja$_j$ pokazal Vasje$_i$ EGO$_i$.
        ...Petja showed Vasja him.

2.2   Russian intensifier *sam* 'himself'

There are several lexical variants of intensifier *sam* 'himself' in Russian; each variant modifies DPs, but their meanings and their syntactic and phonological properties are different (see Kibrik (2003), Ljutikova (2002), a.o.). For instance, (4) contains one of prenominal *sam*'s that may modify non-pronominal DPs; its interpretational import, in the informal setting in which all studies of Russian intensifiers proceeded, would be something like this (a modified definition from (Kibrik, 2003, p. 321)): "the referent of the modified DP may be found at the end of the scale supported by some contextually salient ranking".

(4)   Sam   general priexal.
      Himself general came.

      [The] general himself came.

On the other hand, one of the postnominal *sam*'s, cf. (5), according to (Kibrik, 2003, p. 322), has the following import: "the speaker thinks that there are several potential participants of the situation P [described by the clause in which *sam* 'himself' is present] for some [thematic] role *i*, and the hearer's knowledge allows her to infer that X [the referent of the DP modified by *sam* 'himself'] is not among these potential participants, but the speaker wants to say that X is the actual participant of P [with the role *i*]".

(5) Petja udaril sebja   samogo.
     Petja hit   himself(pronoun) himself(intensifier).

     Petja hit himSELF.

In this paper, we will not be concerned with the exact formulation of the meanings of different *sam*'s. It will suffice for our purposes to note that all such meanings are highly contextualized — the *sam* 'himself' exemplified in (4) makes reference to a certain ranking, but the most salient ranking picked up by it may be different even in two neighbour sentences: the *sam* 'himself' in (6a) uses the ranking of importance in the military hierarchy, while the *sam* 'himself' in (6b) makes reference to the local hierarchy of the rare-shavers.

(6) Today soldiers are waiting for a visit of some officers, and they know that the local officers do not shave too much, and that the captain is the champion: he shaves as frequently as once in a week. The soldiers also know that the captain shaved just two days ago, so he is not expected to shave in the following five days. After one of the soldiers sees the local officers meeting the officers who just arrived, he shares what he has seen with the others:

  a. Sam   general   priexal, ...
     Himself [the-]general came,   ...

     [The] general himself came...

  b. ... i   (daže) sam   kapitan   pobrilsja.
     ... and (even) himself [the-]captain shaved.

     ... and (even) the captain himself shaved.

The *sam* from (5) is dependent of the similarly subtle changes of the context, cf. (7) and repeated (8), now put in an appropriate context. Though all events of hitting are more or less uniform, in (7) Vasja is unexpected to be the hit person, while in (8) it is Petja who is unexpected to be hit:

(7) Vasja wanted Petja to hit Petja himself, but ...

     ... naoborot, Petja udaril Vasju samogo.
     ... vice versa, Petja hit   Vasja himself.

     ... #Petja udaril sebja   samogo.
     ... Petja   hit   himself(pronoun) himself(intensifier).

(8) Petja actually wanted to hit Vasja for what he did, but Vasja evaded, and surprisingly...

... #Petja udaril Vasju samogo.
... Petja   hit   Vasja himself.

... Petja udaril sebja   samogo.
... Petja hit   himself(pronoun) himself(intensifier).

So (for each version of *sam*) there is always a set of referents such that if a DP denotes such a referent, than it may be modified by (this version of) *sam*. Then the meaning of *sam* may be viewed as a predicate, though the set of individuals of which it is true constantly changes. We call this kind of meanings **dynamic predicates**, and will return in section 4 to the discussion of how one can formally describe it, and what consequences the existence of such words as *sam* 'himself' has for the semantic theory.

2.3   [pronoun + *sam*] complexes

Now we are ready to turn to the main empirical point of the paper. While there are several different *sam* 'himself' intensifiers in Russian, one of them is particularly interesting for us, because it shrinks binding domains of the pronouns it modifies. This variant of *sam* 'himself' has a specific intonation pattern distinct from those of other *sam*'s, and may be used only in cases when the whole DP it modifies is contrastively focused. But the most striking evidence that renders it different from other *sam*'s is that the binding domain of the pronoun it modifies gets narrowed to the minimal clause — other lexical variants of *sam*, associated with different intonation and, possibly, linearization restrictions, may never affect the binding possibilities of pronouns.

As was noted in Section 2.1, the Russian pronominal *on* 'he' cannot stay with a c-commanding "coindexed" DP in the same minimal clause, except for very special contexts as in (3b). However, when it is modified with this variety of *sam* 'himself', it *must* find an antecedent inside its minimal clause[6]:

(9)   Lena$_k$ ... .
      Lena   ... .

   a. Anja$_i$ pokazala Maše$_j$ [EJO SAMU]$_{*i/j/*k}$.
      Anja showed   Masha [her herself].

   b. Anja$_i$ pokazala Mašu$_j$ [EJ   SAMOJ]$_{*i/j/*k}$.
      Anja showed   Masha [to-her herself].

   c. Brat Anji$_i$ pokazal Mašu$_j$ [EJ   SAMOJ]$_{*i/j/*k}$.
      Anja showed Masha   [to-her herself].

   d. * Anja$_i$ poprosila Mašu$_j$ [PRO$_j$ nalit'   [EJ   SAMOJ]$_{i/j}$ čaju].
        Anja asked   Masha [PRO to-pour [her herself]   tea].

The unmodified *on* 'he' in (2) could not accept the ancedent in the same clause, yet the same pronoun modified with *sam* 'himself' in (9) must find its antecedent exactly in the same domain where the unmodified *on* 'he' could not — its (minimal) clause,

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[6]The order of the two non-subject DPs in examples like (9a) and (9b) may vary without affecting the acceptability, as long as the pronominal DP is contrastively stressed. Russian is a scrambling language, and many kinds of intraclausal movement affecting the linearization is allowed. Throughout this paper, we just try to use the most neutral linear order.

(9a) and (9b). Moreover, the antecedent must c-command the pronoun, as shown in (9c). That the domain in which the modified *on* must find its antecedent is the minimal clause and not the finite clause is shown by (9d): in the analogous (2c), the pronoun may be bound by the finite clause subject, and in (9d) it may not[7]. The unmodified *on* bears two binding constraints: first, it must not be in the same minimal clause with its antecedent, and secondly, it must not be bound by the subject. However, when *on* 'he' modified by *sam*, an additional constraint is added, namely, that the pronoun must have a c-commanding antecedent in its minimal clause (which overrides the first of the two original constraints, but preserves the second).

As for *sebja* 'himself', a similar change in binding restrictions occurs when it is modified by this version of *sam*: the binding domain, which is the minimal finite clause for the unmodified *sebja*, gets narrowed to the minimal clause. When in a finite clause, (10a), [*sebja* + *sam*] has the same binding restrictions as the bare *sebja*, cf. (1b). However, when embedded into a non-finite clause, (10b), *sebja* in the [*sebja* + *sam*] complex cannot be bound by the subject of the matrix clause, unlike the bare *sebja* in (1c).

(10) a. Petja$_i$ pokazal Vasje$_j$ [SEBJA SAMOGO]$_{i/*j}$.
          Petja showed Vasja [himself himself].

      b. Petja$_i$ poprosil Vasju$_j$ PRO$_j$ nalit' [SEBE   SAMOMU]$_{*i/j}$ čaju].
          Petja asked   Vasja PRO to-pour [himself himself]   tea.

To sum up, when the specific variant of the intensifier *sam* 'himself' adjoins to an anaphoric pronoun, it poses an additional constraint on the pronoun interpretation, in addition to the original constraints: namely, the pronoun modified by *sam* must have a c-commanding antecedent in its minimal clause. This constraint may in principle override those of the pronoun original constraints (as in the [*on* + *sam*] case) that are incompatible with it, but preserves all other constraints. Thus, the contribution of *sam* is compositional[8].

Pronoun systems containing complex pronouns formed by a basic pronoun and some element more or less compositionally adding a new binding constraint are not rare in natural languages. To name a few, even the English anaphor *himself* has emerged as a result of the development of the pronoun-intensifier [*he* + *self*] complex; Hellan (1988) extensively discusses the Norwegian anaphoric system that is very alike to the Russian system described above — the Norwegian anaphoric system is formed by

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[7]It may not be bound by the finite clause object *Maša* either, because *Maša* binds the subject of the minimal clause of *on* 'he', so under this construal the pronoun would be "coindexed" with the PRO subject of its minimal clause which is impossible.

[8]The non-compositional part of the story about one constraint overriding another may be easily explained via Gricean reasoning. If the pronoun bears the constraint K and *sam* — the constraint L that is not compatible with K, if the speaker would want to use K, she should not add *sam* that bears a contradictory constraint. Hence, if she used *sam*, she wanted to use the constraint L and not K.

This story by itself, however, does not justify the use of *sam* when it is incompatible with the original restrictions of the pronoun it modifies. But there is another story doing that job: Russian does not have a pronoun (or pronoun complex) that may be bound by a c-commanding non-subject DP in its minimal clause, since *sebja* 'himself' cannot be bound by non-subjects, and *on* 'he' cannot be bound by an antecedent in the same minimal clause. It is only natural then to assume that this situation is serious enough to force speakers to use constraint overriding, because it will help them to fill the gap in the anaphoric system.

two basic pronouns, corresponding to Russian *sebja* and *on*, and two complex pronouns formed with a former intensifier (historically related to the Old English *self*). The basic pronouns are just the regular anaphor and pronominal, and the complex pronouns have an additional constraint narrowing the domain in which they must have an antecedent, just as in the Russian case. The classical work of Reinhart and Reuland (1993) (among other works on the same subject) relates the distribution of the complex [anaphor + intensifier] in Dutch with the lexical properties of the verb: intransitive verbs allow bare anaphors, and transitive ones allow complex anaphors. On the other hand, there is a number of studies of fine semantic distinctions between the simplex and the complex anaphors, such as Pica and Snyder (1997), who argue that complex reflexives, unlike simplex reflexives, denote "the same individual in some different aspect"; Rooryck and Wyngaerd (1998), who argue that full DPs denote sets of time-slices, and that bare anaphors require identification with a single time-slice in the denotation of the antecedent while complex anaphor require identification with the whole set of the antecedent time-slices; Lidz (2001), who, basing on the Madame Tussaud contexts, proposes that there are two kinds of reflexives, Pure-Reflexives and Near-Reflexives, which in Dutch correspond to the simplex and the complex reflexives respectively. While investigating such fine meaning distinctions is a valuable task, we have little to say on the subject in this paper, and concentrate on the binding domain changes and not on the other semantic effects distinguishing simplex and complex pronouns.

The important point here is that Russian is different from the mentioned above languages because of the special status of the [pronoun + intensifier] complexes. While in other languages investigated to date such complexes are treated as complete lexical entries, we argue that Russian complexes are constructed in syntax, not in lexicon. This fact is of great importance, since the classical form of the binding theory, as we noted above, bears a serious limitation: it cannot allow one lexical item to change the binding constraints of some other lexical item in a structure, and that is exactly what happens in the Russian case.

What evidence there is in favor of the view that the Russian pronoun complexes are free word combinations? Well, frankly speaking, one can hardly find a sufficient set of data to convince everyone, not only in our case, but in each case when the subtle question of what exactly should count as a lexical entry is involved. But here are several arguments in favor of our claim: *sam* carries an independent stress; *sam* is inflected; other lexical variants of *sam* are clearly words and not morphemes; *sam* bears specific information-structural restrictions (the contrastive focus requirement) and the specific intonation pattern, which is hardly possible for a morpheme, but is normal for a word. Last, but not least, the marginality of the construction in question speaks for our point too: only about a half of our informants accept such complexes, while the others reject them. It is understandable if we assume that those speakers who do not accept the pronoun complexes do not have this specific *sam* and therefore cannot combine it with the pronouns — a viable hypothesis in view of the fact that there is a lot of different *sam*-lexemes in Russian; but it is unlikely that a half of the speakers have novel complex one-word pronouns while the other half does not.

While none of these arguments is decisive on its own, we suppose that when they all are put together, they present sufficient evidence for our claim that the Russian com-

plexes are two-word combinations, and not one-word complex pronouns. However, if you are not convinced by those, here is another argument: Suppose that the Russian complexes are actually one-word. Be that as it may, we know that in many languages there are anaphors emerged from [pronoun + intensifier] combinations. It cannot be that such complexes were one-word from the very beginning: first, they needed to be free combinations of pronouns and intensifiers, and only after that the single pronoun word may have been formed. Even if you do not believe that the Russian case represents such two-word stage, you nevertheless need to accept that there is such a stage in the anaphor development process. And if you do, then all consequences for the form of the binding theory survive, even if not on the basis of the Russian data, but on purely theoretical grounds.

3 Variable-free binding theory: how to account for the binding principles?

The previous section has revealed (as we hope) one of the empirical constraints on the form of a viable binding theory: such a theory must be formulated in a way that allows one lexical item to modify the binding restrictions of another lexical item (in certain structural configurations). In this section we will consider a different, purely theoretical, problem relevant for a particular formulation of the binding theory by Jacobson (1999), and then in subsequent sections we will provide a single solution for the problems discussed in these two different lines of the paper.

The binding theory of Jacobson (1999) has been shown to be superior to the more "classical" generative versions of the binding theory based on Chomsky (1981) and Reinhart (1983). But the first and foremost, Jacobson's theory involves an even more drastical change in the perspective than just the change of such module of the grammar as the binding theory, because it eliminites assignment functions from our semantics.

In classical Montagovian semantics, meanings of all natural language expressions are functions from assignment functions to something else. It is a consequence of the fact that this semantics makes use of variables. If we allow variable use, then we must provide some means of determining the values of free variables in a sentence in order to get its truth value. Otherwise, we will not be able to interpret a sentence with unbound variables. Assignment functions are what does this job: they supply values for the free variables. To add an example, the meaning of a sentence "A man walks" is a function from assignment functions to truth values. One needs to supply some "contextually salient" assignment function to obtain an actual truth value for this sentence. In this specific case, the function is a constant one, as it would be just for every other sentence without free variables. The fact that the function from assignment functions to truth values denoted by this sentence is constant means that its truth value is not dependent on the choice of a particular assignment function. We could just have omitted the assignment function layer for such sentences. But the function denoted by "He walks", in contrast with the previous case, will be a non-constant function, since different assignment functions may pick up different actual referents for the pronoun *he* that denotes a variable and (this variable) is unbound.

What if we would want to throw away assignment functions while preserving the standard variable-containing semantics? Nothing good, of course, because those sentences that contain free variables will not be able to get a truth value. It is exactly the existence of variables that may be unbound that forces us to add the assignment function layer to our semantics.

Jacobson in a series of papers argues that we can safely eliminate variables from our semantics and thus also eliminate the need for the assignment functions layer, which in turn will make our semantic theory much easier — the meanings of natural language expressions will not have to be functions from assignment functions to something else, and will become just this "something else".

There are several steps that will allow us to do this move. First, we change the denotations of the pronouns. Under the classical semantics, pronouns' meanings are variables, possibly accompanied with some sortal restrictions (e.g., the male and atom restrictions on *he*). Under the Jacobson system, these become identity functions[9]:

(11) a. The standard view:
          $\lceil he \rceil^g = \lambda g.$if male(g(x)) & ATOM(g(x)), then g(x);
          undefined otherwise.

      b. The variable-free view:
          $\lceil he \rceil = \lambda x.$if male(x) & ATOM(x), then x;
          undefined otherwise.

Thus the semantic type of a pronoun under Jacobson's variable-free theory is not the individual type e (or, rather, $\langle a,e \rangle$, where a is the type of assignment functions), as in the standard semantics, but $\langle e,e \rangle$, the type of functions from individuals to individuals.

Having changed the meanings of some DPs that way, we have to change our view of semantic composition accordingly: if we leave things as they are, no pronoun will be able to occur in an argument position designated for individual-denoting arguments because of the type mismatch. To fix that, we introduce the **g** rule ("Geach rule") that allows us to combine a pronoun with some other expression while passing up the information that there is some unbound pronoun left inside the resulting meaning[10]:

(12)   If there is a meaning α, then there is $\mathbf{g}(\alpha) \overset{\text{def}}{=} \lambda f.\lambda x.\alpha(f(x))$.

Informally, this rule says that if some expression accepts simple arguments, then its **g**-ed version accepts functional arguments, and may then combine with an argument for the function it has combined with to produce a regular meaning. In other words, **g** allows to pass functionality up. (In fact, **g** is just a Curried version of functional composition: $\mathbf{g}(f)(h) = f \circ h$.) If we want to compute the meaning of a sentence like "He walks", we first have to apply **g** to the verb *walks*. That will turn $\lambda y.$walk(y) into $\lambda f.\lambda x.$walk(f(x)).

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[9]Throughout this paper, we use lambda notation for variable-free denotations just as a convenient means to express functional terms, without assuming actual variable use and lambda abstraction. All variables in such formulas are bound, and thus their meanings would be constant functions from assignment functions under the standard semantics. They need a model to be interpreted, but they do not need an assignment function.

[10]Actually, in the complete system of Jacobson (1999) we would need a rule that modifies not only the semantic type, but also the syntactic category — which would be a combinator of Combinatory Categorial Grammar. Here we omit the syntactic side of the theory to keep the things simple.

Now we combine this with the meaning for *he*, $\lambda z.z$, and the result is $\lambda x.walk((\lambda z.z)(x))$ = $\lambda x.walk(x)$. Note that this meaning is not a truth value. Instead, it is a function from individuals to truth values that should be applied to some individual picked up from the context to return a truth value. The sentence inherits the properties of the pronoun it contains: the pronoun wants to be bound, but if it cannot be, it passes the binding requirement along the semantic composition, until there is a binder. This is essentially Jacobson's answer to the question of what should become of sentences "with free variables" under the variable-free semantics — such sentences denote functions from individuals or something else to truth values.

Now we know how to treat pronouns and pass an unbound pronoun up. What is left is to introduce a rule that will allow us to bind a pronoun. Jacobson (1999) defines a type-shift rule **z** to that purpose:

(13) If there is a meaning α, then there is $\mathbf{z}(\alpha) \overset{\text{def}}{=} \lambda f.\lambda x.\alpha(f(x))(x)$.

Informally, the rule says that if some expression has two argument slots, then its **z**-ed version combines with a functional argument, which in turn has an unfilled argument, and binds the argument of the function to its own second argument. We can demonstrate how z works on the following example:

(14) Bill hates himself.
⌈himself⌉ = $\lambda x.x$.
⌈hates⌉ = $\lambda z.\lambda y.hate(z)(y)$.
z(⌈hates⌉) = $\lambda f.\lambda x.hate(f(x))(x)$.
z(⌈hates⌉)(⌈himself⌉) = $\lambda x.hate((\lambda y.y)(x))(x) = \lambda x.hate(x)(x)$.
z(⌈hates⌉)(⌈himself⌉)(Bill) = $\lambda x.hate(x)(x)(Bill) = hate(Bill)(Bill)$.

It is easy to see that the more complex structures would require application of both **g** and **z**, as well as the fact that **z** may be generalized. The interested reader may find the details of such refined implementation in Jacobson (1999), but here we need only the basic understanding of how the variable-free works.

There are various nice empirical payoffs for choosing Jacobson's theory, see, e.g., Jacobson (1994) on "i-within-i" effects, Jacobson (1996) on binding into conjuncts, Breheny (2003) on implicit argument binding, Shan (2004) on the need for variable-free binding for any semantics with alternatives, and Russell (2005) on functional parasitic gaps. However, the system as it is suffers from one serious problem: it does not have means for incorporating pronoun binding restrictions. We cannot use anything similar to the classical binding principles that are implemented as filters on representations, because there are no representations rich enough to apply such filters to under the specific Combinatory Categorial Grammar view of syntax and semantics adopted in Jacobson (1999). But even if we switch from the categorial-grammar syntax of Jacobson to a richer syntax, thus losing many of the strong points of Jacobson's proposal such as direct compositionality and the non-existence of intermediate levels of syntactic representation, be it LF or anything else, we will simply inherit the problems of the standard binding theory (like the problem discussed in the previous section) and will still need the most complicated rules of it, such as Rule I of Grodzinsky and Reinhart (1993), involving trans-derivational computation, for computing grammaticality of coreference construals of pronouns. Here we will not discuss this way out, mainly

because we strongly believe that one should not reject simpler grammars just because someone has already implemented a solution for some problem in a more complex framework when no one has tried to provide a solution for the same problem in a simpler framework.

The simplest approach (apparently) preserving direct compositionality was implemented by Szabolcsi (1992) and Dowty (1999), among others. The idea is that we can build the binding restrictions into the syntactic category of the pronoun. This, however, presupposes that binding is built into pronoun syntactic categories and meanings, and not into type-shift rules like Jacobson's **z**. Under this kind of approach, the pronoun first combines with the predicate of the type ⟨e,t⟩, and then with the binder. In other words, the pronoun is a function of type ⟨⟨e,t⟩,⟨e,t⟩⟩. After combining with the predicate, it merges the argument slots of the binder and of itself, and then it combines with the binder filling both slots with the same meaning, that of the binder.

For instance, *hates himself* will have the reflexive meaning λx.hates(x)(x), and when we combine it with *Bill*, we get hates(Bill)(Bill).

To implement Principle B in this theory, we make the meaning and category for *he* such that the pronoun could not be bound before it meets the first S category expression on its way. For instance, the pronoun may take not two, but three arguments, the first one being the verb of its own clause, the second — the verb of the higher clause, and the third — the binder. After combining with the first two, the pronoun will merge an argument slot of the former with an argument slot of the latter, and then will fill the both with the binder's meaning. So the meaning for *he left* in the sentence *Bill says that he leaves* will be λf.λx.f(leave(x))(x). The meaning of *says that he leaves* will be, consequently, λx.say(leave(x))(x), and the meaning of the whole sentence — say(leave(Bill))(Bill). The Principle B effect is accounted for because of the requirement to combine with two verbs before the pronoun may combine with the binder DP.

However, this view has significant shortcomings. First, if we have such meaning of *he* that allows us to account for the Principle B effect, then this version of *he* will never be free, because we have built the requirement to be bound into its meaning and category. So we will need some different omonymous lexeme *he* for sentences where this pronoun remains free[11]. Moreover, we will need a trans-derivational rule analogous to Rule I of Grodzinsky and Reinhart (1993) to prevent this free version of *he* to be coincidentally coreferent with some other c-commanding DP in its clause. The moral is that if we accept that binding and binding restrictions are built into pronouns, we have to have a more complex view both of the lexicon and of the grammar.

Secondly, such a theory of binding restrictions would suffer from the same problem as the standard Chomsky-Reinhart theory — namely, that it does not allow one lexical item to modify the binding restrictions of another lexical item.

To sum up, Jacobson's theory must be expanded with some account for the data

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[11]For sentences like "The boy said that she slept" it is easy to adopt Jacobson's analysis for free pronouns, under which we accept that meanings of such sentences are of type ⟨e,t⟩. But it will not carry over to sentences in which there is no second verb, like in the simple "She slept", because here we would need to take out of the context not only some salient individual, but also some verb to combine with the pronoun in order to get a truth value, and this is, of course, very problematic, because it is not that "She slept" is different from "Ann slept" and that its meaning must include some additional verb, unlike the meaning of "Ann slept".

usually accounted for by the principles of the binding theory. However, there are several restrictions on possible analyses:

(15) 1. To eliminate the need for Rule I or any its analogue, we must state the binding restrictions in such a way that they may govern both bound-variable and coreference readings of pronouns.

2. Binding restrictions must not use any intermediate levels of syntactic representation (or else we will have to give up on direct compositionality).

3. One lexical item must be able to modify binding restrictions of another lexical item.

Below we will present a theory that satisfies these three restrictions. Our analysis will significantly increase the complexity of the grammar, though. But we argue that this additional complexity is required on independent grounds. The next section discusses a slight shift in the perspective on the dynamics of natural language that is needed to account for the Russian intensifier *sam*, and then in section 5 we will use the results of section 4 to build a theory of binding restrictions that is compatible both with the data presented in section 2 and the variable-free framework of Jacobson (1999) shortly discussed in this section.

4 Towards a possible solution: dynamic predicates as intensifier meanings

Dynamic semantic theories like DRT capture one of the aspects in which the interpretation of linguistic expressions is dependent on the context, that is, the anaphoric potential of linguistic expressions. What we need to account for dynamic predicates is to define a theory with an even richer notion of context in which there would be place for dynamic interpretation of such special predicates. In this section we set up such a theory.

We take as a point of departure the simple DRT language L of van Genabith et al. (prep) and extend it to a new language L_{dyn}.

The vocabulary of L consists of a set of discourse referents **DiscRef**, a set of definite relations **Name**, sets of non-logical constants $\mathbf{Rel}^n$ of arity n, and the set **Sym** of DRT connectives {=, ¬, ⇒, ∨}. In L_{dyn}, we add to these a new set **DynPred** that consists of dynamic predicate symbols.

Traditionally DRS-s consist of two parts: a set of discourse referents **U** (the universe) and a set of conditions **Cond**. We add to these two a third (possibly empty) set, which contains the current definitions of dynamic predicate states, **DynPredState**, and the symbol := { ... } ∈ Sym, defining the syntax of DRS-s as follows:

(16) The syntax of L_{dyn}:

1. The definition of DRS-s:

If U ⊆ DiscRef; Cond is a possibly empty set of condions, and DynPredState is a possibly empty set of dynamic predicate states, then ⟨U, Cond, DynPredState⟩ is a DRS.

2. The definition of dynamic predicate states:

   If DS ∈ DynPren, and $x_i, \ldots, x_n$ ∈ DiscRef, then DS := $x_i, \ldots, x_n$ is a dynamic predicate state.

3. The definition of conditions:

   (a) if x_i, x_j ∈ DiscRef, then $x_i = x_j$ is a condition.

   (b) if N ∈ Name and x_i ∈ DiscRef, then N(x) is a condition.

   (c) if P is a predicate constant in Rel^n and $x_1, \ldots, x_n$ ∈ DiscRef, then $P(x_1, \ldots, x_n)$ is a condition.

   (d) if K is a DRS, then ¬K is a condition.

   (e) if K_i and K_j are DRS-s, then $K_i \vee K_j$ is a condition.

   (f) if K_i and K_j are DRS-s, then $K_i \Rightarrow K_j$ is a condition.

However, while we have added a new set of symbols and a new part of DRS-s containing dynamic predicate states, we do not intend to give them a model-theoretic interpretation. Instead, the models for L_{dyn} will be exactly the same as the models for L: the members of DynPred will not be in the domain of interpretation functions $\mathscr{I}$; and the dynamic predicate states DS will not affect the verification of DRS-s.

But if our extensions do not affect the semantics of the DRT language, then what do they do? We use them not in the process of interpreting DRS-s, but in the process of constructing DRS-s from natural language expressions. In addition to usual rules converting syntactic trees to discourse referents and DRS conditions, as described in detail in, e.g., Kamp and Reyle (1993), we introduce several new rules. These are predicate-specific introduction and update rules, and a general satisfaction rule that works for every dynamic predicate.

We first sketch the rules needed to account for the "unexpected" *sam* described in section 2.2. Let its meaning be a dynamic predicate **Unexp**: ⌈sam*unexpected*⌉ = λx.Unexp(x). For starters, we define a transition from the empty DRS to the one which contains a clause "Unexp := {}" in its DynPredState:

(17) Unexp introduction rule:
      If there is a DRS ⟨U, Cond, DynPredState⟩ U is empty, and Cond is empty, and Unexp ∉ DynPredState, then add to this DRS's DynPredState the state Unexp := {}.

Next, we need to provide means to update this state. In order to do this, we first define the notion of discourse referent equivalence class in (18), modeled after (Kamp and Reyle, 1993, p. 235), and then introduce the update rule (19), which must be executed in the process of analyzing any DP.

(18) Two discourse referents x and y belong to the same equivalence class A relative to DRS K iff there is either a condition x = y ∈ Cond_K or two conditions x = z and z = y ∈ Cond_K.

(19) Unexp update rule:
      Let the processed DP occupy a semantic slot *s,* DynPredState contain a state Unexp := {\ldots, x_i, \ldots}, and the set of discourse referents X contain all x_i.
      First, change the state Unexp := {\ldots} to the state Unexp := {}.

Then for any discourse referent y such that y is not in the same equivalence class of discourse referents with any x_i *in* X, and the processing language user knows that y is unexpected to occupy *s*, and DynPredState contains a state Unexp := {...}, change this state into Unexp := {..., y}.

It is evident that this definition makes reference to the speaker's (or the hearer's) knowledge and expectations. The processing mechanism containing such rules is not fully determined by the linguistic input — instead, it depends both on linguistic input and the psychological state of the language user. Though such a mechanism may at first seem strange, we argue that such dependency on the specific language user is exactly what we need to account for the actual data. If a person A considers somebody's participation in a certain event very improbable, a person B (that possibly has other sources of information and thus a different base assumptions for making inferences) may think quite the contrary.

It may be argued, however, that sometimes the degree of unexpectedness may be determined by the linguistic input. For instance, it is hardly possible for anyone to hit oneself, and thus the Agent of a hitting event is very unlikely to be the Patient of the same event. But since this too is subject to variation from one situation to another, the import of the linguistic context seems to be cancelable. We think that it shows us that the best way to account for such import of the linguistic context is through the modeling of the language user reasoning, and not through the direct update of the dynamic predicate state. For instance, we may develop postulates allowing the language user to infer that the Agent of hitting is unexpected to be the Patient of the same hitting event in the absence of other relevant bases for inferences.

Now, when we have both the introduction rule and the update rule for Unexp, we may turn to the interpretation of *sam*. The first part is rather trivial: we assume that its meaning is processed in the same way as meanings of regular adjectives denoting regular, non-dynamic, predicates. The specific properties of dynamic predicate meanings are realized through a special satisfaction rule, that allows us to erase the condition that makes reference to a dynamic predicate — an impossible operation for normal conditions that must survive and then receive the model-theoretic interpretation. The satisfaction rule is general for all dynamic predicates (in other words, the specific dependencies on the language user's state of mind are encoded in the introduction rule and the update rule only).

(20)   Dynamic Predicate Satisfaction rule:
Let $DP_k \in$ DynPred,
$DP_k := \{x_i, x_{i+1}, \ldots \ x_n\} \in$ DynPredState, and
$DP_k(y) \in$ Cond.
If there is x_j, where $i \leq j \leq n$, such that y is in the same equivalence class with x_j, then erase the condition $DP_k(y)$ from Cond. Otherwise, the derivation crashes[12].

To sum up, we have developed a framework that allows to capture the dynamism of language users' representations of certain special predicates. Normal expressions receive the same treatment as in the standard DRT and do affect truth-conditions. Dynamic predicates, on the other hand, are constantly updated correspondingly with the

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[12]Alternatively, one may define as ill-formed any complete DRS in which there are conditions containing symbols from DynPred.

speaker's or the hearer's knowledge and beliefs, and do not affect truth-conditions directly, but restrict the process of constructing a DRS. It is relatively easy to assign to dynamic predicates their respective introduction and update rules basing on their import, once the mechanism for this is elaborated, though the exact analyses for, e.g., different versions of *sam* are beyond the scope of this paper.

It is worth noting that if we are to define the context change potential of the DRS-s of our new L_{dyn} language (and we leave this to the future work), the notion of information state (see Heim (1982), Groenendijk and Stokhof (1991)) will become insufficient. The information state corresponding to a DRS may be thought of as a package consisting of a proposition and a set of discourse referents available for subsequent anaphora. In a system that allows dynamic predicates, we will need to add to this package a record of the contents of DynPredState. Defined this way, information states will become implicitly dependent on the language user, since the contents of DynPredState is not determined by the linguistic input — instead, it is determined both by the linguistic input and the language user's reasoning.

When this is made clear, it becomes evident that this version of DRT represents not the semantics of linguistic expressions that is equal for all language users, but rather the semantics *and* (the part of) the user-dependent context. However, our update rule in (19) is defined so that if the Unexp state is not introduced by the introduction rule, the update rule cannot work. On the other hand, if DynPredState does not contain the state of a certain predicate, then the truth-conditional semantics just runs as usual, but the occurence of a linguistic expression denoting a dynamic predicate leads to the derivation crash. So in principle, we may restrict the un-classical part of the theory (as long as there are no dynamic expressions in the linguistic input) by just taking away the introduction rules. If we do so, then there will never arise a triggering configuration for the update rules and the satisfaction rules, and thus we will just return to the classical semantics without dynamic predicates.

Alternatively, one may define the predicate-specific rules in a different way, namely, to eliminate the introduction rule and to allow the update rule to introduce a new dynamic predicate state. Then it will be possible to have certain special triggering configurations that force the update rule to work only when it is actually needed. A most radical and convenient choice of such a special configuration would be a constituent containing the actual dynamic predicate. Then the costly computation based on the language user's knowledge and beliefs would be invoked only when it is really needed[13].

One more important point concerns the relation between dynamic predicates and presuppositions. The notion of presupposition may be defined in many various ways, depending on the specific theory. If we classify an expression as presuppositional on the basis of the fact that it makes the whole utterance to be inappropriate (to lack the truth-value) when certain contextual restrictions are not met, then it follows from the Dynamic Predicate Satisfaction rule that dynamic predicates are presuppositional in this sense.

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[13]If we believe that this system models the human language faculty, then a question arises: which of these two possibilities does correspond to what happens inside our head? Again, we leave this question for future psycholinguistic research, but cf. Fedorova and Yanovich (2005) that, if on the right track, presents an argument in favor of the constant update view.

However, dynamic predicates lack some properties that unify the traditionally recognized members of the class of presupposition-inducing expressions, such as definite descriptions or factive verbs: dynamic predicates do not allow projection and accommodation in the same way as definite descriptions or factive verbs do. For instance, it is well-known that the whole sentence will not inherit a presupposition induced by some presuppositional expression if the presupposition may be bound by (that is, identified with) the part of some accessible DRS (see van der Sandt (1992), among many others, on the Binding Theory of presuppositions). Thus (21) does not inherit the presupposition of the existence of the king of France because the presupposition is satisfied by the antecedent of the conditional.

(21) If there is a king of France, then the king of France is bald.

However, in (22) we cannot accommodate $sam_{unexpected}$ by adding a condition to this point to some accessible DRS. It is in line both with the empirical data and with our analysis. To test if such accommodation is possible, we may construct a discourse like this:

(22) a. Esli by ja ne ožidal, čto Vasja udarit sebja, to ja by skazal,
         If SUBJ I not expected that Vasja would-hit himself, then I SUBJ said
         čto ...
         that ...
         "If I would not expected Vasja to hit himself, then I would say ..."
      b. ... Vasja udaril sebja   samogo.
         ... Vasja hit   himself(pronoun) himself(intensifier)
         "Vasja hit himself."

If the dynamic predicate restrictions might be accommodated like presuppositions, then uttering first (22a) would allow the speaker to utter (22b) without committing himself to the claim that he actually does not expect Vasja to be the Patient of hitting. But it does not: uttering (22b) may not be successful if the speaker does not actually believe in this unexpectedness. This constitutes a dramatical contrast with sentences like "If there is a king of France, then the king of France is bald", in which the entire sentence does not inherit the presupposition of the definite description. These facts are consistent with the theory outlined above: under our analysis, the Dynamic Predicate Satisfaction rule checks the DynPredState part of a DRS, and not the condition part. Hence nothing in the condition part may help us to satisfy the rule.

If we compare the behaviour of presuppositions and dynamic predicates in a local context, both put restrictions on it, but the difference in their effects is explained by their respective relations to model-theoretic interpretation. Presuppositions are in a sense normal conditions, that is, they require some propositional content to be present in the context in order for them to be satisfied. On the other hand, dynamic predicates restrict possible mind states of the language user, and do not receive any direct interpretation. Thus no propositional content of the context may satisfy them: it must be made by changing the language user's state of mind.

If, on the other hand, we will view the process of presupposition and dynamic predicate satisfaction/resolution globally, then we will see another distinction (which is still related to the first one, though): while presupposition resolution crucially involves, in

theories like that of van der Sandt (1992) and related work, a specific process of finding the appropriate binder or accommodation site, the resolution of dynamic predicates is much simpler: if the predicate may not be satisfied by the local context, it may not be satisfied at all. While the propositional part of context is structured, and we may accommodate a presupposition in many parts of this structure, it does not make sense to "accommodate" a dynamic predicate to a speaker's state of mind as it were a minute ago: all that matters for language users is their state of the mind as it is now. And it is only natural, since we cannot actually change the mind of ours as it was a minute ago, or as it will be in a minute.

5   From intensifiers to pronouns: How to build binding restrictions into pronoun meanings

In the previous section we have developed a theory for dynamic predicates and demonstrated how it helps to account for the interpretational import of the intensifer *sam*. In this section, we propose that binding conditions of anaphoric pronouns are dynamic predicates too.

It is evident that anaphoric pronouns have in their meanings some presuppositions. For instance, the referent of *he* must be male and atomic. Every theory of pronouns should somehow account for the existence of such 'trivial' constraints on pronoun reference. What we propose is that binding conditions may be represented via analogous conditions, if these conditions denote not usual predicates, but dynamic predicates corresponding to structural binding domains.

Suppose that we have a dynamic predicate ReflMinClause that is defined in such a way that when it meets any DP, it contains discourse referents introduced by all DPs c-commanding the processed DP and which are in the same minimal clause with it. Then if we just add to the conditions male(x)&ATOM(x) in the meaning of *himself* a condition ReflMinClause(x), it will do the job usually performed by Condition A: by the Dynamic Predicate Satisfaction rule, if the referent of *himself* may not be identified with the referent of some c-commanding DP in the same minimal clause, the derivation crashes (instead of being filtered out because of the wrong coindexing by Principle A, as in the classical Binding Theory)[14].

The first good point about this analysis is that it allows to construct a binding theory without indexes and filters on representations. Secondly, it allows us to govern both bound-variable and coreference construals of pronouns without performing transderivational computation, since it is not the binding that is checked but the identity of reference itself[15].

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[14]A binding theory very similar to the just outlined account was proposed by Branco (2001): Branco defines several sets of referents, different sets being accessible for different binding classes of pronouns. Thus, he has sets A, B, C and Z, corresponding to binding principles (the set Z being introduced to account for long-distance anaphors). These sets are constantly updated in the process of derivation, and DPs may choose their referents only from their corresponding sets.

[15]As for the apparent contrexamples to (the traditional) Principle B, widely discussed in the anaphoric literature, in which one and the same individual is present in two different discourse guises, the two DPs in such cases are most likely to introduce discourse referents that do not belong to the same equivalence class.

Our proposal also fits well with the variable-free theory of Jacobson (1999), since it does not require any syntactic representational levels and packs the binding conditions into lexical meanings (and "unpacks", that is, realizes them, in the process of constructing a DRT representation from the syntactic output). Of course, it is not that the introduction of dynamic predicates does not make our grammar more complex, but we argue that this complexity is needed to account for linguistic expressions of a certain kind in general, not for anaphoric pronouns only. So the cost of introducing dynamic predicates is at least much less than that of indexing, Rule I, and other devices developed just in order to account for pronoun binding constraints.

Last but not least, under our analysis there is just no problem of one lexical item compositionally modifying the binding constraints of another lexical item in the structure. Since the binding constraints are just part of meaning, they can be composed by regular semantic composition rules, and thus the Russian pronoun complexes described in section 2.3 may be accounted for. It is as easy as it could be: actually, while the problem for the traditional binding theories is how it can be possible for one lexeme to modify binding restrictions of another, in our theory a different research problem arises: why two-word complexes of the form [pronoun + intensifier] may turn into single words so fast — what exactly makes them different from other free word combinations from the perspective of historic development?

Thus all three requirements on the possible binding theories in (15) are met by our analysis of binding conditions as dynamic predicates. What is left is to develop an analysis for the Russian data presented in 2.3, which will serve as an illustration of how our mechanism works.

We define several dynamic predicates corresponding to structural domains. There will be two predicates containing all discourse referents of c-commanding DPs in some minimal domain: **MinClauseCommand** and **FiniteClauseCommand**; and two predicates containing discourse referents that are either non c-commanding the current DP or outside of its minimal domain: **NonMinClauseCommand** and **NonFiniteClauseCommand**. We will also need two predicates **Subject** and **NonSubject** to account for subjective and anti-subjective orientation.

The meaning for *on* 'he' will include conditions NonMinClauseCommand(x) and NonSubject(x). The meaning for *sebja* will include conditions FiniteClauseCommand(x) and Subject(x). Finally, the meaning for *sam* will include the condition MinClauseCommand(x).

The conditions for the [*sebja* + *sam*] complex will be FiniteClauseCommand(x) & Subject(x) & MinClauseCommand(x). Since at any moment of the DRS construction the referents of which MinClauseCommand is true will be the subset of referents of which FiniteClauseCommand is true, it is equivalent to just MinClauseCommand(x) & Subject(x). It corresponds to the data: [*sebja* + *sam*] loses the possibility to be bound by the subject of the the minimal finite clause that *sebja* has.

On the other hand, the conditions for [*on* + *sam*] will be NonMinClauseCommand(x) & NonSubject(x) & MinClauseCommand(x). Here we arrive at a problem: the two conditions NonMinClauseCommand and MinClauseCommand are contradictory. Our data shows that the actual behaviour of this complex is such as it would be if the first constraint, inherited from *on*, was overridden by the constraint introduced by *sam*[16].

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[16]As (3b) shows, this constraint may be overridden sometimes, though such examples remain some-

We propose a pragmatic explanation for the fact that it is the constraint inherited from the pronoun that is overridden. Here is the pragmatic reasoning behind this: one of the two constraints NonMinClauseCommand and MinClauseCommand must be canceled; the only import of *sam* is the introduction of MinClauseCommand; so if this constraint does not survive, there would be no point in adding *sam* at all. At the same time, NonMinClauseCommand is one of the two binding constraints that the pronoun *on* bears. So even if it is overridden by the constraint of *sam*, the pronoun still has some important binding-theoretic import (not to mention that it bears syntactic category that allows the whole DP to occupy an argument position, and several important features such as gender and number). Thus the conditions for the [*on* + *sam*] complex are NonSubject(x) & MinClauseCommand(x) (note that it is parallel to what remains from the conditions on [*sebja* + *sam*] after we eliminate the condition that becomes superfluous).

Thus the treatment of anaphoric pronouns themselves is relatively easy. What is more complex is the definition of update rules for the dynamic predicates corresponding to structural domains. If we would not have introduced dynamic predicates for an independent reason, the very idea of doubling the traditionally syntactic relations in the semantics may seem very controversial[17]. However, since the introduction of dynamic predicates has independent motivation, the problematic step that we have to take to account for anaphora is much less large. The difference between dynamic predicates for the intensifier *sam* and for anaphoric pronouns is that the states of the latter represent structural domains, while the states of the former represent some aspects of the structure of the language user's state of mind. However, the overall mechanism seems to be the same, though the update rules for predicates of these two types will have crucial differences. We illustrate with a sample update rule:

(23)   MinClauseCommand update rule:
       Let DynPredState contain a state MinClauseCommand := {..., x_i, ...}, and the set of discourse referents X contain all x_i.
       First, change the state MinClauseCommand := {...} to the state MinClauseCommand := {}.
       Then for any discourse referent y such that y is not in the same equivalence class of discourse referents with any $x_i \in$ X, and y is introduced by a DP that c-commands the processed DP and is in the same minimal clause with it, and DynPredState contains a state MinClauseCommand := {...}, change this state into MinClauseCommand := {..., y}.

There are two problems with this formulation. The first problem is that it makes direct reference to syntactic relations. Of course, it is not desirable in any theory, but in principle we have just three options: 1) to make the binding theory a part of syntax; 2) to make direct reference to syntactic relations in semantics; and 3) to pass the

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what degraded.

[17]Though it is evident that any approach that tries to consistently make less work in syntax and more work in semantics will have to do so. There are even more radical proposals than ours in the literature: e.g., Fox and Lappin (2005) try to develop a system for computing quantifier scope that allows to compute the actual scope pattern in semantics on the basis of the underspecified output of syntax and a system of scope filters, and they have to introduce semantic predicates corresponding to such purely syntactic relations as "to be outside of the island of".

relevant syntactic relations from syntax to semantics in some way or other. The first option seems to be impossible in view of the fact that we need to constrain both bound-variable and coreference readings. As for the last two, it is hard to say which one is better: both are bad enough, but we still have to choose one of them. Note also that other DRT analyses for binding constraints suffer from the same problem too. (Kamp and Reyle, 1993, p.238) restrict themselves to simple structures that does not contain any other DPs but the subject and the direct object of the verb, and they implement Principle A by forcing the reflexive in the direct object position to be coreferent to the subject, and Principle B by forbidding for the pronominal in the direct object position to be coreferent with the subject of the same clause. The relevant syntactic relations are not expressed directly in their construction rules, but are introduced implicitly through labeling of the DPs in the triggering configuration. So in order to broaden the empirical coverage of this binding theory, one will need to either widen the relevant triggering configurations or to use syntactic relations explicitly in the rule. It is worth noting that Berman and Hestvik (1997), who put forward a much more explicit and complete system for restricting pronominal reference in the DRT framework, choose the second way and use in their rule definitions clauses like "(the DP introducing the discourse referent) A does not c-command (the DP introducing the discourse referent) B within (the DP introducing the discourse referent) B's binding domain" (from their (27)). Thus while the reference to syntactic relations in DRS constructuon rules does increase the complexity of our grammar, we cannot see a solution that would allow us not to use syntactic relations and at the same time to implement a reference resolution mechanism for pronouns in DRT.

The second problem of (23) is that it is very inefficient: every time we meet a DP, we must recalculate the dynamic predicate state starting from the empty state. This problem, however, is much less serious, since it is easy to make a computationally optimized set of rules equivalent to this update rule. In such a system, there would be a rule that will add every processed DP to the relevant dynamic predicate states, and there would be also rules for several special nodes which would either clear the contents of the dynamic predicate state (for MinClauseCommand, such a rule will run at every S category), or recompute the contents of the predicate starting from an empty state/restore a saved value of the predicate state contents (it will be needed in the case some tree node has two branches with DPs in each — after processing one branch, we will need to restore the contents of the predicate state as it was when we departed for processing this branch). Again, if we believe that the mechanism for pronoun resolution should correspond closely to what people actually do when they use language, then the question of choice between different implementations of update rules becomes an empirical question, since different optimizations may cause different side effects when people process linguistic expressions, but it is hard to argue for any specific implementation on purely theoretical grounds.

6   Conclusion

In this paper, we set up a framework that allows to account for the import of intensifiers in natural language and for the binding restrictions of anaphoric pronouns. This proposal allows us to solve the empirical problem of the Russian pronoun complexes

that cannot be accounted for under the standard binding theory using filters defined for pronoun binding classes. At the same time our proposal constitutes an extension to Jacobson's variable-free binding theory allowing to account for binding restrictions of individual pronouns without introducing such syntactic devices as indexing and grammatical trans-derivational rules such as Rule I.

It is not that the resulting system is as simple as the original DRT or Jacobson's variable-free framework, but we argue that the complexity of our theory adequately corresponds to the complexity of language. We divide components of meanings of natural language expressions to regular conditions and dynamic predicates. Regular conditions are interpreted truth-conditionally, and thus constitute a propositional content of a discourse; on the other hand, dynamic predicates restrict the language users' states of mind during the processing of a discourse. They are not inherited by the "meaning" of the discourse, but restrict the possible states of processing agents.

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