Department of Linguistic and International Studies
University of Surrey

Declarative Derivation

A Network Morphology account of Russian word formation with reference to nouns denoting 'person'

by

Andrew Hippisley

A thesis submitted in accordance with the requirements of the University of Surrey
for the degree of Doctor of Philosophy

September 1997

Abstract

Studies on derivational morphology often assume a procedural view, emphasising the journey from morphologically simple to morphologically complex word. We present a declarative approach with the focus on the relationship between two morphologically connected words. This more static approach enables us to better locate the generalizations present in a derivational system. We test this approach on a specific body of data, namely the formation of nouns denoting 'person' in Russian.

After introducing Network Morphology, the declarative framework within which we base our account, and the Russian data we will be investigating, we provide as theoretical background to our proposed analysis a sketch of the role of morphology in the Structuralist tradition, and in the more important models of the early Generativists (Section I).

Section II is entirely devoted to Network Morphology, and acts as a short survey of the recent work carried out in this framework. The focus is on the key concepts of Network Morphology, inheritance hierarchies and the idea of defaults, and on the nature of the relations that occur within a network.

Since we emphasise the relationship between words, our commitment is to a lexeme-based approach to morphology. Section III explores the implications of this, examining Aronoff's model, and its key elements, Word Formation Rules. We construct a set of Aronovian-style WFRs that account for Russian person derivation.

Section IV constitutes the declarative account. The proposed WFRs for Russian are given a declarative interpretation. The WFRs are viewed as generalizers of derivational information, and exceptionality is characterized as the overriding of certain of the generalizations. Our account is expressed in DATR (the appendices contain the full version) which is computable, and we have therefore been in a position to demonstrate that the theory makes the correct predictions about the data it claims to account for.

for

Rachel

Table of contents

Acknowledgements

The research reported here rests on a bedrock of support, advice and encouragement, and it is with pleasure that I acknowledge the people and institutions which have helped me to carry out this study. A number of people have played a part in this research and I would like to single out a few them for special thanks. First, my supervisor, Prof. Greville Corbett, who has guided me along the way at all levels and has always responded immediately to any type of query I have had, and whose insights about the subject, along with the logical consistency that underpins them, have helped (I hope) my own thought processes and given me something to follow; but almost equally important, whose sheer delight in language and linguistics has inspired my own enjoyment of the subject. Also, thanks to Dunstan Brown for his constructive critical reading of the draft versions, and for patiently listening to me talk about bits of my research over the years, and advising and helping out whenever he can. Since beginning to think about problems in morphology I have benefited greatly from the advice of Dr. Norman Fraser, especially on how to express and present my thoughts. His own clarity of expression is the example I try to set myself. I have been very lucky over the years to have had some valuable instruction on the workings of DATR from the authors of the language, and I would like to thank Prof. Gerald Gazdar and Dr. Roger Evans in this regard. Thanks also to Prof. G. Stump for his conversations with me about morphology, especially 'morphomics', Prof. Alan Timberlake for discussions on Russian phonology near the beginning of the research, to my teachers at SSEES, especially Nick Brown who taught me Russian, and Prof. C. Drage for the detailed answers to my questions on anything about Russian (not just phonology!), and for first suggesting that I do something with Russian and computers. As a part-time PhD student I spent the first few years working as a research fellow on a grant funded by the Leverhulme Trust (F.242M), and I am grateful for their support. I would also like to acknowledge the British Academy for a travel award to present my research at the *American Association for Teachers of Slavic and East European Studies* in Chicago in December 1995, and the *British Association for Slavonic and East European Studies* for funds to attend and present a paper at their 1996 conference in Cambridge. My understanding and interest in morphology has benefited greatly from the two ESRC funded research seminars on morphology that have been running over the past few years, *Frontiers of Research in Morphology* and *Challenges in Inflectional Description*, where I have had the opportunity of learning directly from the experts in the field, and presenting and receiving comments on some of my own work. Finally, I wish to thank my wife, Rachel, for providing the much needed encouragement and care to begin, continue, and finish the research. This is yours.

Abbreviations

abl	ablative	masc	masculine
acc	accusative	neut	neuter
act	active	nom	nominative
adj	adjective	per	person
dat	dative	perf	perfective
deriv	derivation	pl	plural
fem	feminine	PossAdj	possessive adjective
gen	genitive	sg	singular
imperf	imperfective	sup	supine
inf	infinitive	trans	transitive

Note on transcription

Russian orthography closely follows phonemic representation, and the phonemic transcription we use is therefore close to standard transliteration, with a few minor points of difference (based on Corbett and Fraser (1993: fn. 2), which is itself based on Timberlake (1993: 828-832)). The main points are summarised as follows:

Consonants

The set of paired palalatized (soft) and unpalatalized (hard) consonants are distinguished by an acute (´) which marks the soft member of the pair. For example, in the minimal pair *l´uk* 'hatchway', and *luk* 'onion' the first form has the soft /l´/. Note that consonants are always soft before the phoneme /e/, hence there is no need to mark them with an acute in this context. For example, the locative singular of *zakon* 'law' is represented as *zakone* since the stem final /n/ is automatically soft.

The velars /g/, /k/ and /x/ are hard except when preceding the /i/ and /e/ phonemes; in these contexts they are automatically softened. We therefore do not use an acute on the velars in these contexts since they are automatically softened. Compare the nominative singular form *ručka* 'handle' with the genitive singular *ručki*, where the /k/ is soft before the *-i* ending but not indicated as such.

Note that unpaired soft /č´/ and /šč´/ are redundantly marked with an acute when preceding a vowel, but unpaired soft /j/ is never marked with an acute.

Vowels

We recognize five vowel phonemes (under stress) which are /a/, /e/, /i/, /o/, /u/. The phoneme /i/, standardly transliterated as '*i*', has an allophone [ɨ], standardly transliterated as '*y*'. The allophone [ɨ] is automatically used when following a hard consonant. The correct version of /i/ will therefore be implied by the nature of the preceding consonant. For example, compare *s´irij* 'orphaned' and *sir* 'cheese', which in transliteration would appear as *siryj* and *syr* respectively. We ignore vowel reduction (when unstressed) in our transcription, but should draw attention to the 'reduction' of /o/ to [ə] or [i] after a soft consonant.

Finally, we use the *Slavonic and East European Journal* transliteration system for citing the Russian literature; to avoid confusion with transcribed forms, anything in transliteration in the main text appears in quotes.

SECTION I

Background

Chapter 1:
Introducing the framework and the data

1.0. A word on 'declarative derivation'

In computer science declarative languages are the set of programming languages which explicitly state properties, as opposed to procedural languages where properties are derived by a sequence of operations. Thus in the Dictionary of Computing:

> "Since declarative languages are concerned with static rather than dynamic concepts (i.e. what rather than how) they do not depend on any inherent ordering and there is no concept of flow of control..." (Illingworth 1990: 124).

Now in linguistics derivation represents the procedure from one stage of structure to another; it is "the process of the formation of an expression" (Janssen 1994: 872). The expressions we are concerned with are complex words, in other words derivation for us denotes specifically derivational morphology. Given this, 'declarative derivation' appears to be an odd collocation. It in fact is meant to suggest an approach to morphological word formation where the standard procedural view of derivational morphology is replaced by a declarative one, and rules of word formation are replaced by generalizations that can be made about types of derivation; these are situated in a network of nodes and inherited by lexical items by default. The focus is not on the procedure from simple to complex, but on the relationship between two morphologically related words.

To illustrate, consider a list of derivationally related items such as the one in Figure 1.1. based on Tixonov (1985). The careful indentations allow us to see that *dobrotnost´* is derived from *dobrotn(ij)*, which in turn is derived from *dobrot(a)*, and so on. Bold type denotes the affix added in the derivation[1]. How might we approach data of this kind?

dobr(ó) 'good deed'

dóbr-**Ø**(ij) 'good' (adj)

dobr-**ot**(á) 'goodness'

dobrót-**n**(ij) 'of good quality'

dobrótn-**ost´** 'good quality'

Figure 1.1. Partial derivational nest of *dobr(o)*

An obvious way would be to take the most basic word *dobr(o)* as primary and somehow account for the way it generates the whole nest of derivatives. Such an approach lies at the heart of the lexicalist morphology framework of Kiparsky (1982; 1983). Crucial to such an approach is stipulating the order in which rules apply. The derivative *dobrotnost´* can be represented with labelled brackets in (1.1).

(1.1)

$[[[[[\text{dobr}]_{\text{noun}}\ \text{Ø}]_{\text{adj}}\ \text{ot}]_{\text{noun}}\ \text{n}]_{\text{adj}}\ \text{ost´}]_{\text{noun}}$

The brackets represent different rules: for example, one rule adds the adjective forming zero suffix, another the noun forming suffix *-ot*, and so on. The generation of the nest is accounted for in the way described by Figure 1.1 by arranging the rules in an appropriate order with respect to one another. Of the two adjective forming suffixes *-Ø* must be ordered before *-n*; and of the two noun forming suffixes *-ot* must be made to attach before *-ost´*. Ordering gives the rules a dynamic role: a primary word is cycled through the layered blocks of rules, accumulating structure as it goes, and derivation is viewed as a process from the most basic to the most complex. Though there exists a large body of literature pointing out the problems with this approach to derivation[2], particularly for the forced stipulation of rule ordering, a procedural approach such as this does at any rate appear to be apt since word formation itself suggests the proceeding from an old word to a new word.

An alternative view presents itself, however, if we think of the rules not so much as dynamic generators of structure, but as static conditions on possible structures. For example, a rule might have the condition that its input must carry a certain suffix. Fabb (1988) is one of the most convincing arguments for dismissing level ordered morphology. He proves that the same data so eloquently accounted for in a lexicalist model can be equally well (and in fact better) accounted for by simply finding the conditions for the attachment of affixes, and stating them in the rule. Fabb examines the forty three most productive English suffixes, based on Walker (1924). The point of departure is that of the 1849 possible suffix combinations (43 x 43), only 50 actually occur. Fabb carefully demonstrates that level ordering on its own is unable to account for suffix combinations that do not occur (at best it reduces the number to 614). He concludes that:

> "level-ordering does no extra work in ruling out suffix pairs beyond that done by independently needed selectional restrictions ." (1988: 538)

In this approach there are no cycles, but simply a satisfying of conditions. Now if rules can be viewed as sets of conditions on the attachment of formatives to Bases, we can have a declarative interpretation of such rules. The set of conditions and corresponding form is set up as a node in a network of similar nodes. Lexical entries are also represented as nodes in the same network. Word formation rules are then seen as redundancy statements between two lexical entries representing the 'deriving' word and the 'derivative' word, what we will term the Base and the Derivative. The focus is no longer on the procedure from most basic to most complex, but on the relation between two immediately connected items, a Derivative and its Base, both of which are 'declared' in the network. The idea is represented in Figure 1.2. (The arrow represents that the flow of information is from the Base to the Derivative.)

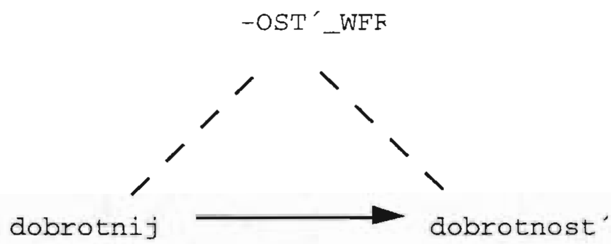


FIGURE 1.2. A declarative account of the Derivative *dobrotnost´*

The relationship between *dobrotn(ij)* and *dobrotnost´* is partially specified by the node -OST´_WFR which acts as a redundancy rule over the two items. It supplies the suffix, the syntactic class information, the inflectional class information, and some of the meaning to the Derivative (i.e. 'state of X'). Conditions at -OST´_WFR also ensure the well-formedness of the Derivative. One such condition would be that inputs must be adjectives, another that they must be specifically qualitative adjectives, etc.

In this thesis we offer a declarative account of Russian derivational morphology along these lines. The account is couched within the nascent framework of Network Morphology. In **1.1** we outline the conceptual apparatus behind Network Morphology, its set of assumptions about the morphological system, and its formal representation. In **1.2** we give a brief sketch of Russian derivational morphology, looking at the chief morphological operation types, the derivational categories in noun formation, including person formation, and allomorphy in Russian derivation. Finally in **1.3** we give an overview of the thesis, and the limitations of our study of Russian derivation.

1.1. Network Morphology

Following Zwicky, a framework differs from an 'approach' in that it is more focused: it has a conceptual apparatus and a network of assumptions (1992: 328).

1.1.1 Conceptual apparatus of Network Morphology

The central concept that lies behind Network Morphology is that complexities characteristic of morphological systems can be more parsimoniously described by distributing information declaratively across a network, and in such a way that generalisations may be expressed[3]. Network Morphology should therefore be seen as a member of the set of declarative frameworks which make use of inheritance hierarchies.

1.1.1.1. Inheritance hierarchies

If in a declarative approach morphological facts are distributed across nodes, of primary importance is the relations between the nodes. Nodes can be arranged hierarchically and the flow of information between them can be given the interpretation of inheritance. The more general a fact, the higher will be its place on the hierarchy to ensure widest possible application. Conversely, rarer facts will appear lower down, and their inheritance will be more limited. The notion of inheritance hierarchy has been imported into linguistics from representations of knowledge common in the Artificial Intelligence literature (see Gazdar 1987: 45-8). Daelemans, De Smedt and Gazdar offer a brief survey of the important inheritance-based frameworks used for accounts of syntax, morphology, phonology and semantics (1992: 210-13).

For example, in Hudson's Word Grammar framework (Hudson 1984; 1990) the grammar is made up of a number of different hierarchies: one includes information about word-types (word class), another about possible dependency relations (note that Word Grammar has a dependency-based approach to syntax). Even non-linguistic concepts are included in the network, representing the view that language knowledge is just one type of knowledge. Amongst inheritance-based frameworks of interest for morphology is Flickinger's (1987) work on the lexicon where the syntactic properties of lexical entries are organised in a network of hierarchies. Not mentioned in the survey but important for derivation are Kilbury's inheritance accounts of German. For example in Kilbury (1992) a hierarchy of 'derivational paradigms' is proposed from which lexical entries inherit for their formal and syntacticosemantic structure. This can be compared to the feature-based inheritance account of German derivation in Krieger and Nerbonne (1993: 113-34).

1.1.1.2. Default inheritance

The inheritance from nodes in Network Morphology has a non-monotonic, default interpretation. In a default inheritance hierarchy, what are stated at higher level nodes are not absolutes, but generalisations. These generalisations may be overridden locally. A default inheritance hierarchy naturally captures, for example, the fact that English plural is realized by attaching the suffix *-s* to the stem, but that in the particular case of the noun *ox* something else happens. Thus default inheritance goes hand in hand with Network Morphology's aim of expressing morphological generalisations.

1.1.1.3. Constraints for typology

Finally, though the underlying aim is to allow generalisations in a given language to be optimally expressed, Network Morphology imposes a set of constraints on the way facts are distributed and the relations that pertain between them. This meets the broader aim in Network Morphology of having a framework that extends across the typological spectrum[4]. Besides Russian, Network Morphology has been used to describe Arapesh (Fraser and Corbett forthcoming), Polish (Brown 1996a), Bulgarian (Brown 1996b), Hua[5] (Brown 1996c), and Central Alaskan Yup'ik Eskimo (Brown 1997).

1.1.2. Assumptions of Network Morphology

Having looked at Network Morphology's conceptual apparatus, we can set out the key assumptions it makes about morphology. There are three main assumptions, the first concerning the minimum linguistic unit, the second the division in morphology between inflection and derivation, and the third the nature of the lexicon.

1.1.2.1. Lexeme as minimal sign

In Network Morphology the focus is on the relationship between words, rather than morphemes. The approach to derivational morphology is in terms of the relationship between a Base and its Derivative, and not on the constituent structure of the Derivative. Network Morphology should therefore be seen as word-based, where the minimal linguistic unit is the word[6]. It has been noted by a number of people, for example Matthews (1991: chapter 2), that what is meant by word is not at all straightforward, and requires clarification. To anticipate somewhat, Network Morphology assumes a lexeme-based approach to morphology. Lexeme-based frameworks occupy an important place in the Generative enterprise, and so we consider Aronoff's lexeme-based work in chapter five. The point of departure is the dissatisfaction with the numerous problems associated with morpheme as minimal sign. We can summarise the main problems as follows, drawing partly from Anderson (1992: chapter three), and Beard (1995: chapter two).

In the morpheme-based approach a word's meaning is computed by adding the meanings of all embedded morphemes. This is the 'classic' model of morphology, adopted by the Structuralists, as we shall see in chapter two. Because a word's meaning depends on morphemes, interpretation relies on the fact that one particular 'morpheme', or meaning unit, will be phonologically realised by one particular form, or 'morph'. The meaning-to-form mapping should thus be 'biunique'. It is conventional to represent morphemes using curly brackets. So the morpheme {plural} should biuniquely correspond to the morph *-s*. Clearly, difficulties with this arise in instances where biuniqueness, for one reason or another, breaks down; and unfortunately, such instances appear to be the expected rather than the exceptional situation in morphology. The breakdown may involve one meaning corresponding to various forms as when in English the morpheme {plural} is realised by the morphs *-s* and *-en* (in *oxen*). In this instance we can think of 'rival' affixes. Affix rivalry is not limited to inflection. Person derivation is marked by a great number of formatives in Russian, for example Cubberley lists over fifty (1994: 111-112). A couple of the more productive suffixes are *-´ik* as in *skromn´ik* 'modest person', and *-tel´* as in *p´isatel´* 'writer'.

The converse situation is also common enough, where one morph realises a number of morphemes. An inflectional example would be the single morph *-aja* in the Russian adjective *skromn-aja* 'modest' which realises simultaneously the several different morphemes {singular}, {nominative}, {feminine}. Such a formative is termed a 'portmanteau morph'. In Russian derivation, the morph-*´ik* realises a number of morphemes, one of which carries the meaning 'diminutive' as in *dom* 'house' > *domi´ik* 'little house'; and another the meaning 'person' in *skromn(ij)* 'modest' > *skromn´ik* 'modest person', as mentioned above. Such 'affix homonymy' in the derivation example is widespread in Russian.

Another situation is where a morpheme may have no corresponding morph, in other words no form at all. In Russian inflection the genitive plural of class II hard stem nouns[7] such as *komnata* 'room' has no formal marking, as is the case with the nominative singular of class I nouns such as *stol* 'table'. Morpheme-based accounts are forced to posit 'zero morphs' in such cases. The two Russian examples would be represented as *komnat-Ø* and *stol-Ø*. Lack of formative is also widespread in derivation. An example of this in English would be the noun *gold* and its derived adjective *gold-Ø*, which curiously has a parallel in Russian: the noun *zolot(o) 'gold'* derives the adjective *zolot-Ø(oj)* (where brackets represent inflection)[8].

The opposite also exists, where no morpheme can be found to correspond to a morph. Katamba (1993:38) illustrates this with adjectives in English built in the suffix *-al*, such as *tribal* and *medicinal*. However, in *sensual* there appears to be an extra morph *-u* which does not contribute anything meaningful to the word, i.e. has no corresponding morpheme. We can therefore think of *-u* as empty of meaning, or an 'empty morph'. A sort of variation of the empty morph, the 'superfluous morph', is mentioned in Anderson (1992:54). In this case the morph realises a morpheme, only the morpheme is irrelevant and therefore superfluous to the description of the word's semantic structure. An example is French *doucement* 'softly' where *-ment* corresponds to a morpheme that functions to derive adverbs, but the *-e* is superfluous. Unlike the empty morph above, the *-e* in adjectives marks agreement with feminine nouns; however it is superfluous in our example since gender distinctions are irrelevant in French adverbs.

All the above demonstrates that the level of the morpheme is too low to look fruitfully for meaning-to-form correspondences, simply because biunique examples, though possible, are rare. Instead the correspondence should be explored one step up, at the level of the lexeme.

1.1.2.2. Distinguishing derivation and inflection

Much has been written on the division of morphology into two areas or roles: a syntactic role, inflection, and a lexical stock expanding role, derivation (or (morphological) word formation). In some models inflection and derivation are viewed as discrete, and placed in separate components. For example, Anderson (1982) suggests placing derivation in the lexicon, and inflection in the phonological component (and we will discuss his proposals in chapter five). Scalise goes even further by dividing off expressive derivation from non-expressive derivation, and housing it in a special expressive component (1986: 131-3). In other approaches no division is made at all; instead the whole of morphology is viewed as a cline. This is the position of Bybee (1985: 82), for example. What is the position in Network Morphology? Though Network Morphology accepts some sort of split in the morphology, it does not view inflection and derivation as entirely discrete. Two hierarchies are posited, one for inflection and one for derivation, but both belong to the same network, and are interconnected. In this way an attempt is made to account for the fact that a number of characteristics tend to coincide with inflection, and others with derivation. As Stump remarks:

> "any carefully articulated theory of morphology should offer some account of this coincidence [of characteristics]" (1990: 99).

The characteristics that force one to recognise some sort of division in morphology have been outlined in a number of places, and it is worthwhile at this point to look briefly at the main ones. The following discussion draws chiefly on Anderson (1982: 585-591), Bauer (1988: chapter 6), Katamba (1993: 51-54; 206-212), Scalise (1986: 102-115; 1988) and Stump (1990: 97-103).

Relevance to syntax

We start off by observing that inflection builds units (morphosyntactic words) that encode syntactically relevant features, whereas this is not the case for derivation (see Anderson 1982: 587). This is illustrated in (1.2) and (1.3) (based on Stump 1990: 98-99). In (1.2) the choice of the inflected word-form *run* over *runs* is already made by the syntax, and hence is pre-determined (1.2). On the other hand, in (1.3) the choice of the Derivative *employer* over *employee* is a choice made in the lexicon, and therefore is not determined in the same way. As Stump puts it, "...nothing in a noun's syntactic environment ever requires it to be marked with agentive morphology..." (1990: 99).

(1.2)

a. The boys run

b. * The boys runs

(1.3)

a. What sort of employer are you looking for?

b. What sort of employee are you looking for?

Productivity

A second observation concerns the difference in 'productivity'. This is best described if we think in terms of paradigms. Characteristic of inflection is that all the cells are filled, hence inflection is typically 'fully productive', whereas derivation leaves gaps, hence is at best 'semi-productive'. Table 1.1 (based on Aronoff 1976: 44) shows the 'paradigms' of four lexical items and their Derivatives, illustrating semi-productivity in derivation.

monster	*cury	glory	labour
monstrous	curious	glorious	laborious
monstrosity	curiosity	*gloriosity	*laboriosity

TABLE 1.1. Semi-productivity

In one sense Table 1.1 is a reflex of our first observation that whereas inflection is obligatory, derivation is optional. Thus the non-existence of **gloriosity* is due to its non-requirement: the deriving lexeme *glory* is always used instead, because it fills the same 'meaning slot' as **gloriosity* would. In the same way, *labour* preempts the need for **laboriosity*[9]. These gaps are therefore accounted for by the 'blocking' of already existing forms. This happens in Russian too: the Russian noun *slava* 'glory' derives the adjective *slavn(ij)* but there is no abstract noun derivative **slavnost´*. We can think of another type of blocking, 'morphological' blocking, where one morphological operation is blocked by an item's use of another one. Consider an illustration of semi-productivity resulting from this in Russian in Table 1.2, where the morpheme that corresponds to the meaning 'person' is realised by the rival affixes *-tel´* and *-n´ik*. The semi-productivity in Table 1.2 is a natural consequence of these two affixes being in complementary distribution. In fact what needs to be examined in these instances is the factors determining the selection of one affix over another. We look at this more closely in chapter five.

uč´i(t´)	'teach'	pomošč´	'help'
uč´i-tel´	'teacher'	*pomošč-tel´	*
*uč´i-n´ik	*	pomošč-n´ik	'helper'

TABLE 1.2 Rival affixes in Russian

It should be noted that there are various senses attached to the term productivity, and we will need to be clear in future discussions as to what sense we are referring to. Following Corbin (1987: 176) we distinguish three senses for productivity. In the first, the productivity of an affix corresponds to the number of words carrying it, in other words the 'profitability' of an affix. Thus *-ric* in English is very low on the profitability score since it only appears once, namely in the noun *bishopric*. In the second sense, what is at issue is whether or not the affix is being used synchronically, in which case we will speak about its 'availability'. An affix will score high on the availability scale if it attaches to borrowings, or is used to coin new words. Now high availability may well result in high profitability, but the point behind dividing productivity in this way is that there need not be a correspondence. Carstairs-McCarthy (1992:37) illustrates the situation where an affix is highly available, but has low profitability. The suffix *-et* in English meaning 'piece of music played by an *n* number of musicians' attaches whenever it can, i.e. to stems such as *quart-* to form *quartet*, *quint-* to form *quintet*. However, for non-linguistic, i.e. musical reasons there are a limited amount of appropriate bases. Hence though highly available, *-et* is not highly profitable. It should be clear that this distinction in productivity has important consequences for rival affixes. Some may not be profitable because of the nature of their conditions, but at the same time may be highly available because they attach every time the conditions are met. This will contrast with other affixes which have low profitability because synchronically they are not available. For example the suffix *-th* in English that attaches to adjectives to derive nouns as in *warm* > *warmth* is not profitable because the synchronic, or highly available, suffix *-ness* is used instead.

Corbin includes a third sense of productivity, 'regularity'. This corresponds to semantic transparency. For example, though words in *-th* have low availability, Bauer (1988:60) notes that they are semantically transparent, hence have high regularity, e.g. *greenth* is easily recognisable as an abstract noun derived from *green*. Taking all these senses together, inflectional systems display high levels of productivity, whereas the derivational system is only partially productive.

Semantic transparency

Inflection leaves a structure semantically transparent, whereas the result of a derivation is a new word whose meaning is subject to drift though the passage of time, in which case its interpretation cannot be rendered by simply decomposing the lexeme into constituent parts. For example, though *employer* may be analysed as 'one who employs', *awful* cannot be analysed as *awe* plus the possessional adjective suffix *-ful* to render 'having (much) awe'.

Affix order and multiple affixation

A fourth observation is that in morphologically complex words inflectional affixes appear outside derivational ones. In *employers*, for example, the plural inflection *-s* is ordered after the derivational suffix *-er*. Closely linked with this is a further observation that generally inflection acts to close word structures as can be seen in the English example in (1.4a); whereas derivational affixation leaves a structure open for further application of affixes, as shown in (1.4b). Derivation is therefore characterised by allowing for such multiple affixation. Recursion is a type of multiple affixation where the same affix is used more than once. In (1.4c) we see that the adjective forming suffix *-al* appears twice in the structure.

(1.4)

a. industries i.e. (industry-s)
b. industrialisation i.e. ((((industry)-al)-ise)-ation)
c. industrialisational i.e. (((((industry)-al)-ise)-ation)-al)

Preservation of morphosyntactic features

A fifth observation is that whereas in derivation there is a change of features that are inherent to the Base, these features are preserved in inflection. For example, recall the *zolot(o) > zolot(oj)* example where the syntactic category of the Base shifts from noun to adjective. Russian also presents numerous examples of inflectional class change. We can recognise four declension classes for Russian nouns (which we discuss in more detail in chapter three). *Orator* 'orator' belongs to class I but its abstract noun derivative *oratorstv(o)* 'oratory' to class IV. For change in sub-categorisation frames, we give an Italian example from Scalise (1986: 110). (1.5) and (1.6) show how sub-categorisation features change in the derivation *rubare* 'steal' > *derubare* 'rob'. Note that other features changed in derivation are gender and animacy.

(1.5)

rubare	_NP,	_PP
	[-animate]	[+animate]
a. Giorgio ruba	i risparmi	di Antonio
George steals	the savings	from Antonio
b. * Giorgio deruba	i risparmi	di Antonio

(1.6)

derubare	_NP,	_PP
	[+animate]	[-animate]
a. Giorgio deruba	Antonio	dei risparmi
George robs	Antonio	of his savings
b. *Giorgio ruba	Antonio	dei risparmi

Obligatoriness[10]

The final criterion is not always mentioned in the literature, but is nonetheless an important one. Inflectional categories are obligatorily expressed, whereas derivational categories are not. For example, in English nouns number is obligatorily expressed:

the stem plus (usually) the suffix *-s* , as in *cats*, expresses number information, namely plural; but equally the lack of a suffix expresses number information, namely singular. In other words, by simply specifying the stem number information is being conveyed "even if such detail is of no particular communicative relevance" (Plank 1994: 1672). In Bybee's words:

> "An inflectional category is obligatorily marked every time a stem category to which it applies appears in a finite clause. The consequences of this are that there must be some means of expression for the category with every stem." (Bybee 1985: 27).

The inflectional and derivational characteristics outlined above are summarised in Table 1.3.

Characteristic	**Derivation**	**Inflection**
Relevance to syntax	not relevant	relevant
Affix order	before inflectional affix; leaving word open	after derivational affix; closing a word
Multiple affixation	possible	not possible
Feature preservation	possible change of syntactic category, inflectional class, sub-cat. frames, gender, animacy	no change to inherent features of deriving lexeme
Semantic transparency	not always semantically transparent	nearly always semantically transparent
Productivity	semi-productive (at best)	fully productive
Obligatoriness	not obligatory	obligatory

TABLE 1.3. Inflectional and derivational characteristics

It should be carefully noted that this discussion concerns observations, or tendencies. For each characteristic we can easily find counter-examples. Often cited in the literature are counter examples to affix ordering. Booij (1994: 38) notes that in Dutch the inflectional suffix *-en* realising {plural} may be ordered before the collective derivational suffix *-dom* as in *scholier-en-dom* 'set of pupils'. Stump (1990:115-6) shows multiple affixation applying in inflection in the case of Breton double plurals: *ronse* 'horse' > *ronsed* 'horse (pl)' > *ronsedoù* 'horses (double pl)'. In the plural diminutive *bag-où-ig-où* 'little boats' the plural formative *-où* appears twice in the structure, once before the diminutive *-ig*, and once after (1990: 104), hence representing an example of recursion. Note that in the Breton example plural inflection is not closing the word. This peculiar phenomenon is in fact relatively widespread in Breton, as Stump (1990) shows: in addition to diminutives the plural formative may be found inside adjective derivation, as well as verb derivation[11].

The inflectional characteristic of preserving features can be found in areas of derivation. An example of this is Russian expressive derivation where syntactic category and gender are preserved, even when there is a change in inflectional class. This is illustrated in (1.7) for the augmentative *dom´i šč´(o)* 'large house' which belongs to class IV, associated with neuter gender, but nonetheless is masculine due to its Base *dom* being masculine.

(1.7)

gromadn-ij	riž-ij	dom´išč´-o
huge-Masc.Nom.Sg	rust-Masc.Nom.Sg	house-Masc.Nom.Sg

'the huge red-brown house'
(Čexov, 'Svetlaja ličnost´')

Regarding semantic transparency, examples exist where an inflected item is no longer transparent due to semantic drift, which as we have shown is a characteristic of derivation. Bybee gives the English example of *clothes* which can no longer be interpreted as the plural of *cloth*, showing the item's meaning has drifted (1985: 91). Lastly, for productivity Halle (1973: 7-8) cites Russian verbs as an instance where inflection is not fully productive. A number of verbs lack a first person singular in the non-past, for example *pobed´it´* 'conquer' .

1.1.2.3. The role of the lexicon

In chapter two we will show how the role of the lexicon develops from a storehouse for what is idiosnycratic, the view of the Structuralists (see Bloomfield 1933: 274), to a more structured component where word formation is accounted for, a view beginning with Chomsky's (1970) seminal paper, and followed in Halle (1973), and Anderson (1982, 1992) amongst others. Thus the lexicon in Anderson (1992: 181) is a "component of linguistic knowledge parallel to syntax and phonology". What role does the lexicon play in Network Morphology? Before answering this we ought to be clear on what is meant by 'lexicon'. Aronoff (1994: 16-21) makes the interesting observation that 'lexical' has two senses, one when it refers to a Bloomfieldian-type list of idiosyncrasies, and the other when it refers to the lexeme. It is this dual sense, he argues, that has led linguists such as Halle and Anderson rather bizarrely to use one and the same term both to list what is idiosyncratic and to express what is not, namely the lexicon.

In Network Morphology we may say that we have a highly structured lexicon, in the sense of a component that accounts for lexemes. This component comprises a Lexemic hierarchy where generalisations relating to word classes are stored, an Inflectional hierarchy for inflectional morphology and a Derivational hierarchy for derivation, which is of course our main area of interest. As for lexicon in the sense of a list of idiosyncrasies, this is provided for by the hierarchical organisation of facts. Lexical idiosyncrasies are encoded in the lexical entries, and the lexical entries appear as leaf nodes of the lexemic hierarchy. From this follow two things: first, lexical entries are partially specified items and are 'filled out' by inheriting information from the network; and secondly lexicalised exceptionality is naturally encoded by local information overriding information in the hierarchies, possible due to inheritance from nodes being non-monotonic, or default (this is explained in detail for derivation in chapter eight).

1.1.3. Representing Network Morphology theories

We end this section on Network Morphology with a brief discussion of the formalism used to represent Network Morphology theories. Zwicky notes that when moving on to consider its possible theories, a framework needs to be refined in two ways. First "the set of assumptions has to be filled out as to be complete with respect to the domain at issue" (1992: 328). We will see how this requirement is met in the course of our account of the Russian data. Second, "a descriptive mechanism (that is, an interpreted formalism) must be provided" (1992: 329). The formalism used to represent Network Morphology theories is the lexical knowledge representation language DATR, which was developed by Evans and Gazdar at Sussex in the late 1980s. DATR defines networks by links typed by attribute paths through which information is inherited (Gazdar 1990a: 1). Its interpretability comes from an explicit theory of inference (see Evans and Gazdar 1989a), an explicit declarative semantics (see Evans and Gazdar 1989b). It is implementable on computer (a number of computer interpreters exist for DATR descriptions, see for example Evans 1990, and its enhancement in Jenkins 1990) which of course allows for a given theory's predictions to be verified by computer. Lastly, as a main feature DATR has a non-monotonic notion of inference by default (Gazdar forthcoming: 15).

All these features make DATR highly appropriate for default inheritance frameworks, such as Network Morphology, as noted in Evans and Gazdar (1996: 207). All Network Morphology theories have been represented in DATR, and computationally verified, including the present theory of Russian derivation proposed in this thesis. Indeed it is a somewhat delicate question as to how far it is possible to separate the Network Morphology framework and its theories from the DATR formalism in which they are expressed. Shieber devotes a paper to the issue of whether theories and their representation are separable. He makes the assumption that the conceptual apparatus of the framework transcends the formalism itself (1985: 19); the same theory can be expressed in various ways, provided there is some compatibility between the formalisms. Indeed, DATR is of course not limited to Network Morphology. For example, Gazdar (1992) uses it for a theory based on Stump's Paradigm Function Morphology (Stump 1991). Moreover, there exist a host of DATR theories that are not tied to any particular framework. (Many of these can be found in the DATR archive (Evans, Gazdar, and Keller 1997)). DATR is not even restricted to theories of morphology. For example it has been used to represent accounts of lexical semantics (e.g. Kilgarriff 1995), phonology (e.g. Gibbon 1991, 1992; Cahill and Gazdar 1997), and allomorphy (Cahill 1991). But it should be noted that though it is claimed Network Morphology theories can in principle be expressed in other formalisms (Fraser and Corbett 1995: 125), in practice this has never been carried out.

Having introduced the framework in which our account is couched, we move on to the data that is accounted for.

1.2. Russian derivation

Russian is an East Slavonic language with approximately 153 million speakers, of which 137 million are native speakers (Timberlake 1993: 827). Russian is morphologically rich, and has therefore been an appropriate language of investigation in the Network Morphology enterprise. As a typical member of Indo-European, Russian is a fusional type language where a single form encodes a number of inflectional categories. (Examples of this were given above.) What particularly marks out Russian (and Slavonic in general) from other Indo-European languages is the way its verbal system is organized around the morphological marking of aspect. Indeed the grammatical term 'aspect' meaning 'view, aspect' comes from Russian 'vid'. For an introduction and overview of Russian, the reader is referred to Comrie (1987). For a more detailed account, see Timberlake (1993) and Comrie, Stone and Polinsky (1996). In this section we give a brief overview of Russian word formation. We look at the types of morphological operations used in Russian to mark derivation, the main derivational 'categories' themselves used in noun formation, and allomorphy in derivation.

1.2.1. Morphological operations

The derivational system in Russian makes use of a range of morphological operations. By far the most common type of morphological operation in derivation (and, for that matter, inflection) is suffixation. The formation of nouns denoting persons and things is exclusively carried out by suffixation, as we shall see in chapters five to seven. Though the main type is suffixation, compounding and prefixation are also possible, as well as 'zero' affixation.

1.2.1.1 Compounding

Compounding (*slovosloženie*) accounts for a relatively small proportion of derived words in Russian. For example, of the 126034 derivatives listed in Tixonov's derivational dictionary only 17344 are compounds, representing around 14% of derived words (1985: 440). We base our overview of Russian compounds on the useful typology of compounding given in Spencer (1991: 309-313, 319-326).

In most compounds one of the elements acts as the head, for example in *blackbird* this is the right element *bird*. Headless, or exocentric compounds, are also possible, for example *cut-throat*. An example of an exocentric compound in Russian is *divan-krovat´* 'sofa bed' from *divan* 'sofa' plus *krovat´* 'bed'. Most compounds in Russian, however, are headed, or endocentric, as in English. Elements may be joined by the special coordinating formative /o/ (represented as /e/ after palatalised consonants) as in the examples below; or may not as in the *divan-krovat´* example, where a hyphen is used in the orthography. In Russian compounds it is common to find what appears to be simultaneous suffixation of the second element. For example *prostoreč´ij(o)* 'popular speech' is derived from compounding the elements *prost(oj)* 'simple' and *reč´* 'speech', and simultaneously attaching the abstract noun forming suffix *-´ij(o)* to *reč´*. The suffixation seems to be simultaneous with the formation of the compound because *reč´ij(o)* on its own is not an attested word in the language; and a bound morpheme interpretation is problematic since it would be odd to find bound morphemes which are themselves derivatives of free morphemes (*reč´ij(o) < reč´*).

We can divide Russian endocentric compounds into 'primary' (or 'root') compounds, and synthetic compounds where the head is a deverbal noun (agent or nominalization). In most endocentric compounds the head element is a noun. The non-head may be another noun, as in *vodoxran´il´išč´(o)* 'reservoir' from *vod(a)* 'water' plus *xran´il´išč´(o)* 'storehouse'. Or an adjective, as in *raznoobraz´ij(o)* 'variety' from *razn(ij)* 'various' plus *obraz* 'form' (note the simultaneous *-´ij(o)* suffixation). Numerals can act as non-heads as in *tis´ačelet´ij(o)* 'millennium' from *tis´ač´(a)* 'thousand' plus *let(a)* 'year (pl)'. Interestingly, apart from 'thousand' and 'hundred', numerals take a genitive case form. For example, *tr´oxlet´ij(o)* 'three year anniversary' where *tr´ox* is the genitive of *tr´i* 'three'. In such instances no coordinating formative is used.

Where the head is an adjective, it is not uncommon to find 'dvanda' compounding, i.e. where the relationship between the two elements is one of conjunction. For example, *russko-angl´ijsk(ij) slovar´* 'Russian-English dictionary' (i.e. 'Russian and English'), *sine-belo-krasn(ij)* 'red, white and blue' (from *s´in´(ij)* plus *bel(ij)* plus *krasn(ij)*). However, the relationship may also be one of head and modifier of head, as in the following compound colour terms made up of *ser(ij)* 'grey' and *zel´on(ij)* 'green': *zel´ono-ser(ij)* 'greeny-grey', *sero-zel´on(ij)* 'grey-green' where the first is a shade of grey, and the second a shade of green.

In synthetic compounds, the deverbal noun head may be an agent as in *bitop´isatel´* 'historian' from *bit* 'way of life', plus *p´isatel´* 'writer, the derived agent of *p´isa(t´)* 'write'; or a nominalization, as in *stankostroen´ij(o)* 'machine-tool construction' from *stanok* 'machine-tool', and *stroen´ij(o)* 'building', the nominalization of *stroi(t´)* 'build'. As can be seen from these examples, the non-head is fulfilling the function of one of the arguments of the underlying verb, as expected in synthetic compounds (Spencer 1991: 319).

Russian compounding generally follows the assumptions of compounding outlined in Spencer (1991: 318). For example, endocentric compounds are right-headed as all our examples have shown (see for example the compound colour term examples). Also, in synthetic compounds the non-head cannot act as the subject argument of the derived verb, which is the case in Russian. There is one area, however, where Russian appears to represent a counterexample. Since compounding is assumed to be derivation[12], we would not expect to find inflection on the first element, as this would be an example of inflection occuring inside derivation (see **1.1.2.2** above). However, in two of the examples given above, this appears to be happening. In *tis´ačelet´ij(o)*, the second element is the suppletive plural stem of *god* 'year'. A more serious counterexample is *tr´oxlet´ij(o)*, where we showed that the first element is a form with a genitive inflection. Yet we could view these as only apparent counterexamples since in both instances the first element is inert, remaining constant throughout the various syntactic environments. This is not the case, however, with the Russian word for 'saw fish'. This is a compound made up of *p´il(a)* 'saw' plus *rib(a)* 'fish. The problem is that the first element inflects, along with the second! The nominative singular is *p´ila-rib(a)*, the accusative *p´ilu-rib(u)*, the genitive *p´ili-rib(i)*, etc. (Zaliznjak 1977: 145).

1.2.1.2. Prefixation

Prefixation plays a significant part in the Russian verbal system. As mentioned above, aspect is morphologically marked in Russian. Perfectivity is usually associated with the prefixed version of the verb, for example *dela(t´)* 'do (impf)' *sdela(t´)* 'do (perf)'. Prefixed verbs may also differ semantically from their unprefixed counterparts. For example, *zap´isa(t´)* 'write down' differs from *p´isa(t´)* in aspect as well as in meaning. In this sense prefixes must be regarded as word forming. Prefixed verbs themselves may serve as inputs to prefixation rules. Stankiewicz cites the three-prefix example *po-vi-na-dumiva(t´)* 'think up' (1962: 15). However, in noun and adjective formation prefixation is marginal. Thus in the section on nominal formation in the chapter on word formation in Vinogradov, Istrina and Barxudarov (1953), no mention is made of prefixation. In adjective derivation, one highly productive prefix is the negating prefix *ne-* as in *v´inovn(ij)* 'guilty' > *nev´inovn(ij)* 'innocent'. Several intensifying prefixes are also fairly productive, for example *pre-* in *predobr(ij)* 'extremely kind' (see Townsend 1975: 213).

There is one case where prefixation appears to be productive in nominal derivation. This is so-called 'parasynthesis', where prefixation of the Base appears to occur simultaneously with suffixation. Examples of this are *podpolj(o)* 'underground', *zareč´j(o)* 'area across the river', *pobereźj(o)* 'coast', with the 'prefixes' *pod-*, *za-*, and *po-*, and the suffix *-j(o)*. However, since each of these Derivatives can be traced back to a prepositional phrase, as shown in (1.8) to (1.10), a better analysis would be suffixation of a phrase. What appears to be a prefix is then really the preposition in the phrase. Interestingly, main stress is always on the second element, and in particular on the syllable before the suffix (Shapiro 1967: 193). In other words, on the noun of the deriving prepositional phrase.

(1.8)

pod	pol-om
under	ground-Masc.Inst.Sg

(1.9)

za	rek-oj
beyond	river-Fem.Inst.Sg

(1.10)

po	bereg-u
along	shore-Masc.Dat.Sg

1.2.1.3. Zero derivation

We have already seen two examples of zero derivation. In Figure 1.1. the adjective *dobr(ij)* 'good' is derived from the noun *dobr(o)* 'good deed', and in **1.1.2.1** we discussed the example of the adjective *zolot(ój)* 'gold' derived from the noun *zólot(o)* 'gold'. Zero derivation is not restricted to noun > adjective derivation. Švedova (1980: §§446-467) presents a detailed list of the various possibilities. Collectives can be 'marked' in this way, for example *gol(ij)* 'naked, poor' > *gol´* 'the poor' (§458), where the Derivative is a member of class III[13]. Verbs derive zero affixed nouns denoting 'single act of verb', for example *vzmaxnu(t´)* 'to wave' > *vzmax* 'a wave (of the hand)' (§449). Not all zero derivation is conversion to another word class. An interesting case is a type of female derivation where the female lexeme is distinguished from the male purely by inflectional class. For example, *suprug* 'spouse (male)' belongs to class I (e.g. genitive singular is *supruga*), and the female counterpart *suprug(a)* belongs to class II (e.g. genitive singular *suprugi*). For other examples, see Švedova (1980: §467), Tixonov (1985: 13).

1.2.2. Russian noun formation categories

Nouns represent overwhelmingly the largest word-class in Russian. Ilola and Mustajoki (1989:7) put nouns as representing nearly 48% of all lexical items in Zaliznjak (1977), verbs nearly 29%, adjectives 21%, adverbs 1% and others, such as prepositions, conjunctions etc. 1%. The figures and percentages are given in Table 1.4. (based on Table 1, p.7 in Ilola and Mustajoki).

Part of speech	**Number**	**%**
Noun	47030	47.63
Verb	28469	28.83
Adjective	20791	21.10
Adverb	1381	1.4
Other	1057	1.04
TOTAL	98728	100

TABLE 1.4. Items divided by part of speech

The significance of nouns as compared with other syntactic categories is graphically represented in Figure 1.3. We can assume that the disproportionate size of the noun slice reflects the fact that noun formation represents the most productive, i.e. 'profitable' part of the derivational system[14]. This is somewhat substantiated by Likova's (1959) study which is a count of new formations in the four volume Ušakov dictionary (1935-40), cited in Panov (1968:171 f.n.1). Of the nine hundred new formations, 73.6% are nouns; next is adjectives with 18.8%.

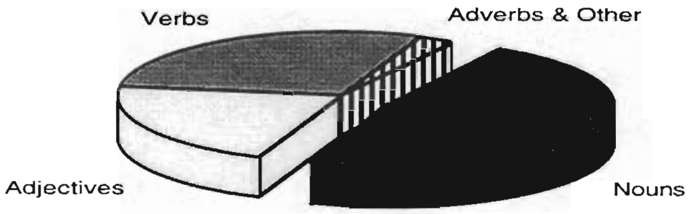


FIGURE 1.3. Nouns in relation to other categories

Descriptive works on Russian noun formation are traditionally organized around derivational categories, such as Person, Abstract, Collective, etc. (see for example Vinogradov 1953, Gvozdev 1961, Townsend 1975). The most commonly cited noun formation categories are given in Table 1.5. We could add expressive morphology to the Table, i.e. where diminutive, augmentative, pejorative and affectionate shades of meaning are formally encoded. However, major word formation studies tend to view this as separate from other word formation. For example, Gvozdev (1961: 189) splits all noun formation suffixes into two major groups: 'word formational' ('slovoobrazovatel´nye suffiksi') and 'evaluative' ('suffiksi ocenki').

Semantic category	*Base*		*Derivative*	
Abstract	č´ist(ij)	clean	č´ist-ot(a)	cleanliness
Person	skromn(ij)	modest	skromn-´ik	modest person
Object / 'thing'	gore(t´)	burn	gore-l´k(a)	burner
Female	student	student	student-k(a)	student (female)
Collective	zver´	wild beast	zver´-j(o)	wild beasts (collect.)
Singulative	bus(i)	beads	bus-´in(a)	bead (single)
Young of animal	tigr	tiger	tigr-´onok	tiger cub

TABLE 1.5. Categories in Russian noun formation

It is common in the literature to find the categories themselves organized into the 'super categories' ('slovoobrazovatel´nye značenija') of 'transposition' ('transpozicionnye značenija'), 'mutation' ('mutacionnye značenija') and 'modification' ('modifikacionnye značenija'). This approach is detailed for example in Uluxanov

(1979). It can be found in the descriptive works of Gvozdev (1961) and, to some extent, Zemskaja (1973), amongst others.

Mutational noun formation
Mutational noun formation is characterised by a substantial change in the Base's semantics. For example abstract to concrete, or non-person to person. Person formation is therefore a prototypical example.

Transpositional noun formation
In transpositional noun formation the relation between the Base and the Derivative is marked by a change in syntactic category, and the 'meaning' associated with that category, but the essential semantic make-up of the Base is preserved. Transposition from verb to noun is productively realised by the suffix *-n´ij(o)* as in *m´iga(t´)* 'blink' > *m´igan´ij(o)* 'winking'. Transposition from adjective to noun is productively realised by the suffix *-ost´*, as in *bescel´n(ij)* 'aimless' > *bescel´nost´* 'aimlessness'.

Modificational noun formation
In modificational noun formation there is no change in syntactic category, and change in semantics is less drastic than in mutational derivation, and can be interpreted as a modification. Female formation based on a male person noun represents a prototypical example, since the meaning of 'person' is preserved, but modified to denote female sex. If this is a modification on the basis of sex, we could view collective formation as a modification on the basis of number. For example *uč´itel´* 'teacher' derives the Collective noun *uč´itel´stv(o)* 'group of teachers' with the suffix *-stv(o)*[15] (Townsend 1975: 194-5). Conversely, singulative formation in *-´in* could be viewed as modificational, for example *bus(i)* 'beads' > *bus´in(a)* '(single) bead'. Finally, the category 'Young of animal' could be seen as modifying an animal Base. A productive suffix is *-´onok*, as in *volk* 'wolf' > *volč´onok* 'wolf cub'. Interestingly, this 'super category' approach has found its way into current generative models, most notably in Robert Beard's work (e.g. Beard 1995: 155).

1.2.3. Allomorphy in Russian noun formation
An introduction to Russian derivation is not complete without a mention of the system of morphologically conditioned alternations. This for the most part concerns the stem final consonant, or consonant cluster, which we will limit our discussion to.

Russian consonantal alternations revolve around palatalization, in various ways. The alternation may be a result of bare palatalization (C^1); or mutation, i.e. palatalization that is concomitant with a 'change in the basic place of articulation...or a change of one phoneme into a cluster'[16] (C^j); or loss of palatalization (C^{1a}). Consonants and their sets of graded alternations are listed in Table 1.6, where they are grouped into velars (G), labials (P), dentals (D) and resonant dentals (L). Note that in presenting the Russian consonant alternations in this way we follow Timberlake (1993: 835).

C^0	C^1	C^j	C^{1a}
D {d, z, s, t, c}	{d´, z´, s´, t´, č}	{ž, ž, š, č, č´}	{d, z, s, t, č}
P {p, b, v, f, m}	{p´, b´, v´, f´, m´}	{pl´, bl´, vl´, fl´, ml´}	{p, b, v, f, m}
G {g, k, x}	{ž, č´, š}	{ž, č´, š}	{ž, č´, š}
L {l, r, n}	{l´, r´, n´}	{l´, r´, n´}	{l´, r, n}

TABLE 1.6. Russian consonant alternations

Setting the alternations in an historical context, grade C^j reflects first palatalization of velars and jotation of dentals and labials, whereas C^1 reflects first palatalization of velars and bare palatalization of dentals and labials. C^{1a} is the result of C^1 alternants losing palatalization before suffixes beginning with dentals (Timberlake 1993: 835). Derived contexts can be divided up according to which 'grade' of palatalization they are associated with. We may briefly consider examples illustrating the various contexts. Note that most examples are taken from Švedova (1980: §1090-1107).

C^o contexts

The basic (or default) alternant is used for example with the pejorative person suffix *-an*: *gorl(o)* 'throat' > *gorlan* 'bawler', *vel´ik(ij)* 'great' > *vel´ikan* 'giant'.

C^1 contexts

In the C^1 grade dental and labial consonants receive bare palatalization, and the velars and /c/ mutate. The diminutive suffix *-onk(a)* is associated with this grade: *bab(a)* 'peasant woman' > *bab´onk(a)*, *komnat(a)* 'room' > *komnat´onk(a)*, *jubk(a)* 'skirt' > *jubč´onk(a)*, *s´il(a)* 'strength' > *s´il´onk(a)*, *šč´ipc(i)* 'tongs' > *šč´ipč´onk(i)*.

CJ contexts

The C^j grade denotes mutation for all consonants, except for the resonant dentals which have bare palatalization. The C^j grade is found in the main in the verbal paradigm, and when it shows up in derived contexts, it does so sporadically. There is, however, one area where it is regular: nominalizations in *-(e)n´ij(o)*, used mainly where the Base is a verb belonging to the second conjugation[17], e.g. *oslab´i(t´)* 'weaken' > *oslablen´ij(o), svest´i(t´)* 'shine' > *sveščen´ij(o)*[18].

C^{1a} contexts

The final context C^{1a} involves mainly dental suffixes. Except for velars, /c/ and /l/ (which are palatalized) all consonants become or remain depalatalized. One such suffix is *-n´ik* which derives persons. For example, *bort´* 'wild bee hive' > *bortn´ik* 'wild honey farmer', *karman* 'pocket' > *karmann´ik* 'pickpocket'; but note *sokol* 'falcon' > *sokol´n´ik* 'falconer', *katorg(a)* 'penal servitude' > *katoržn´ik* 'convict', *mes´ac* 'month' > *mes´ač´n´ik* 'peasant receiving monthly wage'.

1.3. Limits of study and general overview of thesis

We close this introductory chapter with a few words on exactly what data are included in our study, as well as a brief sketch of the thesis in terms of sections and chapters.

1.3.1. Limits of study

At the beginning of **1.2** we mentioned how Russian's rich derivational system makes it appropriate for a study of word formation. In **1.2.2** we further showed that compared to the other word classes, the noun system is the most productive, hence we would assume Russian noun formation to be a fruitful area of investigation. In fact noun formation is too vast to cover in adequate detail, and we therefore focus on one aspect of it, namely the formation of nouns denoting persons. The choice of this area of noun formation is deliberate. First, it is highly productive: for example, of the new noun formations in Likova's report mentioned above nearly half are Person nouns (45.7%), i.e. 34% of all new formations. Second, it is both a 'mutational' and 'transpositional' type of category (**1.1.2**) and in this way represents prototypical word formation (see Dressler 1989: 7). Thirdly, it is encoded by affixation, the prototypical morphological operation (Dressler 1989: 4-5), and in particular suffixation. This allows us to concentrate exclusively on one morphological operation.

To summarise, in terms of super categories the account is restricted to mutation and transposition, and omits modification. Thus derivation of female nouns from males, a modificational category, lies outside the domain of our study. In terms of the derivational categories themselves, only the noun formation category of person is investigated, the most productive category. And finally, in terms of morphological operations, only suffixation in Russian is accounted for.

A final point is that we make no attempt to account for allomorphy in Russian derivation, either in the stem or suffix. In the previous section we saw the importance of this area with a brief overview of consonant alternations. We should point out that morphologically conditioned vowel alternations also occur, as well as alternations in stress. Network Morphology has not ignored these issues. For example, there is a detailed account of noun stress in Brown, Corbett, Fraser, Hippisley and Timberlake (1996). Dunstan Brown has been careful to incorporate consonant (and vowel) alternations in his accounts of the Russian verb, where the grades of alternations are arranged hierarchically, and placed orthogonally to the morphological hierarchy (for example Brown 1995). In general, however, issues in morphology 'proper' have taken precedence over issues in allomorphy, and this same spirit informs the present account. That is not to say that it is desirable to ignore allomorphy in derivation. Rather, what is offered should be seen as a platform on which to build a Network Morphology account of allomorphy in derivation, a project reserved for some future date.

1.3.2. Overview

The thesis falls into four main sections. Section I, the Background section, includes this introductory chapter and a chapter on the developing role of morphology in the models of the structuralists and early generativists (chapter two).

Section II outlines the framework of Network Morphology, drawing on recent Network Morphology accounts for illustration, and in this sense can be viewed as a short survey of the Network Morphology literature. Chapter three introduces inheritance hierarchies and defaults, key concepts in Network Morphology, and chapter four examines the kinds of relations that occur within a network.

In Section III we turn to consider lexeme-based morphology, the approach assumed in Network Morphology (**1.1.2**). Chapter five introduces the idea of viewing word formation as 'lexeme formation'. The classic model of Aronoff (1976) is presented in some depth. This is preparation for a lexeme-based account of Russian person formation in chapter six, where we propose a number of Aronovian style word formation rules (WFRs) to describe the productive types.

Section IV constitutes the Network Morphology account of Russian derivation. In chapter seven we show how the WFRs proposed in chapter six are declaratively encoded in the framework. Chapter eight looks more carefully at WFRs as generalizers of derivational information, and considers how exceptionality is expressed in terms of overriding the generalizations. Conclusions and proposals for future research following on from our study are set out in chapter nine.

[1] The 'zero' affix in *dobr(ij)* is used for purposes of exposition, and should in no way be taken as a theoretical stance; zero affixes are discussed later in the chapter. In instances of zero affixation motivation must be found for the directionality posited. In this case motivation is provided in the discussion of lexeme based morphology in **1.2.1.** (see particularly f.n. 8).

[2] See for example the list in Gussmann (1988: 238-9), who bemoans the "impoverished view of morphology that is resorted to" (1988: 238). There is no convincing account of affix rivalry, blocking, semantics in derivation, conditions on rules, or even the ordering of affixes when they apply at the same level.

[3] On this see for example Corbett and Fraser (1993: 116); Fraser and Corbett (forthcoming b: 2, 89).

[4] Fraser and Corbett (forthcoming b: 89).

[5] A Papuan language of the Eastern Highlands of New Guinea.

[6] c.f. for example Kilbury's work, including Kilbury (1992), which is morpheme-based, and takes its lead from the morpheme-based generative literature on derivational morphology, e.g. Lieber (1980). Stems and affixes are listed separately as lexical entries, and are specified with subcategorization frames together with a series of conventions on how a word's constituent structure is to be interpreted.

[7] As well as soft stem nouns with stress on the stem, e.g. *nedél´-Ø* 'week (gen pl)'.

[8] How do we know the adjective is derived from the noun, and not vice versa? Isačenko (1969: 52-53) notes the stress properties of the noun and adjective: in the noun stress is on the first syllable of the stem *(zólot(o))* and in the adjective the stress is on the ending *(zolot(ój))*. This type of stress shift is common in denominal adjective derivation, for example *béreg* 'shore' > *beregovój*, *gólos* 'voice' > *golosov(ój)* where the suffix *-ov* marks relational adjective derivation. In fact this data is used to suggest that the *zolot(oj)* example may not be straightforward zero derivation: underlyingly there is a morph which is responsible for the stress shift, but never surfaces.

[9] But it does not appear to block *laboriousness*. Aronoff argues that formations in *-ness* are so productive that they are not necessarily lodged in the lexicon, hence are not blocked.

[10] This criterion was drawn to my attention by Greville Corbett.

[11] However, if inflection can be sub-divided into inherent and contextual, following Booij (1996), instances if this kind are reduced to inherent inflection only.

[12] Compounding does, however, have features reminiscent of syntax as noted in Spencer (1991: 310-12). For example, compounds have a clear constituent structure, a (usually) straightforward compositional semantics, and a relationship between elements similar to that between words in a phrase (head-modifier, predicate-argument, etc.).

[13] Note the concomitant softening of the stem final /l/ in this derivational context. Stem allomorphy revolves around softening, or palatalization, and is discussed in **1.2.3** below.

[14] Galkina-Fëdoruk, Gorškova and Šanskij (1957: 236) for example note that within the derivational system, the derivation of new nouns is the most active.

[15] This suffix is also used to derive abstract nouns. Hence *uč'itel'stv(o)* has the second meaning 'teaching profession'.

[16] Jakobson (1948: 126).

[17] Or a suffixless verb in the first conjugation, e.g. *pek(ut)* 'they bake' > *peč(e)n'ij(o)*.

[18]Note that a possible interpretation of this suffix is that of a stem formative *-(e)n* plus the suffix *-'ij(o)*. The same stem formative is used when the verb forms a past passive participle, e.g. *oslabl'(e)nn(ij)* 'weakened', and occasions the same grade of alternation. This is the approach, for example, of Sadler, Spencer and Zaretskaya (1997) who base their analysis on Aronoff's (1994) notion of stem. The C^j context would then be excluded altogether as a regular context in derivation, and hence may be used to distinguish inflection and derivation. We will look at their proposal in more detail in chapter six.

Chapter 2: Structuralist and (early) Generative morphology

2.0. Introduction

As a prelude to our particular approach to morphology we give a brief history of morphology's role in Structuralist and Generative linguistics, concentrating on derivation in early Generative models. We show that as models develop to give a more systematic account of word-structure, the lexicon changes from a list of idiosyncratic information to a structured component where morphological generalization may be stated.

In the compartmentalised but to some degree homogenous Structuralist models of language, more important than dwelling on those morphological issues that point to morphology as an object of enquiry in its own right was identifying those characteristics that showed morphology to be a component in harmony with the principles of syntax and phonology. This attitude to morphology was inherited by early generative models. Their enterprise was the serious formalization of language, an aim made feasible by the Structuralists' assumption that syntax and phonology are exceptionless. Morphological problems were kept at a safe distance; as Aronoff (1983) notes, the early generative period was a dark time for morphology. Serious thought about the issues behind word-structure only really begins with the recognition that word structure cannot be accommodated within a transformational treatment of syntax and phonology. This is best highlighted by Lees' (1960) attempt at a transformational account of English nominalizations which relies on the introduction of a range of new and much more powerful transformations. Thus word-structure begins to receive the attention it deserves almost because it was a threat to transformations.

In the final section of the final chapter of Chomsky (1965) it is hinted that, apart from nominalizations which can be handled by transformations, derivation is a problem requiring a quite separate solution (1965: 186-90). Chomsky (1970) went further: an explicit comparison was made between the exceptionless and productive nature of 'gerundive' nominalizations (i.e. *-ing* type nominalizations such as *do* > *doing*) with the less productive and highly irregular nature of other nominalizations such as *destroy* > *destruction.* Now syntactic transformations could naturally accommodate gerundive nominalizations, but the other type clearly needed a separate account. This was taken as a call for an account that would keep clear of transformations. The first serious generative attempt to treat word-structure as an object in its own right comes with Halle (1973). Subsequent generative models can be seen as a reaction to it (Spencer 1991: 90).

After reviewing morphology in the language system of the Structuralists (**2.1**), we note its marginal role in the 'classical' model of Chomsky's (1965) 'Aspects of the Theory of Syntax' (**2.2**). We then examine the call for a new approach to word-structure made in Chomsky's (1970) 'Remarks on nominalization' (**2.3**), and the first reply in Halle's (1973) 'Prolegomena to a theory of word formation' (**2.4**).

2.1. Structuralist morphology

For the Structuralists, the analysis of language must begin with sound forms. This is because although meaning itself could not be analysed, it is deducible from the analysis of the units carrying the meaning, i.e. the signals (Bloomfield 1933: 162). From the phonemic principle we see that the signalling unit is the phoneme. In terms of structure, the phoneme is the "minimal distinctive element of sound structure" (Anderson 1992: 11). Phonemes in turn are the units of what the Structuralists considered to be the minimal sign of a language, the morpheme. To identify a morpheme in a language the investigator seeks repeated occurrences of distinct phonological segments corresponding to distinct semantic information; see for example Nida's 'Principles Employed in the Identification of Morphemes' (Nida 1949: 6-61).

Continuing in the structuralist spirit we see that morphemes are themselves units of a structure at a higher level, namely the level of the minimal free form (or word). Note that a complex minimal free form would be seen as being decomposeable into constituent morphemes; on the other hand, minimal free forms that are not morphologically complex will contain only one morpheme unit, a so-called 'free' morpheme. By extension, complex minimal free forms are units of still higher structures, namely phrases. The units and the structures they appear in are represented in Figure 2.1.

phoneme

|

morpheme

|

free form

|

phrase

FIGURE 2.1. Units and structures

A view of language in terms of structures as presented in Figure 2.1 indicates that meaning is deduced not simply by the presence of certain units in a structure, but additionally by their arrangement in a structure. Thus Bloomfield (1933: 163) states "Every language shows part of its meanings by the *arrangements* of its forms." Hence the phrases (2.1a, b) carry very different senses due to the difference in the arrangement of their minimal free forms. Likewise at the morpheme level, *pin* and *nip* contain the same phonemes, but they are distinguished on the basis of phoneme arrangement.

(2.1)	a.	John hit Bill
	b.	Bill hit John

Structuralists were therefore interested not only in identifying units of structure, but also identifying the principles constraining the arrangements of units in structure (the 'tactics' of the system). At the lower level, the phonological system identified phonemes, and the principles by which they arranged themselves into morphemes. At the higher level, the grammatical system identified morphemes and the principles whereby they arranged themselves into either morphologically complex words or phrases (see Hockett 1958:137). The overall structure of language operated to encode real world 'meaning' of things and situations in terms of arbitrary patterns of sound waves. This can be represented diagrammatically in Figure 2.2[1], where the system of language is divided into various sub-systems. The sub-systems themselves are grouped into those central, and those peripheral, to language.

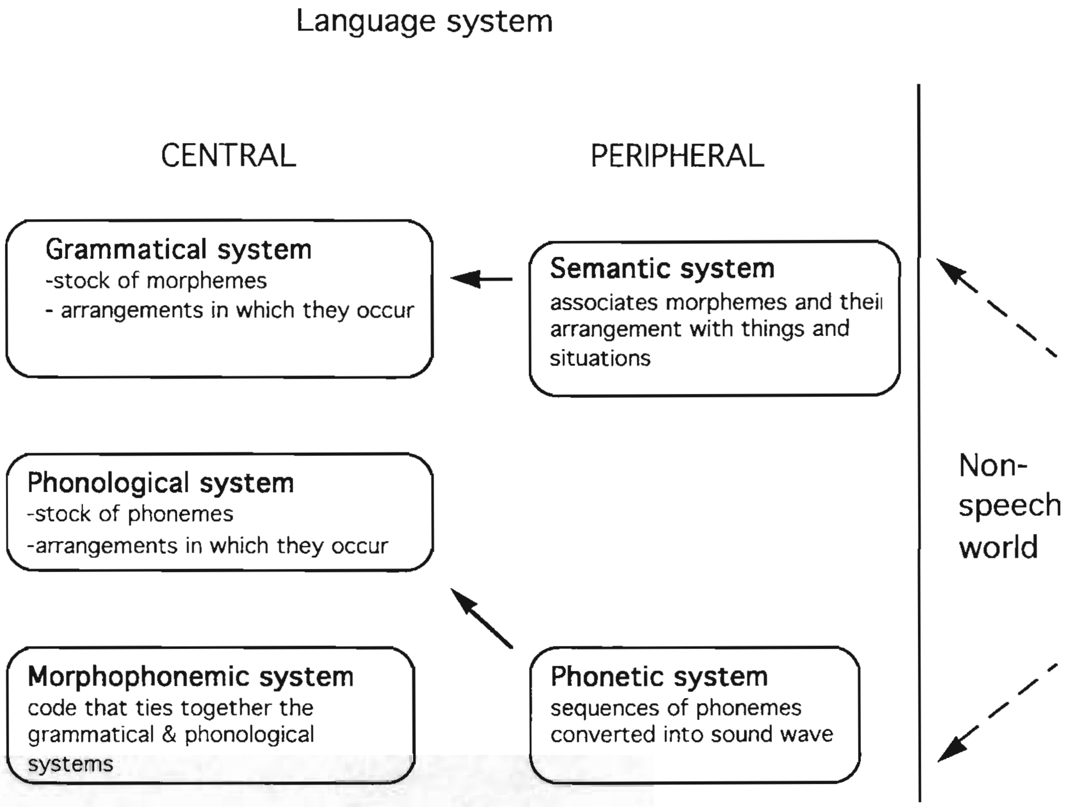


FIGURE 2.2. Structuralist's Language System

Several points can be noted from Figure 2.2. First, the grammatical and phonological sub-systems are discrete, yet importantly their function is in principle the same: that of identifying units and arranging them in structure. Second, syntax and morphology are subsumed within a single sub-system ('grammar'). This is because both have to do with morphemes, and their arrangement. Combinations of morphemes within phrases and morphemes within morphologically complex lexemes can be accounted for with the same device: that of the 'Immediate Constituent Hierarchy'. The ultimate constituents are morphemes, and the next level are free forms, which as discussed above may be morphologically complex. The next constituent level is the phrase. Hence the only difference between syntax and morphology is that in syntax the immediate constituents are free forms, and in morphology they are bound forms (Bloomfield 1933:184). Hence compounds are morphological structures that are most similar to syntactic constructions. In (2.2) we see an Immediate Constituent analysis of the phrase 'Princess of Wales'.

(2.2)

Prince ess	of	Wales	morpheme level
Princess	of	Wales	free-form level
Princess	of	Wales	phrase level

At the phrasal level, the free form *Princess* makes up a Noun Phrase, and *of* and *Wales* together make up a Prepositional Phrase. Constituents can be grouped together according to the patterns they appear in. Such a grouping is a 'form class'. At the phrasal level, Princess could be substituted by the Immediate Constituents *men* or *mountains*, because they belong to the same form class, in this case syntactic category. By the same token, morphemes can be divided into form classes based on their selectional properties. These form classes can be divided into whether the morpheme is free, or whether it attaches to Nouns, Verbs or Adjectives etc. Syntax and morphology are therefore analysed by the same principles: Immediate Constituent analysis for the arrangement of the units of syntax or morphology into structures, and form classes for a taxonomy of the units, and their selectional restrictions. The grammatical core of the language is essentially the pattern of arrangement of units in structure and form classes (the 'skeleton' of the language (Hockett 1958: 265)).We can briefly summarise the position of the Structuralists on the key questions of morphology, how it interacts with syntax and morphology, the role of the lexicon and the division of derivation and inflection.

First, morphology and syntax operate according to the same principles, therefore are subject to the same analysis. Second, the lexicon is the storage house of 'contentives' (the flesh of the skeleton (Hockett 1958: 265)). It is "a list of irregularities" and hence "really an appendix of the grammar" (Bloomfield 1933: 274). The correspondence of strings of phonemes that make up morphemes to the meaning they denote is arbitrary, hence free, and bound morphemes will be housed in the lexicon. Morphologically complex lexemes will be part of the grammar, however. Third, morphophonemics from figure 1 can be seen as the system that unites the grammatical and phonological systems and is part of the overall grammar of the language. It accounts for alternations in phonological shape of morphemes, due to: (i) Phrasal context (so called 'external' sandhi Hockett (1958: 277) or 'synactophonemics' (Nida 1949: 200)); and (ii) Morphemic context ('internal' sandhi, or morphophonemics proper). Finally, derivational and inflectional morphology are recognised as behaving differently, and inflectional morphemes and derivational morphemes are hence grouped separately (e.g. Bloomfield 1933: 237; 209). However, there is no principled account for the separation.

The attraction of the model's Item and Arrangement treatment of morphology, i.e. identify the morpheme and account for its arrangement in structure, is summed up by Matthews:

> "It employs only one fundamental unit [the morpheme]; it reduces all statements of exponence to one, very straightforward relation; and it reduces the description of word-structure to a form which may be conflated with the description of sentence-structure." Matthews (1972:44-5) (square brackets are mine).

The departure from Structuralism to Generativism has been noted by some as a switch from taxonomic descriptive linguistics on the one hand, to linguistic theory whose aim is the formalization of generation rules that account for possible and actual structures. The Structuralist point of view was external: the task was to account for a body of data; the Generative view point was internal: the task was to account for the speaker's knowledge of language (Robins 1980: 269). The surface diversity of language of the Structuralists is replaced by the search for "the underlying universality of language as a human faculty" (Robins 1980:278). The demise of a role for morphology follows from this for various reasons. The first, due to the spirit of Generativism, is that "the ratio of what is learned to what is innate appeared higher in morphology that in syntax..." (Carstairs-McCarthy 1992:5). Second, as we have seen in Structuralism morphology has limited status since the shape of the morpheme and its arrangement in words is handled by the tactics of the system. The Generative programme inherits this position, with generative syntax taking the place of morphotactics and generative phonology the place of phonotactics (Anderson 1992:13). Thirdly, initially Generativism reacted against the Structuralists' ban on mixing linguistic levels. This had the consequence that Transformational-Rules (T-Rules) were encouraged in both syntactic and phonological analyses, which further emphasised the importance of these levels in the grammar, so reducing morphology to the T-rules of syntax and phonology (Scalise 1986:196)

2.2. Chomsky's 'Aspects'

Early Generativism begins with Chomsky's 'Syntactic Structures' which is subsequently modified in 'Aspects'. After introducing the general workings of the model, we will explore those areas relevant to word-structure, namely: the way inflection and derivation are actually handled, the nature of the lexicon, and morphophonemics. We will end by noting the modifications made in 'Aspects' with respect to derivational morphology.

2.2.1. The classical model

Figure 2.3 represents the 'classical' model, taken from 'Aspects', and reproduced in Newmeyer (1980:74), from whose commentary we partly draw.

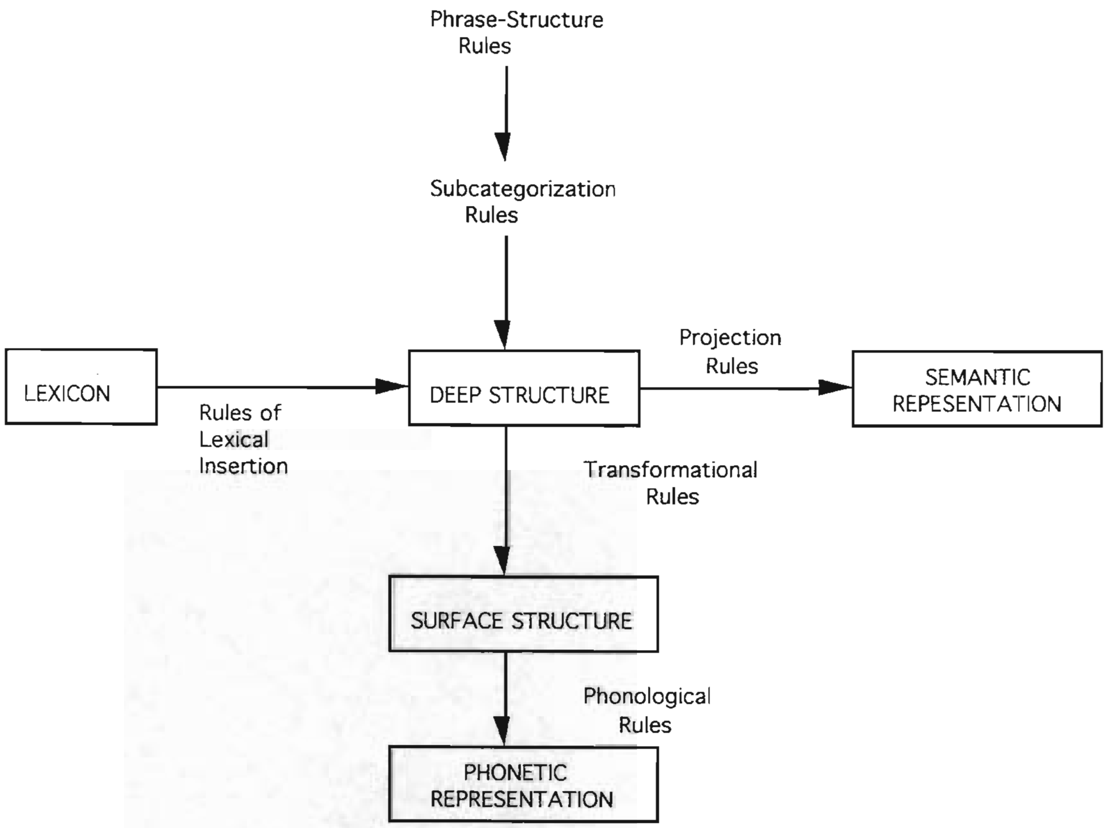


FIGURE 2.3. The 'classical' model

In Figure 2.3. the Phrase Structure Rules expand or 'rewrite' phrase structures into sub-phrases, and sub-phrases into sub-sub-phrases: for example S $\rightarrow$ NP + VP, NP $\rightarrow$ DET + N, etc. The number of phrase types generated by the Phrase Structure Rules is finite. These finite phrase types are represented in Deep Structure. In order to capture the infinite number of phrases actually possible in a sentence, as for example in the case of embedding, Transformational Rules apply cyclically to the phrases at Deep Structure, acting to rearrange structure which will eventually lead to the Surface Structure. Transformations serve to relate two sentences that on the surface are distinct, but identical at Deep Structure. For example, (2.3a, b) are related to the Deep Structure (2.3c) by passive transformation (actual details not relevant here).

(2.3)

a. John kissed Mary

b. Mary was kissed by John

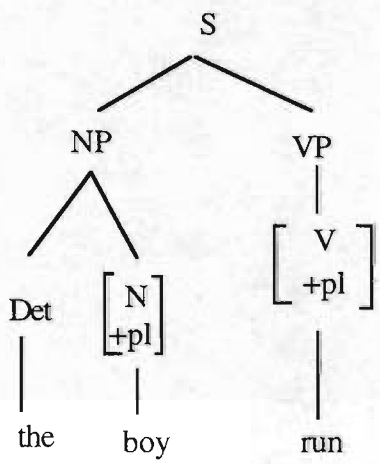
c. John kissed Mary

Before the T-Rules apply, the terminal nodes of phrases in Deep Structure (Phrase Markers) are filled with items from the Lexicon by means of Lexical Insertion Rules. For example in (2.3c) the Lexical Insertion Rules have filled the phrase marker Subject Noun with *John*. After T-Rules the Surface Structure, lexically filled, is then sent to the Phonological Rules which act to yield the phonetic form. The lexical entry will be specified for phonological representation in terms of phonological features, which correspond to the basic alternant. By default, these pass straight through to become phonetic representations. Allomorphy is accounted for by the special nature of the Phonological Rules which are Transformational, rearranging, adding or deleting features to yield the correct allomorph.

2.2.2. Inflection and derivation in 'Aspects'

The first question about the model concerns its account of morphological structure. The immediate answer is that inflection and derivation receive different treatments. Inflectional morphemes are features in a phrase structure. An example of this based on Spencer (1991:65) is the sentence 'The boys run'. The N in the NP will be marked with the feature +pl. Agreement inflection is accounted for by a T-Rule which copies this feature from the N in the NP onto the V in the VP, as in (2.4)[2].

(2.4)



The actual form (the morph) of the morphemic representation is derived in two stages. First, Readjustment Rules apply to Surface Structures such as (2.4) and readjust features such as +pl on the N so as to yield a phonological feature which will be the basic alternant of the morpheme {plural}. Second, the readjusted Surface Structure is sent to the Phonological Rules to yield the phonetic representation of the allomorph, along with the rest of the phrase.

Derivational morphology is assumed to be the result of T-Rules acting on Deep Structure. A Nominalization Transformation accounts for the change in category of *destroy*$_{[V]}$ > *destruction*$_{[N]}$. Readjustment Rules provide the phonological reflex of the nominalization, as they did for inflection. For the precise details of this kind of treatment, see Lees (1960) which deals with English nominalizations and compounding[3]. To summarise, word-structure is handled by the syntax, where the morphemic level is accounted for, and by the phonology, where Phonological Rules account for the actual form. Where's morphology then? If the main role of morphology is the mapping of syntacticosemantic information (morphemic level) to phonological form (allomorphic level) then the place where this is done is the Readjustment Rules. Aronoff (1976: 7) notes that these were "The first hints that there might be something between syntax and phonology"[4].

2.2.3. Morphophonemics in 'Aspects'

The Phonological Rules handle the fairly straightforward phonologically predictable type of allomorphy, for example the /s/, /z/, /ez/ allomorphy for {plural}. This is achieved by viewing phonemes as sets of features, such as +high etc., and altering these features in such a way as to yield the correct phonetic representation. The exact details are outlined in Chomsky and Halle's (1968) 'The Sound Pattern of English' (henceforth 'SPE'). Allomorphy in lexeme formation, such as the shift in stress from *théatre* to *theátrical* to *theatricálity* is accounted for by a stress rule that applies on every cycle of the derivation, being sensitive to the boundary of each cycle. In some derivations, such as *kíng* > *kíngdom*, it would appear that no stress rule has applied. This is accounted for by dividing boundaries into word-boundaries (denoted by #) and morpheme-boundaries (denoted by +). A morphological structure will be composed of + and # boundaries, and cyclic rules will be restricted to the + boundary. We can thus analyse the structure of *kingdom* as *king#dom*, and hence explain lack of stress alternation[5]. Word-structure is thus accounted for purely in terms of phonological structure. Thus the stress rules identify a bracketing [[[theatre]ical]ity]; the fact that it corresponds exactly to the morphemic derivation of Noun > Adjective> Noun points to a correspondence between meaning and form, which is suspected to be a principle of Universal Grammar (Carstairs-McCarthy 1992: 64).

As for the more drastic types of lexical allomorphy involving partial or total suppletion, lexical entries are specified for certain features which the Readjustment Rules read, and then assign a phonological representation to. The correct allomorph will then be passed through to the Phonological Rules. Thus, for example, *ox* will be marked with the feature that /en/ is added in the context of the morphosyntactic feature +pl. As much allomorphy as possible is specified phonologically, so as to minimalize morphology[6]. Thus lexical entries may be specified to receive a special diacritic from the Readjustment Rules, e.g. *sing* will be assigned the diacritic 'Vowel-lowering in the context of +past'. It will then undergo a 'minor phonological rule', thereby capturing the relation between *sing* and *sang* phonologically (see Carstairs-McCarthy (1992: 52)). In sum, then, morphophonemics was the job of the Readjustment Rules and Phonological Rules.

2.2.4. Lexicon and lexical entries in 'Aspects'

From Figure 2.3 we see that Lexical Insertion Rules inserted lexical items from the lexicon into phrase markers. What then is in the lexicon? By the time of 'Aspects', the lexicon contained only the free morphemes of the Structuralists. (Inflectional morphemes are specified as features in the syntax, and spelled out as forms in the phonology.) Furthermore, these free-morphemes had to belong to the major lexical categories, so as to fill nodes labelled NOUN, ADJECTIVE, VERB (Chomsky 1965: 84-7, 164). Lexical entries, therefore, specify syntactic category. Because the Phrase Structure Rules also generated so-called sub-categorisation frames (see Figure 2.3) which specified the context of a particular phrase marker, e.g. that a Verb occurs in the context of an Object Noun, the lexical entry needed to supply relevant sub-categorisation information, for example whether it could take an Object Noun, i.e. whether or not it was transitive. They also had to contain phonological information, i.e. the basic alternant which would eventually be read by the Phonological Rules. Finally, they specified semantic information. A lexical entry, then, was a free morpheme that specified arbitrary syntactic, semantic and phonological information. Lastly, it should be noted that the lexicon was more than a list: it stated generalizations about the lexical entries. For example, an entry specified as +human will also be +animate (Chomsky 1965: 166-8). These implications were stated by lexical redundancy rules[7]. Because it stored arbitrary information, the lexicon is in keeping with the Structuralist lexicon. However, the lexicon has become more structured due to the lexical redundancy rules, and due to part of morpheme order now being accounted for by the sub-categorisation frames in the lexical entry.

2.3. Chomsky's 'Remarks'

In 'Aspects' it seemed natural to treat word formation by T-Rules because in cases such as compounding and nominalizations, at any rate, the derivative and deriving words could be related in terms of Deep and Surface Structures, as with sentences (Scalise 1986:17). As mentioned above, Lees (1960) goes so far as to develop an intricate model in order to demonstrate the feasibility of such an approach. But what is most striking about Lees' model is not the fact that it can 'do it', rather the extremely complicated and intricate nature of the T-Rules which are introduced. This is in fact the expected reflex of one of the characteristics that prototypically distinguishes derivation from inflection, namely productivity as we saw in **1.1.2.2**. Now in 'Aspects' productivity was the test of whether something should be treated by the T-Rules[8] (Newmeyer 1980:79). In this connection recall from **1.1.2.2** that non-productivity is characteristic of derivation: first, semantic unpredictability was not unusual for Derivatives; second, different Bases selected different morphs to encode the same derivational category; and third, a given derivational operation might include some Bases, but exclude others. In 'Remarks' Chomsky draws attention to these three points in order to emphasise the need to move derivational morphology away from the syntactic component.

2.3.1. 'Remarks' and derivational productivity

The non-productivity of derivational morphology is highlighted by comparing two types of nominalizations: on the one hand 'gerundive nominalizations (*-ing* words), which are fully productive and therefore the domain of the syntactic component; and on the other, 'derived nominals' (i.e. all other nominals) which need separate treatment due to their non-productivity at the syntactic, semantic, and morphophonological level. The following discussion draws on Spencer (1991:70), and Scalise (1986:19). First, at the syntactic level sentences may drive nominalizations of both types, as shown in (2.5), where there is no alteration of sub-categorisation frame: the verb subcategorises for direct object in (2.5a-c).

(2.5)

a. The enemy destroyed the city with fire

b. The enemy's destroying the city with fire...

c. The enemy's destruction of the city with fire...

However, though a gerundive nominalization is always possible, in some situations a derived nominalization cannot be used as seen in (2.6c) for the verb *amuse*.

(2.6)

a. Tom amused the children with his stories

b. Tom's amusing the children with his stories...

c. *Tom's amusement of the children with his stories...

Second, at the semantic level gerundive nominalizations are always transparent, but derived nominalizations often have a second idiosyncratic meaning. For example, *revolution* has a meaning in addition to the one transparent to the verb 'turning around', in phrases such as *Russian Revolution* and *Industrial Revolution.*

Third, at the morphophonological level gerundives consistently attach the suffix *-ing* to the verb stem, whereas for derived nominals there is a host of suffixes available; and furthermore, derived nominalizations usually involve phonologically and morphologically conditioned allomorphy: note the drastic allomorphy in *destroy* > *destruction*, and the stress alternation, and stem final alternation in *revólve* > *revolútion*. The upshot of all these observations is that whereas it is fine for T-Rules to handle gerundive nominalizations, something else is required for derived nominalizations. And by implication, word formation in general.

2.3.2. Lexicalist Hypothesis

There was a proposal to ban category changing T-Rules altogether; derived nominalizations (and other derivation) should have their syntactic category (and sub-categorisation frames) specified before lexical insertion. From Figure 2.3 we can see that this means complex items should be stored in the lexicon. This is the gist of what Chomsky called the Lexicalist Hypothesis[9]. Such a move appears to solve a number of problems all at once. First, it allows for derived nominalizations to be lexically marked, hence handling their non-productivity. Second, it explains another difference between gerundive nominals and derived nominals, namely that of internal structure. It was noted in 'Remarks' that whereas gerundives like verbs could be modified by adverbs, and unlike nouns could not be modified by adjectives, this was the exact reverse with derived nominalizations (1970: 195). This is shown in (2.6), taken from Spencer (1991: 70).

(2.6)

a. Dick's $\left\{\begin{array}{l}\text{sarcastically}\\ \text{*sarcastic}\end{array}\right\}$ criticizing the book

b. Dick' s $\left\{\begin{array}{l}\text{*sarcastically} \\ \text{sarcastic}\end{array}\right\}$ criticism of the book

The examples in (2.6) indicate that the difference between the two nominalizations is that the structure in (2.6b) is a NP. Other sub-categorisation properties it ought to have are that it can occur with determiners, and PP complements, but not negatives, aspect or tense[10]. This is all predictable if it is a noun in the lexicon. And third, derived nominals may have idiosyncratic sub-categorisation frames. For example whereas *refusal* has a plural, *destruction* does not. If derived nominalizations are in the lexicon, these can be marked lexically, as with other nouns.

A fourth reason why the Lexicalist Hypothesis seemed right was that it accounted in a natural way for the fact that derived nominalizations do not occur in transformationally derived structures, whereas gerundive nominalizations do. In other words, derived nominalizations are not subject to T-Rules, a reasonable expectation if it was decided that they were already derived in the lexicon. Compare the sentences in (2.7) which show that the verb (2.7b) and the gerundive nominalization (2.7c) are subject to RAISING-TO-OBJECT (2.7a), but not the derived nominalization (2.7d)[11].

(2.7)

a. John believed that Bill was a fool → RAISING-TO-OBJECT
b. John believed Bill to be a fool
c. John's believing Bill to be a fool
d. *John's belief of Bill to be a fool

Finally, the Lexicalist Hypothesis fits in with a general spirit at the time to limit wherever possible the power of T-Rules. It was becoming worryingly obvious that T-Rules could account not only for possible sentences, but any sentence; hence in their current form they were considered Turing equivalent. In fact the Lexicalist Hypothesis in this regard was also a reaction to Generative Semantics which was busy introducing ever more powerful T-Rules[12].

Thus the fundamental differences between gerundive and derived nominalizations are explained in terms of the Lexicalist Hypothesis. But something must also be said about their similarities. For example, morphophonologically both use affixes, and more particularly suffixes, as morphological operation types (Spencer 1991: 71). Syntactically, for a start both are nominalizations; and further both inherit the selectional feature requiring an +animate subject[13]. Semantically, derived as well as gerundive nominalizations can be transparent. The answer to these points was that just as idiosyncrasies can be stated in the lexicon, similarities can be too. We have already seen how selectional implications are stated in terms of Lexical Redundancy Rules. These are now expanded to capture the fact that there are generalizations that can be made over a verb and its derived nominalization. In order to do this, an abstract 'neutral' lexical entry is set up where common information was stored. A verb lexical entry and a (derived) noun lexical entry are then related via the abstract lexical entry. In a sense they are both 'derived', and they specify features peculiar to them (Chomsky 1970: 19). Spencer in fact detects in the lexical redundancy rules a "call for a new, generative, theory of morphology" (1991:71).

2.3.3. Derivation and inflection

Derivational morphology is thus handled by redundancy rules in the lexicon. What is interesting about this analysis is that it is advocating a split between derivation and inflection. After all, gerundive nominalization will still be handled by T-Rules, and will be spelled out by the Phonological Rules; this accords with the view that they are inflectional. Moreover, it has already been noted that comparison of gerundive and derived nominalizations resembles our comparison of derivation and inflection in **1.1.2.2.** Thus 'Remarks' could be seen as the first model that suggests a theoretical explanation for some of the differences between these two areas of morphology. This is incorporated in Jackendoff's Extended Lexicalist Hypothesis (Jackendoff 1972:13) which states that the only change T-Rules can make to lexical items is to add inflectional affixes. As we shall see in chapter five, this idea of 'splitting' morphology on theoretical grounds is taken up seriously by Anderson (1982).

2.4. Halle's 'Prolegomena'

The first significant reply to 'Remarks' was Halle's (1973) 'Prolegomena to a theory of word-formation' and as such marks the first serious attempt to 'do' morphology in generative grammar. Whereas 'Remarks' suggested treating lexeme formation in a separate component, 'Prolegomena' outlines in some detail what such a component might look like. Above all it introduces the idea of generative rules for word formation, Word Formation Rules (WFRs).

The paper begins in the same vein as 'Remarks', noting how idiosyncrasies are characteristic of word formation. Furthermore, it makes the observation that inflection is not without its share of irregularities. In addition to examining the semantic and morphophonological levels, it notes idiosyncrasies at the phonological level. Figure 2.4 represents the model for morphology in generative grammar, as proposed in 'Prolegomena' (Halle 1973: 8). Halle assumes that the grammar contains a list of morphemes, bound and free, which are marked with syntactic information, along with WFRs to account for the way they are combined in words. Morphologically complex words, with sub-categorisation frames and selectional features, are then inserted into syntax as in the 'Aspects' model (Figure 2.3). And as in 'Aspects' they pass through the phonological component to emerge as phonetic forms.

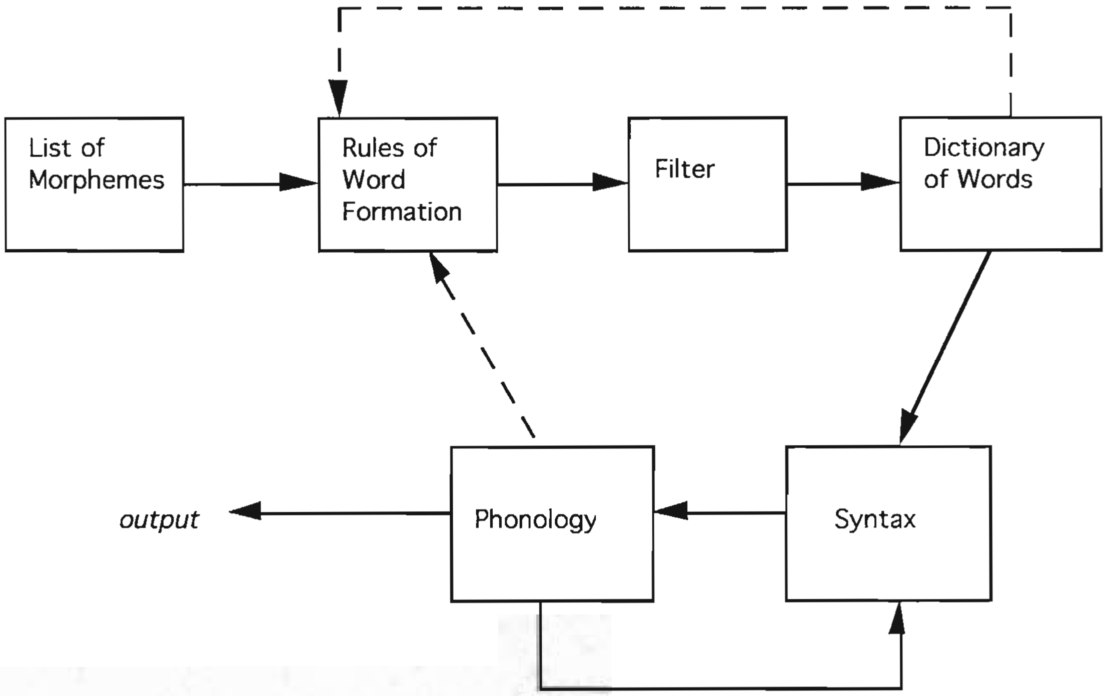


FIGURE 2.4. Generative Morphology, as proposed in 'Prolegomena'

2.4.1. The lexicon

As there are four sub-components before lexical insertion into syntax, Figure 2.4's overall impact can be seen in terms of greatly increasing the structure of the lexicon. Leaving aside the WFRs for now, the lexicon is made up of two separate but inter-related lists. The List of Morphemes defines three types of morpheme: free morphemes, 'stems', and bound morphemes. What is meant by stem is a morpheme which is bound, but not considered an affix, such as *serendip-* in *serendipity*. The second list is the Dictionary of actual words, which is where the output of the WFRs is stored; Lexical Insertion Rules operate over the Dictionary. An innovation is the Filter, a component standing between the WFRs and the Dictionary. The filter is there to handle the idiosyncrasies associated with word formation, at the semantic, morphological, and phonological levels. For example, it will mark those nouns that do not undergo Trisyllabic Laxing, such as *obese* > *obesity*. It also accounts for semi-productivity (see **1.1.2.2**). The WFRs generate potential, as well as actual, words. To provide for lexical gaps, the Filter marks the potential word with the feature -lexical insertion[14]. The lexicon is thus highly structured, both in terms of its various components, and the way they interact, as indicated by the arrow lines. The interaction revolves around the WFRs, which we now look at.

2.4.2. Word Formation Rules in 'Prolegomena'

The WFRs capture regularities at all levels of morphological structure, and as such are a more sophisticated version of the Lexical Redundancy Rules of 'Remarks'. They accomplish various tasks, and are of different types. The first type generates stem-based complex words, such as *serendipity*. Bound morphemes are found and stuck to stems according to templates of the type $[\text{STEM} + \text{i} + \text{ity}]_N$ (to generate *serendipity*). The WFR specifies the syntactic category (and sub-categorisation features) of the output. However, it is not sensitive to the syntactic category of the STEM because it is assumed that stems are neutral, as in 'Remarks'. The WFR will also provide any additional semantic information.

The second type generates words from words. These are more complex for several reasons. First, they are sensitive to the syntactic category of the deriving word, as well as to the semantic and phonological features. A WFR of this type for *boyhood* would be $[\text{NOUN} + \text{hood}]_N$, i.e. specifying the syntactic category of the input and the output, and the bound morph. It will also provide semantic information such as +abstract. One consequence of this type of WFR is that it provides labelled bracketing for morphologically complex words, in a similar way to syntactic constructions. This marks a change from 'Aspects' and 'SPE' where word structure was accounted for by the phonological rules applying to structures generated by syntax. Since Phonological Rules owe a lot of their characterisation from the way that they account for morphologically complex words, this obviously had implications for generative phonology, as noted by Aronoff (1983:357). A second complicating factor is that they have access to the Dictionary for their input to account for derivational families; hence a loop is required from the WFRs to the Dictionary. Thus we have a serious attempt at accounting for an important aspect of derivation, that of multiple affixation and recursion (see **1.2.2**), as noted in Scalise (1986:26).

2.4.3. Inflection and derivation in 'Prolegomena'

As well as word formation being accounted for by a structured lexicon, 'Prolegomena' proposes that inflection be handled in the lexicon too. In support of this move, Halle cites examples of idiosyncrasies in inflection. At the morphophonological level, Halle lists 'inflectional gaps' from Russian, where verbs lack a first person singular, as we showed in **1.1.2.2**. At the semantic level, he again gives examples from Russian, noting that for some nouns denoting periods of time the instrumental case adds an adverbial function, e.g. *letom* 'in summer', *noč'ju* 'at night'; but not all, e.g. *avgustom* cannot have the meaning 'in August'. And finally he argues that Russian nouns having different stress patterns reflects idiosyncrasy at the phonological level. Thus he concludes that all morphology, both derivation and inflection, is the domain of the lexicon. Lexeme Insertion Rules therefore insert fully inflected words. The fact that the choice of some inflection is not made until syntax, such as agreement and case, is accounted for by inserting a word along with its paradigm; a general principle then deletes all but the relevant inflection.

2.5. Concluding remarks

We have shown that the Structuralist's marginalization of morphology is inherited by early generativism, but the trend is for morphology to be taken more seriously, if only to save syntax and phonology. A question that emerges is whether or not there is a separate component for word-structure with separate generative rules. 'Remarks' suggests that the separate component is the lexicon, and 'Prolegomena' follows the suggestion with the incorporation within the lexicon of a morphological component, with generative WFRs, that handles all word-structure issues.

It has been noted by Scalise (1986:2) that as the classical model developed to give a more systematic account of word-structure, the role played by the lexicon moves from marginal to central. The development of the lexicon can already be seen to be taking place in 'Aspects' if we compare it with Chomsky's earlier (1957) 'Syntactic Structures'. There the lexicon is assumed to be the same as that of the Structuralists, an arbitrary list. Lexical insertion was part of the Phrase Structure Rules, such that NP $\rightarrow$ N, and N $\rightarrow$ *John*, for example. Furthermore, there were no Lexical Redundancy Rules of the type discussed above. The main motivation behind the modifications of the lexicon comes from a desire to preserve as much as possible the productivity of syntactic and phonological operations by releasing some of the burden from T-Rules, in particular problematic areas such as the idiosyncrasies inherent in word-structure. This could be achieved by lumping it in the lexicon with the rest of the irregularities, the Lexicalist Hypothesis. As Chomsky observes:

> "...it is to be expected that enrichment of one component of the grammar will permit simplification in other parts. Thus certain descriptive problems can be handled by enriching the lexicon and simplifying the categorial component of the base..." (1970: 185).

Trying to preserve generative phonology and syntax therefore had two consequences for morphology: an increase in its profile, and the development of a separate component, the lexicon, to handle morphology in a different way from the T-Rules of syntax and phonology.

Notes to chapter 2

[1]Based on the description in Hockett (1958:137).

[2]Note that the feature +3 per need not be specified on the N since all Ns (apart from pronouns) are +3 per. Note also that the original example omits the +pl feature on the noun.

[3] Note that Scalise (1986:9-11) provides a detailed commentary of some of Lees' compounding examples. For example *manservant* is the result of T-Rules applying to the Deep Structure 'the servant is a man'. We need not discuss this here because of the high degree of complexity associated with such T-Rules, and because this sort of analysis for derivation was quickly abandoned as we shall see.

[4] In a similar vain, Katamba (1993:11) calls Readjustment Rules "morphology in disguise".

[5]Siegel (1979) later takes up this idea and draws up a taxonomy of #morphemes which produce word-boundary structures, such as #dom in *kingdom*, and +morphemes which produce +boundary structures.

[6]Aronoff (1976: 4) notes that: "...in its zeal, post-*Syntactic Structures* linguistics saw syntax and phonology everywhere..."

[7]Actually termed 'syntactic redundancy rules' to show that they were analogous to Halle's (1959) 'phonological redundancy rules' (Chomsky 1965: 168). The former fill in the abstract C features, just as the latter filled in the D features, of lexical entries.

[8] In keeping with Bloomfield's comments about syntax being inherently productive.

[9]A phrase borrowed from Chapin (1967), as noted in Newmeyer (1980:107). This is later formalised as the Extended Lexicalist Hypothesis in Jackendoff (1972).

[10]Newmeyer (1980:109).

[11] Modified from Newmeyer (1980:107).

[12]See Newmeyer (1980) chapter 4 for the Generative Semantics background to 'Remarks'.

[13] Bauer (1983:81) lists a possible exception to this: the derived nominalization *hope* (by means of conversion) precludes a +animate subject, as in '?our hope for a miracle'.

[14]Note that the problem of potential words is a reflex of the proposal that generative rules can account for word formation.

SECTION II

The Network Morphology Framework

Chapter 3:
Inheritance hierarchies and defaults

Network Morphology represents the lexicon in terms of a network of nodes, capturing the generalisations that can be made about morphology, as well as providing for the idiosyncrasies characteristic of morphology. In this section we detail Network Morphology, the framework in which our account of Russian derivation is couched. We introduce inheritance hierarchies and defaults as key concepts in Network Morphology in the present chapter, and examine the kinds of relations that obtain in a network in the next.

3.0 Introduction

Network Morphology is a declarative framework where information is expressed in path:value pairings. Such pairings, or 'facts', are located at nodes on a hierarchy, which are related by means of inheritance, specifically default inheritance. To express generalisation, Network Morphology allows for inheritance from more than one parent, but imposes orthogonality to prevent possible conflict arising between parents. All Network Morphology analyses are formalized. For this we make use of the DATR representation language, developed by Evans and Gazdar (Evans and Gazdar 1989a, 1989b). DATR was designed specifically for lexical knowledge representation (Evans and Gazdar 1996: 167). It is particularly appropriate for frameworks such as Network Morphology in which properties are inherited through a network of nodes, where the type of inheritance has a specifically non-monotonic interpretation. A great advantage of any analysis represented in DATR is that its predictions can be verified by computer. This is due to the existence of computer interpreters that can implement DATR theories (see for example Evans 1990 and Jenkins 1990) and all Network Morphology analyses have been validated in this way.

We introduce Network Morphology by outlining the framework's key features, inheritance hierarchies and default reasoning, and their expression in DATR. We begin by discussing how Network Morphology organises linguistic 'facts' into 'nodes' (**3.1**). In **3.2.** we consider the way in which these nodes of facts are arranged in inheritance hierarchies. We show in **3.3.** how the interpretation of inheritance in these hierarchies is specifically non-monotonic, or 'default', and in **3.4.** the way in which Network Morphology supports inheritance from more than one source. Due to the important role it plays in the framework, we end by exploring in some detail the various notions of 'default' (**3.5**).

3.1. Network Morphology 'facts'

In Network Morphology linguistic facts are expressed in DATR as the pairing of an attribute structure consisting of one or more attributes with a particular value. Attribute structures are represented as paths, and delimited by angle brackets. Paths appear on the left hand side of a path:value pairing, and the pairing itself is represented by a double equals. For example, the stem of *komnat(a)* 'room' is expressed by the fact in (3.1), consisting of the path `<stem>` and the value `komnat`. Paths may be complex. The syntactic category of *komnat(a)* is expressed by the fact in (3.2), where the value `noun` is paired with an attribute structure consisting of two attributes, `syn` and `cat` (abbreviations of 'syntactic' and 'category').

(3.1)

```
<stem> == komnat.
```

(3.2)

```
<syn cat> == noun.
```

The facts in (3.1) and (3.2) pertain to the Russian word *komnat(a)*. To capture the way in which facts may be viewed as properties of an item, Network Morphology distributes facts across 'nodes', where a node marks the collection or set of an item's properties. Thus the facts in (3.1) and (3.2) can be represented as facts about *komnat(a)* by listing them as properties of the node `Komnata`, as shown in (3.3). Note that as a convention nodes are distinguished by upper case. (Note also that the ellipsis in (3.3) is short-hand for all other properties that may be listed at the node, and is not part of the representation language.)

(3.3)

```
Komnata:
    <stem> == komnat
    <syn cat> == noun
    ...
```

The above example illustrates the simplest type of fact in Network Morphology, where a single atomic value is directly specified for a particular attribute structure. A more complex type of fact involves a value structure consisting of an atomic value together with a descriptor, i.e. a path which is elsewhere paired with a value. This is how noun inflections are described. For example, we can represent the nominative singular as in (3.4) where the descriptor `<stem>` constitutes part of the value of the path `<mor sg nom>`[1]. As we showed above the descriptor `<stem>` is a path paired with the value `komnat`, hence the full value of `<mor sg nom>` will be the concatenation of the atomic value `a` to the value of `<stem>`, which is `komnat`, i.e. '`komnat a`'. In this way Network Morphology expresses inflection in terms of the stem and formative together, in accordance with a lexeme based approach to morphology[2].

(3.4)

```
Komnata:
    <mor sg nom> == <stem> a
    ...
```

In Network Morphology facts are organized into nodes; these nodes are themselves organized into inheritance hierarchies, to which we now turn our attention.

3.2. Inheritance hierarchies

Properties of one item may be shared by another. Network Morphology provides for this by expressing property sharing as information shared between hierarchically arranged nodes. Consider the inflections of the nouns *zavod* 'factory', *kart(a)* 'map', *tetrad´* 'exercise book' and *bolot(o)* 'swamp' in Table 3.1.

		I	II	III	IV
		zavod	karta	tetrad´	boloto
		'factory'	'map'	'exercise book'	'swamp'
SG					
	nom	zavod	kart-a	tertrad´	bolot-o
	acc	zavod	kart-u	tetrad´	bolot-o
	gen	zavod-a	kart-i	tetrad´-i	bolot-a
	dat	zavod-u	kart-e	tetrad´-i	bolot-u
	inst	zavod-om	kart-oj	tetrad´-ju	bolot-om
	loc	zavod-e	kart-e	tetrad´-i	bolot-e
PL					
	nom	zavod-i	kart-i	tetrad´-i	bolot-a
	acc	zavod-i	kart-i	tetrad´-i	bolot-a
	gen	zavod-ov	kart	tetrad´-ej	bolot
	dat	zavod-am	kart-am	tetrad´-am	bolot-am
	inst	zavod-am´i	kart-am´i	tetrad´-am´i	bolot-am´i
	loc	zavod-ax	kart-ax	tetrad´-ax	bolot-ax

TABLE 3.1. Russian noun inflection

Every declinable noun in Russian patterns like *zavod*, *kart(a)*, *tetrad´*, and *bolot(o)* in their inflections, at least to some degree. For example, the inflectional facts about *komnat(a)*, as well as for a host of other nouns[3], will be the same as those about *kart(a)* in Table 3.1. To capture the notion of paradigm, the pattern which a set of items shares, nodes are set up to represent the four inflectional classes in Table 3.1. This kind of node is different from the individual lexical entry nodes, and can be thought of as an 'abstraction' which acts as a "collection of properties shared by the members of a set" (Touretzky 1986: 2). Hence the node `N_II` in (3.5) representing class II acts as an abstraction node where inflectional facts about class II nouns, such as *komnat(a)* and *kart(a)*, are listed.

(3.5)

```
N_II:
   a. <mor sg nom> == "<stem>" a
   b. <mor sg acc> == "<stem>" u
   ...
```

Because facts at declension class nodes such as `N_II` are inflections of a lexical entry's stem, the value part of an inflectional fact is complex, including as it does a reference to the lexical entry's stem, as we showed above in (3.4). The quotes surrounding `<stem>` are important: they express that the descriptor is instantiated by a value according to the global context. Recall from (3.3) that the stem and its value is among the facts listed at a lexical entry. We will see further examples of quoted paths throughout the chapter.

Setting up abstraction nodes such as `N_II` allows for facts to be shared across lexical entries, and as such is doing no more than Word and Paradigm models of inflection. What is special about Network Morphology is that we can allow the inflectional classes to share facts amongst themselves. This will enable us to capture inflectional homonymy, a phenomenon that is highlighted in Word and Paradigm. From Table 3.1, based on Corbett and Fraser (1993: 126), consider, for example, how the dative, instrumental and locative endings in the plural are shared by all four classes; or how the oblique endings in the singular are shared by classes I and IV. Organizing the nodes in a taxonomic hierarchy, such as the one in Figure 3.1, allows inflectional facts to be shared across the different nodes. The sharing of facts is expressed by mother and daughter node relationships, where the information at a mother node is made available to a daughter node.

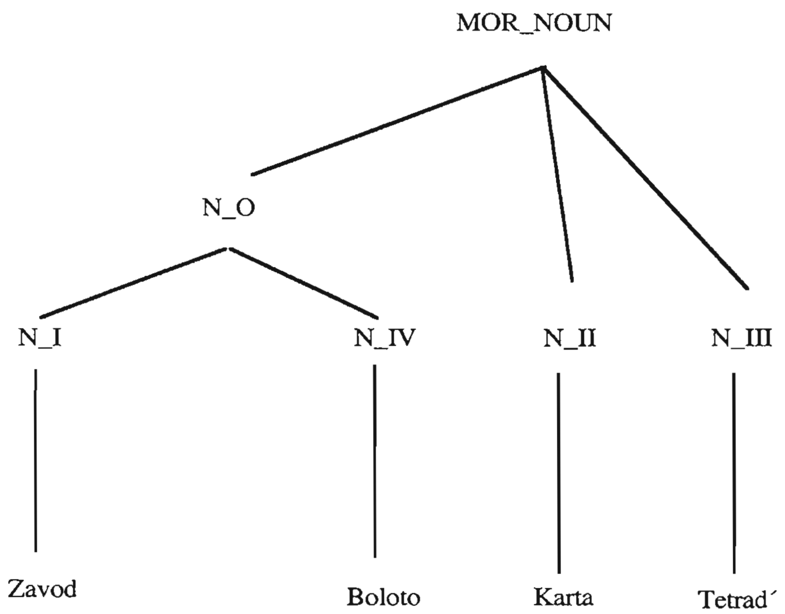


FIGURE 3.1. Russian noun inflectional class hierarchy

The node MOR_NOUN acts as a mother to the declension class nodes, which in turn act as mothers to the lexical items[4]. Information which is shared between all classes will be made available from this node; for example the dative, instrumental and locative plurals[5]. Where sharing is restricted to only certain declension classes, a node is set up as mother over only those classes. For example, sharing the oblique singular inflections is restricted to N_I and N_IV. A node N_O is set up which will store these facts, and from which N_I and N_IV will draw. In a taxonomic hierarchy, fact sharing is expressed by information sharing between a mother node and its daughter(s). This sharing of information is termed 'inheritance' (e.g. Flickinger 1987: 57). The idea of inheritance hierarchies originates in Artificial Intelligence approaches to the representation of knowledge, and has only latterly been used in linguistics. For a survey of frameworks organized around inheritance, see Daelemans et al (1992: 210-14).

The hierarchy in Figure 3.1 with the interpretation of inheritance discussed so far only accounts for some of the homonymy in Table 1. For example, it says nothing about the sharing of the locative singular *-e* by three of the classes (I, II, IV), or the sharing of the nominative plural *-i* by three of the classes (I, II, III). One way would be to set up special nodes such as N_O. The difference between this and the situation with classes I and IV, however, is that the locative singular is shared by most classes. These facts should be viewed therefore as tendencies, or generalizations. To capture fact sharing as a generalisation, Network Morphology makes use of hierarchies with a type of inheritance that allows for exceptions. This type of inheritance is termed default inheritance.

3.3. Default inheritance

In the system discussed so far, inheritance is mandatory, or monotonic. Each daughter node inherits the full list of facts stated at its mother. But, as noted by Touretzky (1986: 3), this kind of mandatory inheritance is "too inflexible for representing real world knowledge." In a non-monotonic hierarchy what is identified as the member of a set is identified as such not because it inherits necessarily all the properties of a set, rather because it inherits most of them. To illustrate, consider a class hierarchy for aircraft, which we give in Figure 3.2 (loosely based on Brown and Hippisley 1994: 52)[6].

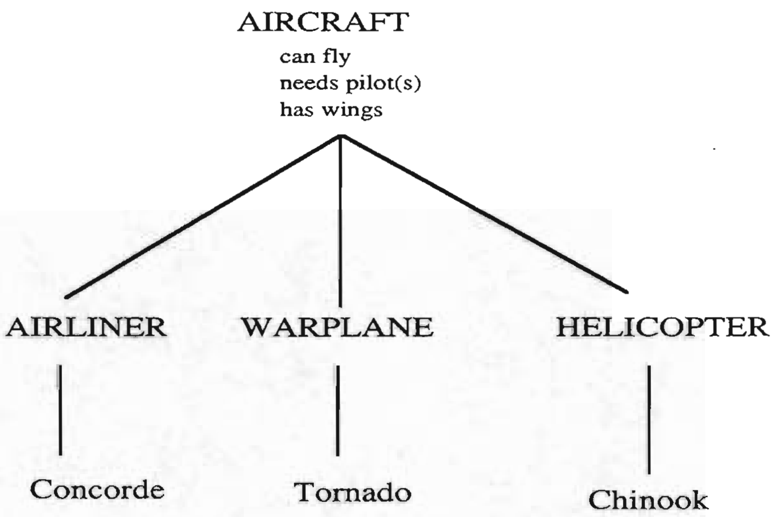


FIGURE 3.2. Aircraft hierarchy

In Figure 3.2 HELICOPTER is considered a member of the class AIRCRAFT not because it has all the properties of an aircraft, but because it has most of the properties, i.e. ability to fly, need of a pilot. Because helicopters use rotary blades instead of wings to fly, its mother AIRCRAFT lists properties which are viewed as typical, rather than mandatory. To capture this, allowance must be made for inheritance by a daughter to be overridden. In default inheritance networks "properties that are attached to a node take precedence over those that are inherited from its parent" (Daelemans et al. 1992: 207). The property of not having wings at HELICOPTER will take precedence over the property of having wings at

AIRCRAFT. A non-monotonic default inheritance hierarchy therefore represents knowledge in terms of generalisations, and exceptions to generalisations.

More than express a generalisation and its exceptions, a default inheritance hierarchy encodes various degrees of exception, and hence various degrees of generalisation. If the 'top' node AIRCRAFT is thought of as the 'root' node, Daelemans at al. (1992: 209) observe the following consensus amongst those working with default inheritance, namely that:

> '...nodes that appear close (or identical) to the root(s) of the network should be used to encode that which is regular, "unmarked", and productive, and that distance from the root(s) should correlate with increasing irregularity, "markedness", and lack of productivity.'

Note that 'distance correlates with *increasing* irregularity' (my italics). The exception about wings that would be stated at HELICOPTER in Figure 3.2 is an exception to a high level generalisation about aircraft; but since this exception, as well as all non-exceptions, is inherited by default by members of HELICOPTER, it can be viewed as a generalisation, albeit of a lower order, that concerns helicopters. Hence, in terms of this lower level generalisation, Chinook is not an exception at all. Chinook is an exception, however, to a generalization about helicopters that the number of main rotary blades is one. In this way, what is really exceptional about Chinook can be pulled out, that it has two main rotary blades, and not that it does not have wings. HELICOPTER is 'more' irregular than AIRCRAFT, and Chinook is 'more' irregular than HELICOPTER, and the increasing irregularity correlates with the distance from AIRCRAFT in the hierarchy. Recall from **3.0** that integral to Network Morphology is the expression of generalisations about morphological facts in a network. It should now be clear how default inheritance is a central notion of Network Morphology (e.g. Corbett and Fraser forthcoming a: 5).

3.3.1 Default inheritance and Russian inflection

By recasting the noun inflection hierarchy in Figure 3.1 as a default inheritance hierarchy, we can apply it to the inflectional homonymy problem noted at the beginning of this section. In Figure 3.1 we simply use the root node `MOR_NOUN` to capture sharing of the nominative plural between `N_I`, `N_II` and `N_III`, and the sharing of the locative singular between `N_I`, `N_II` and `N_IV`. The root node `MOR_NOUN` lists these facts, which are inherited by the class nodes by default, but `N_IV` and `N_III` are made to override: `N_IV` overrides the nominative plural with a more specific fact that the nominative plural is in *-a*; and N_III overrides the locative singular default with a more specific fact that the locative singular is in *-i*.

A default inheritance hierarchy will also allow us to capture exceptional lexical items, where overrides will be stated at the lexical entry level. The class IV noun *bolot(o)* and the class III noun *tetrad´* inherit the nominative plural and locative singular overrides from their respective parent class nodes. Thus at the lexical entry level no exception is encoded, hence these two nouns are not viewed as exceptions. Yet some lexical entries behave exceptionally in terms of their inflection (as Chinook with respect to HELICOPTER). This is easily captured in a default inheritance hierarchy, since a lexical entry is permitted to override inflectional facts at a class node, and still be regarded as a member of that class. For example, the noun *soldat* 'soldier' patterns like class I in every respect except for the genitive plural which is *soldat* (instead of **soldatov*). It is therefore specified as inheriting from N_I, but overrides the fact about the genitive plural by specifying genitive plural as the bare stem.

3.3.2. Representing default inheritance

As we have said DATR defines non-monotonic, default inheritance networks. This is due to its principle of default inference, which we shall briefly look at. DATR's principle of default inference is based on the fact that any path which is an extension of another path receives the same definition as the path it extends, unless otherwise stated. Put another way, by default a path implies any further specification of itself. A good illustration would be the way Russian *kot´onok* 'kitten' distinguishes stems for singular and plural inflection, e.g. nominative singular *kot´onok* and nominative plural *kot´at(a)*. This is naturally expressed in DATR by simply extending the path <stem> with the paths <stem sg> and <stem pl>. We can think of <stem> as the 'leading subpath' and therefore <stem sg> and <stem pl> as having common leading subpaths.

For an ordinary noun such as *komnata* there is no need to distinguish a singular stem from a plural stem. Since the value for <stem sg> and <stem pl> by default will be the same as that of their leading subpath <stem> we express the non-distinction in the stem by representing the fact as <stem> == komnat.

(3.6)

```
Komnata:
    <stem> == komnat
    <syn cat> == noun
    ...
```

However, in the case of *kot'onok* 'kitten' the stems are formally distinguished, as represented in (3.7). Here the extension `<stem pl>` no longer shares the definition of the path it extends `<stem>` since an alternative definition has been specified.

(3.7)

```
Kot´onok:
    <stem sg> == kot´onok
    <stem pl> == kot´at
    <syn cat> == noun
    ...
```

We can therefore think of the default inference principle as the 'longest-defined-subpath-wins principle' (Evans and Gazdar 1995: 20). Given the principle of default inference, how does DATR represent the default inheritance of facts specified at a generalizing node such as MOR_NOUN in Figure 3.1? One fact specified at MOR_NOUN will be that concerning the nominative plural since it is shared by most inflectional classes. How do we represent its inheritance by the daughter node N_II? This is represented in DATR by the 'empty path'. In (3.8) and (3.9) we see the nodes MOR_NOUN and N_II. We can think of the empty angle brackets <>, the 'empty path', in (3.9) as expressing the inheritance by N_II of every path at the mother MOR_NOUN which is not specified at N_II. This is because the empty path is taken to be a leading subpath of every path at the mother node (Evans and Gazdar 1996: 172), in this case MOR_NOUN. In other words every path at MOR_NOUN is, unless otherwise specified, an extension of paths at N_II. And because the longest defined subpath wins, the values for `<mor sg dat>` and `<mor pl nom>` at N_II will be that given for this path at MOR_NOUN.

(3.8)

```
MOR_NOUN:
    <mor sg dat> == "<stem>" e
    <mor pl nom> == "<stem>" i
    ...
```

(3.8)

```
N_II:
    <> == MOR_NOUN
    ...
```

We have shown how in Network Morphology linguistic facts are organised amongst nodes arranged in tree-structured hierarchies, and related by means of inheritance, in particular default inheritance. Network Morphology also allows nodes to inherit from more than one source; in other words it supports 'multiple' inheritance.

3.4. Multiple inheritance

In **3.3.1** to capture the irregularity of *soldat* we proposed overriding the inheritance of -*ov* from `N_I` by marking in the lexical entry that the genitive plural is the bare stem. Yet this seems to miss a generalisation, since the genitive plural being a bare stem is a fact about `N_II` and `N_IV`. How can we avoid this same fact being stated three times? The answer lies in allowing a daughter more than one source of inheritance. In other words, constructing hierarchies that support multiple inheritance.

3.4.1. Multiple inheritance and the aircraft hierarchy

To illustrate, recall the aircraft hierarchy in Figure 3.2. Supposing we included Harrier amongst the daughters of WARPLANE. Now an interesting property of harriers is their vertical takeoff capabilities. This could be stated at Harrier, but it is a fact that could equally be listed under HELICOPTER. In other words, it is a property that is not unique to harriers, and we need a way of capturing this. In strictly tree-structured hierarchies like the ones outlined so far, we are forced to set up a sub-node of WARPLANE which represents warplanes with vertical takeoff, from which harrier, and other such aircraft will inherit. Yet this still does not get around duplicating the property of vertical takeoff, it simply pushes the problem further up the hierarchy. Alternatively, we may abandon strictly tree-structured hierarchies in favour of ones where inheritance need not be from mother to daughter. Such a hierarchy will allow Harrier to inherit from more than one source, WARPLANE and HELICOPTER. This is represented in Figure 3.3.

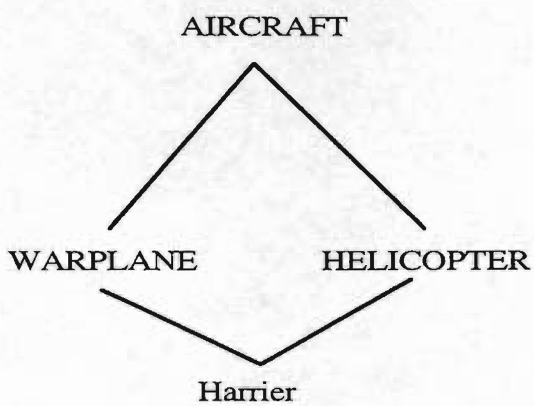


FIGURE 3.3. Multiple inheritance and the aircraft hierarchy

Allowing for multiple inheritance solves one problem but introduces another: a daughter may well inherit contradictory properties if it has more than one parent. This is the case with our harrier illustration if we consider the property about wings. WARPLANE will inherit the property of having wings from AIRCRAFT, but HELICOPTER will override this property. Since Harrier inherits from both nodes, it will have wings, and not have wings at the same time.[7] We thus need a way of constraining multiple inheritance so that contradictory properties are not inherited. There are two basic strategies. In Prioritised Multiple Inheritance, priority is given to the properties of one of the parents by ordering the parent nodes in respect of each other (e.g. Flickinger 1987: 60; Daelemans et al. 1992: 209). In Orthogonal Multiple Inheritance, tree-structured networks are replaced by orthogonal networks and properties that are inherited from parent nodes must be disjoint (Touretzky 1986: 73).

3.4.2. Orthogonal Multiple inheritance and *soldat*

Network Morphology adopts the latter strategy for avoiding conflict (Corbett and Fraser 1993: 122; Brown et al. 1996: 64). The lexical entry *soldat* inherits from two parents, `N_I` and `N_II`, in an orthogonal network where facts are partitioned between nodes (Daelemans et al. 1992: 209), in this case facts about inflection. The lexical entry node `Soldat` will not inherit conflicting facts (which we see from Table 3.1 would include all singular case forms except the locative) since the node `N_II` is specified as an inheritance source only for the fact about the genitive plural, and is therefore orthogonal to the general inheritance from `N_I`. This is represented in Figure 3.4, where the unbroken line expresses the main line of inheritance, i.e. inheritance from the maximal source.

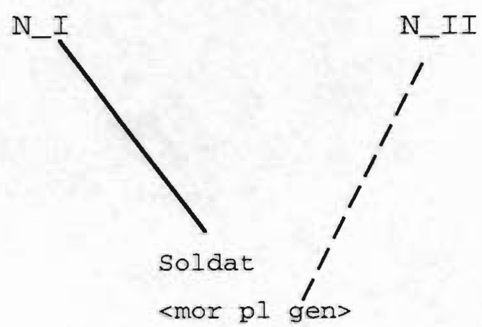


FIGURE 3.4. Multiple inheritance of *soldat*

By adopting Orthogonal Multiple Inheritance, Network Morphology can also allow for multiple inheritance amongst inflectional class nodes. This is, for example, how the genitive plural homonymy between classes II and IV is captured. The node `N_IV` specifies `N_II` as its source of inheritance for the genitive plural, but `N_O` for its main inheritance source. In this way Orthogonal Multiple Inheritance allows the fact of the genitive plural being the bare stem to be stated only once at N_II. In fact Brown and Hippisley (1994) show that the evaluation of the genitive plural at N_II is complex, but interestingly that the evaluation of the genitive plural for class IV nouns is complex in exactly the same manner. Hence N_IV multiply inheriting from N_II encodes not only the sharing of the fact, but also the sharing of its evaluation.

3.4.3. Representing orthogonal multiple inheritance

Though it is possible to represent prioritised multiple inheritance networks in DATR, as shown in Evans at al. (1993), DATR was designed with specifically orthogonal multiple inheritance networks in mind (Evans and Gazdar 1995: 21). N_IV multiply inheriting from N_II and N_O is represented in (3.10). As discussed in **3.3.2** the empty path indicates the inheritance of every path unless otherwise stated. In cases of multiple inheritance this will denote the main source of inheritance, which in this case is N_O. The path <mor hard pl gen>, however, escapes by being specified as inheriting from a secondary source, N_II.

(3.10).

```
N_IV:
    <> == N_O
    <mor hard pl gen> == N_II
    ...
```

Other homonymy can be similarly captured. From Table 3.1 we see that class III *tertrad′* and class II *kart(a)* have the same formative *-i* for the singular genitive. We can represent class III referring to class II for the singular genitive, while maintaining MOR_NOUN as its main inheritance source (3.11), (3.12).

(3.11)

```
N_III:
    <> == MOR_NOUN
    <mor sg gen> == N_II
    ...
```

(3.12)

```
N_II:
    <> == MOR_NOUN
    <mor sg gen> == i
    ...
```

3.5. Defaults in Network Morphology

Having discussed default inheritance and how it makes possible orthogonal multiple inheritance, we focus on the notion of default itself. We look at how features may have values assigned not by one default statement, but by a set of interdependent defaults (see Gazdar 1987: 42-5). We also show how one set of interdependent defaults may be nested within another (Corbett and Fraser forthcoming a).

3.5.1. Interdependent defaults and gender assignment

The defaults we have met so far are straightforward, such as the default that in Russian the nominative plural is in *-i*. This is expressed by a fact at the root node MOR_NOUN which is shared by declension class nodes, and ultimately lexical items (see Figure 3.1). With defaults such as these the default value is one of several values for a particular feature. Thus for the values *-i* and *-a* for the nominative plural feature one is taken as the default. As well as straightforward cases as these, Network Morphology encodes sets of interdependent defaults for a particular feature (Corbett and Fraser forthcoming a: 2)[8]. With a set of interdependent defaults, a feature has several competing values, but each value can be expressed as the default if the value of another feature is taken into consideration. We can illustrate with Fraser and Corbett's (1995) account of gender assignment in Russian. It is common in the world's languages to find gender being associated with a noun's semantics, they note. This is what characterises the so-called 'natural gender systems' (Corbett 1991: 9). Fraser and Corbett's semantic assignment rules in (3.13) capture the fact that gender in Russian is predominantly assigned semantically, such that nouns denoting males are assigned masculine gender, and nouns denoting females are assigned feminine gender.

(3.13)

1. sex-differentiable nouns denoting males (humans and higher animals) are masculine: for example, *student* '(male) student';
2. sex-differentiable nouns denoting females are feminine: for example *uč'itel'n'ica* '(female) teacher' (Fraser and Corbett 1995: 128).

The rules in (3.13) can be stated as interdependent defaults, where the values for gender can be expressed as a set of defaults depending on the lexical entry's value for semantic sex. To express interdependent defaults in DATR where one value is dependent on another, we make use of evaluable paths in DATR (see for example Evans and Gazdar 1996: 175-6). This is a technique whereby the value of a path:value pair is complex, consisting of at least one embedded path; what is important is that upon evaluation the resulting value is given the interpretation of an attribute in a path of a secondary path:value pair. This is illustrated by (3.14) and (3.15) from Fraser and Corbett (1995: 129) which is the representation of the gender assignment rules in (3.13).

(3.14)

```
NOUN:
    <syn gender> == GENDER: <"<sem sex>">
    ...
```

(3.15)

```
GENDER:
    <male> == masc
    <female> == fem
    ...
```

We can explain (3.14) and (3.15) as follows. Using an evaluable path, the assignment of gender is in two parts. The equation's value in (3.14) is the descriptor `<sem sex>` whose evaluation will be the basis of a secondary path at a separate node, GENDER. It is the value of this secondary path that will be the ultimate value of `<syn gender>`. Thus the feature for gender is made to be dependent upon the feature for semantic sex of a particular lexical entry. The second part, the node GENDER in (3.6), expresses the set of defaults that ensues from this dependency: if the semantic sex is male, the gender of the item is masculine, if female feminine. Note that the quotes surrounding the descriptor `"<sem sex>"` indicate that this value is retrieved from the query lexical entry.

Now as well as male and female nouns, Russian nouns that are undifferentiated for sex, such as *komnat(a)* 'room', must also carry a feature for gender, as shown by the agreement in (3.16).

(3.16)

bol'š-aja	komnat-a
big-Nom.Sg.Fem	room-Nom.Sg.Fem
(the) big room	

Yet such nouns, which are the majority, will fall outside the domain of (3.14) and (3.15). Either undifferentiated nouns are marked for gender lexically, or as is the case with many languages they may be '...subject to very general rules of a different type, based on a criterion depending on form...' (Corbett and Fraser forthcoming b: 4).

In Russian each of the four declension classes is associated with a gender, so by virtue of belonging to a declension class a noun will have its gender assigned. This is captured by the morphological assignment rules for gender in (3.17). Just as with the semantic based assignment rules, declension class based assignment rules, or morphological assignment rules, can also be expressed as a set of interdependent defaults, where the dependency this time is one of declension class. This is captured by stating a fact about gender at each declension class node[9].

(3.17)

1. nouns of declension class I are masculine;
2. nouns of declension class II and III are feminine;
3. nouns of declension class IV are neuter (Fraser and Corbett 1995: 128).

3.5.2. 'Nested' defaults and gender assignment

In Russian there are therefore two ways in which gender is assigned. If we leave these two different sets of defaults for assigning gender as they are, it should be clear that we are going to run into conflict. We can take the case of *uč'itel'n'ic(a)* '(female)teacher' in (3.13). Because it is female, it will be assigned gender by (3.14) and (3.15); but it will also be assigned gender according to a default based on (3.17). In other words, though sex undifferentiated nouns are assigned gender from the declension class node only, all male and female nouns will be assigned gender according to both semantic sex and declension class. To resolve this we introduce the notion of 'nested' default.

Supposing a noun had a value for gender assigned by the semantic based set of defaults that was different to the one assigned by the declension class based set. This in fact is the case for a host of class II nouns which are masculine[10], an example of which is *d'ad'(a)* 'uncle'. Being male will lead to it being assigned masculine gender by (3.14) and (3.15), but belonging to class II will lead to it inheriting feminine gender according to (3.17). Clearly it would be unusual for one noun to have two genders[11]. The gender of *d'ad'(a)*, and nouns like it, is actually masculine, i.e. the value from the semantic based set of defaults. We therefore need a way of allowing both sets of defaults for assigning gender, but ensuring the semantic based set takes precedence. This can be found by observing that when the assignment of a feature's value relies on interdependent defaults, there is a possibility that the assignment will be let down. This will occur when the values of the feature on which the defaults are interdependent cannot be retrieved. To make provision for this situation, a door to another set of defaults is required. We can think of the semantic based interdependent defaults as the prime way of assigning gender. This captures the fact that formal gender systems always have a semantic core (Corbett 1991: 34). Nouns which are undifferentiated for sex will then be viewed as letting down the assignment system, as the values male and female cannot be retrieved from such nouns. Another level of defaults is therefore required for such nouns. It is at this level that the declension class based set of defaults plays a role.

The value for gender provided by the declension class of the noun is a default nested within semantically based gender assignment defaults. Not all nouns have the value male and female, but because all nouns belong to the morphological system each will be provided with a default for gender[12]. Of course this default will only actually be used when the first level semantic based default is unavailable. To accommodate this we mark (3.15) to include the path `<undifferentiated>` as in (3.18). The declension class based assignment is expressed in (3.18) as a default for undifferentiated nouns. To express that the nested default is that delivered by the morphological class of the noun, gender assigned by declension class is given the special label 'morphological formal gender' and is represented by the path `<mor formal_gender>`. Note that quotes express that the value will be taken from the declension class of the query lexical entry, which is `N_II` in the case of `Komnata`.

(3.18)

```
GENDER:
    <male> == masc
    <female> == fem
    <undifferentiated> == "<mor formal_gender>".
```

Extending the discussion of defaults beyond gender assignment in Russian, Fraser and Corbett (forthcoming) show how nested defaults offer an elegant account of declension class assignment in Arapesh. Drawing on work by Aronoff (Aronoff 1992a), Fraser and Corbett assume that declension class in Arapesh is assigned by a set of interdependent defaults based on the phonology of the noun's stem. Accommodation has to be made for nouns whose stem shape does not fit that required by the interdependent defaults. As it happens, all such nouns end up being assigned to the same declension class. This is met by viewing this declension class as the default which is made available when the values of the feature on which the defaults are interdependent cannot be retrieved. Interestingly, a second group of nouns is assigned this default declension class. These nouns have the values required by the interdependency defaults, but do not inherit these defaults. The same assignment for both problematic types is viewed as a sort of 'exceptional case' default.

3.5.4. 'Exceptional case' defaults and neutral gender assignment

In Corbett and Fraser the notion of default is explored more deeply and they include the idea of a default '[concerned] with exceptionality'. Their discussion, drawing on Corbett (1991), centres on gender assignment in a number of languages including Russian, where the NP is viewed as being nonprototypical[13]. Two examples given in Corbett (1991: 204-5) are NPs in Russian with an infinitive phrase acting as subject, and NPs whose subject is not overt.

It might seem odd to think of infinitive phrases as controllers, and even more odd to think of covert subjects as controllers, since they do not have features such as number and gender. The problem lies, however, in the targets: "[I]f a particular target type can mark agreement in gender then in many languages it must." (Corbett 1991: 203). In other words, of the forms that are used to mark normal agreement one of them will be chosen in the enforced agreement of nonprototypical NPs. This is what Corbett terms 'neutral' agreement (Corbett 1991: 204)[14]. We see neutral agreement in (3.19) and (3.20) (examples from Corbett 1991: 204).

(3.19)

dozvonit´sja byl-o problemoj
to.ring.through was-NEUT.SG problem
'To ring through was a problem.'

(3.20)

byl-o xolodn-o
was-NEUT.SG cold-NEUT.SG
'It was cold.'

Examples in (3.19) and (3.20) show that because past tense verbs and predicate adjectives act as targets in Russian, they must carry a gender form. What is interesting is that the form 'pressed into service' in each case is the neuter form. In other words, neuter is the neutral gender in Russian. To capture this Corbett and Fraser (forthcoming a: 16) claim that assignment in these circumstances is handled by an exceptional case default, and the exceptional case default is neuter. The question is, how would they tally this with the nested default for morphologically assigned gender?

The answer appears to be in viewing defaults as operating at different levels. Defaults concerning neutral gender are described as higher level defaults (Corbett and Fraser forthcoming a: 16-17) and operate at a different level from defaults concerning typical gender assignment. Given a particular level, what are described as normal case defaults are the values that are normal for that level; and what are described as exceptional case defaults are the values that are not normal for that level, but may be considered the default at another level. Thus at the level of the phrase, neutral gender assignment could be described as a normal case default. At this level, neutral gender assignment could even be stated as a set of interdependent defaults, as in typical gender assignment. For example, a set of semantic based interdependent defaults could be used to capture the correspondence between the inanimacy of phrases and their neuter gender. The possibility of neuter gender being semantically assigned is discussed with relation to a number of languages in Corbett (1991: 205-7), and interestingly, for some languages formal criteria could also be said to apply. In this case the form used to mark neutral agreement corresponds to that form used to mark gender on targets which has the widest range, i.e. which displays the most syncretism (Corbett 1991: 211). Why this is interesting is that, like with typical gender assignment, formal criteria appear to be used only when semantic criteria 'provide no help' (Corbett 1991: 210).

3.6. Concluding remarks

In the last section we looked at defaults in more detail, introducing the idea of nested defaults. At the level of the word, assignment is by a set of semantically-based interdependent defaults. If something goes wrong with retrieving a semantic value on which the assignment depends, one finds nested within these defaults a set of defaults based on form. With non-prototypical NPs, not only does something go wrong with the semantic value, but also with the form. Controllers in these cases are either phrases or covert subjects, both of which fall outside the morphological system. Hence the nested default that is used for sex undifferentiated nouns will be of no use. An exceptional case default is therefore activated, namely the one that assigns neutral agreement.

This underlines the important place default reasoning occupies in Network Morphology, which we have shown in this chapter is a declarative framework where morphological facts are organized into nodes, which are themselves arranged in a hierarchy. The relation between nodes is either as mother-daughter, or sister-sister in the case of multiple inheritance, and capture the sharing of morphological facts, such as the inflectional homonymy present in the Russian noun system. In the next chapter we focus on the exact nature of the relations between nodes in Network Morphology.

Notes to chapter 3

[1] Note that the attribute `mor` is a 'hierarchy identifier' denoting the morphological (or inflectional) hierarchy. Hierarchy identification is discussed in the next chapter (**4.2.1**).

[2]Recall from chapter one that one of the key assumptions in Network Morphology is that the lexeme is the minimal sign (**1.1.2**, **1.1.2.1**). Lexeme-based morphology is discussed in detail in chapter five.

[3]For example, Zaliznjak (1977) contains about 13600 nouns which pattern like *komnata.* (See Brown et al . 1996: 57 for this figure).

[4] Actual Network Morphology accounts position the inflectional hierarchy alongside a 'lexemic' hierarchy of words, and lexical items are daughters of this hierarchy, as we will see in the next chapter. For purposes of exposition, the hierarchy in Figure 3.1 will be assumed here.

[5] These facts may be stated at a higher node MOR_NOM which acts as a mother to MOR_ADJ as well as MOR_NOUN . The details are not important at this point of the discussion.

[6] Other non-linguistic examples have been used in the Network Morphology literature for the purpose of illustration of default inheritance and can be found in Corbett and Fraser (1993: 118-120); Corbett and Fraser (forthcoming a: 3-5); Fraser and Corbett (1995: 123-5). The interested reader may also wish to look at Gazdar (forthcoming) who uses the mollusc family for illustration.

[7] A famous example of conflict arising in multiple inheritance is the so-called Nixon Diamond scenario (Touretzky 1986: 11). Nixon inherits from the node QUAKER and the node REPUBLICAN to capture the fact that he is both a Quaker and Republican. But both nodes will have contradictory information about pacifism. The 'diamond' comes from the diagrammatic representation of this problem (see for example Corbett and Fraser 1993: 122).

[8]For differentiating between straightforward and interdependent defaults, see Gazdar (1987).

[9]Note that morphological gender assignment, i.e. assignment by the declension class, is not a view shared by most Russianists who prefer to have gender assign declension class. The arguments in favour of it are worked out in detail in Corbett (1982), the central idea being that this is more economical since inflectional class has to be specified in the lexical entry for other reasons, therefore there is no loss in locating gender there; but specifying it in the lexical entry will lead to a less economical situation.

[10]Using the electronic version of Zaliznjak (1977), a count revealed 167 nouns of the *d'ad'(a)* type. There are a further 360 of common gender, for example *vozn'ic(a)* 'coach driver, male or female' (Dunstan Brown, pc).

[11] But this is not ruled out in the world's languages. For example, see the discussion of hybrid nouns in Corbett (1991: 225ff).

[12] Exceptions are of course the class of indeclinable nouns. However, these can be fitted into the inflectional hierarchy under a node N_V as "their lack of declension is itself a matter of morphology" (Fraser and Corbett 1995: 129). A fact about formal gender is stored at N_V, whose value is indirectly referenced on the basis of semantic animacy (Fraser and Corbett 1995: 130). Note that Hippisley (1996: 217-218) argues for direct reference of a value for formal gender at N_V.

[13] Another candidate discussed for the exceptional default is where an NP is overspecified for gender, i.e. when there are conjoined NPs and more than one gender which in theory could act as the controller. Still another candidate is where a normal semantic based assignment would result in overspecification. For example, if the sex of a child is unknown, assigning it a semantic based gender might imply that the speaker has knowledge of the child's sex, which he/she does not.

[14]Note that Corbett (1991: 214-6) observes an alternative strategy in some languages, where a special neutral agreement form is used.

Chapter 4:
Relations between and within hierarchies

4.0. Introduction

From chapter three we see that the nesting of defaults can be understood in terms of the levels of linguistic information at which they operate. Network Morphology provides for the combination of different levels of linguistic information by associating each level with a distinct hierarchy (Brown et al. 1996: 59). The two main hierarchies are the Lexemic hierarchy, where information about words is organized, and the Inflectional hierarchy, where information about their inflectional properties is stored. With regard to these two hierarchies, in this chapter we explore the way in which Network Morphology distinguishes two basic types of relation: 'hierarchy relations' where the relation is between nodes within a single hierarchy, and 'network relations' where the relation is between nodes belonging to separate hierarchies.

We begin in **4.1** with a discussion of the Lexemic and Inflectional hierarchies, showing how it is useful to distinguish the kinds of relations that exist between the nodes. In **4.2** we examine hierarchy relations in some detail, introducing a convention which distinguishes them from network relations, and looking at two principles associated with them. In **4.3** we turn to network relations, exploring the role they have played in previous Network Morphology accounts. We end in **4.4** by looking at how hierarchy and network relations are used to encode Zwicky-like rules of referral to capture inflectional homonymy. Constraints on referrals are necessary, however, if we wish to distinguish systematic from accidental syncretism, and in this connection we introduce the Referrals Principle.

4.1. The Lexemic and Inflectional hierarchies

Figure 4.1 (based on Brown et al. 1996: 72) represents a network consisting of two hierarchies, the Lexemic hierarchy and the Inflectional hierarchy.

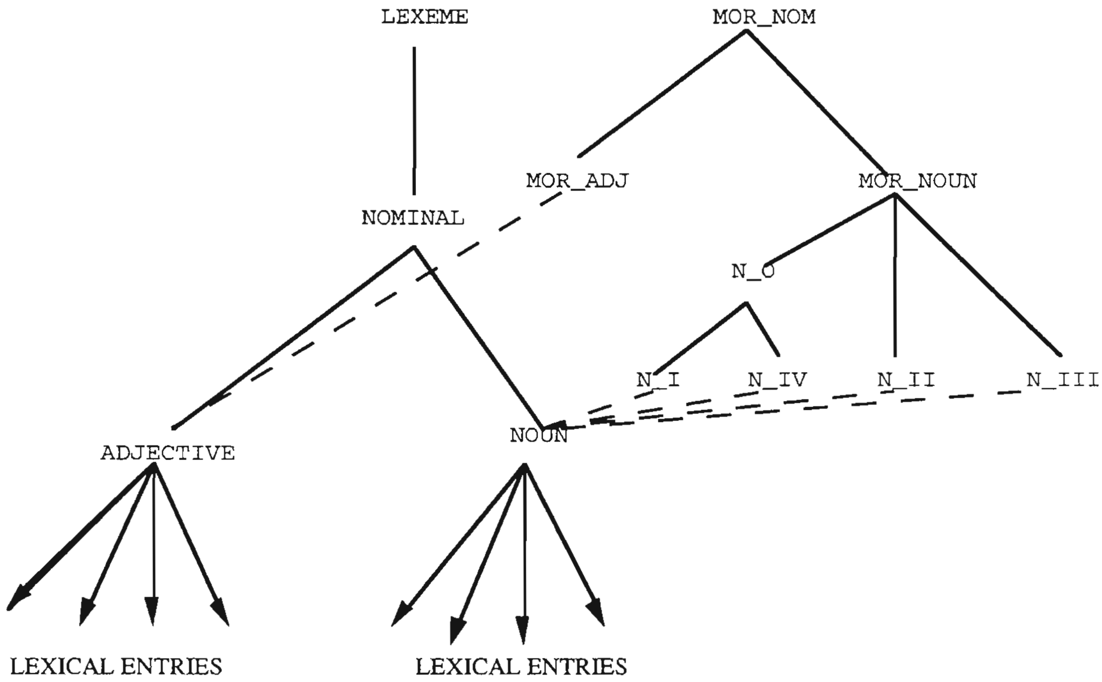


FIGURE 4.1. The Lexemic hierarchy and the Inflectional hierarchy

In the Lexemic hierarchy nodes representing the various word classes are arranged under the root node LEXEME. The node NOMINAL generalises over ADJECTIVE and NOUN, which in turn act as mothers to adjective and noun lexical items. The Lexemic hierarchy makes generalizations about lexemes: their phonology, syntax and semantics. For example, adjectives and nouns normally have stems ending in a hard consonant, hence this is a phonological generalization that can be stated at NOMINAL. General semantic information, such as the fact that nouns are normally undifferentiated for sex, is stated at NOUN. When we saw the Inflectional hierarchy in isolation in chapter three the terminal nodes were the lexical items. When we consider the Inflectional hierarchy as part of a network of hierarchies as shown in Figure 4.1, we see that it is orthogonal to the Lexemic hierarchy where the lexical items are the terminal nodes. This encodes the way in which morphology is orthogonal to the word, thereby constituting a distinct, but connected, level of linguistic description.

In Figure 4.1 the relations between the nodes belonging to the Inflectional hierarchy are hierarchical, as we saw in chapter three. A hierarchy can be defined as a set of nodes connected by 'hierarchy relations'. The relations between nodes belonging to different hierarchies define networks, and these are termed 'network relations' (see Brown forthcoming a)[1]. As a convention, hierarchy relations will be represented by unbroken lines and network relations with broken lines (Brown forthcoming a)[2]. In Figure 4.1 we see how the relations between nouns and their inflectional classes are specified by network relations between the node NOUN in the word class hierarchy and the declension class nodes in the Inflectional hierarchy. As an example, we can think of the value for formal gender being used to evaluate syntactic gender as a network relation between an inflectional class node in the Inflectional hierarchy and the NOUN node in the Lexemic hierarchy (see discussion in **3.5.2**).

4.2. Hierarchy relations

The two types of relation clearly play very different roles in a Network Morphology account. Whereas hierarchy relations define a hierarchy, network relations express exactly how it is that two hierarchies belong to the same network, in other words in some sense they define the network of hierarchies. In this section we examine hierarchy relations in more detail beginning with the Hierarchy Identifier Convention.

4.2.1. The Hierarchy Identifier Convention

The distinction between network and hierarchy relations is maintained by adopting the Hierarchy Identifier Convention. This requires a single identifying attribute to appear in first position to distinguish nodes of facts of one hierarchy from nodes of facts belonging to another. The hierarchy identifier appears as the first attribute in the path of any fact that is stated at one of the nodes of a particular hierarchy. For example, all facts in the Inflectional hierarchy will have paths beginning `<mor>`, e.g. `<mor formal_gender>` is identified as a path of a fact in the Inflectional hierarchy whereas `<syn gender>` would not be identified as belonging to the Inflectional hierarchy, because only the former contains the Inflectional hierarchy identifier attribute `mor`. The Hierarchy Identifier Convention is given in (4.1)

(4.1)

Hierarchy Identifier Convention

i) Whenever they occur in a path, hierarchy identifiers must occur as the first attribute.

ii) Except for the Lexemic hierarchy and interdependency nodes, hierarchy identifiers should be used in paths found at nodes which are part of a hierarchy. These paths must contain the hierarchy identifier for that hierarchy (Brown forthcoming a).

The first clause constrains hierarchy identifiers in path structures to first position. Hence, for example, in the Inflectional hierarchy not only will all paths of facts contain `mor`, but more specifically they will be prefixed by `mor`. The second clause ensures that nodes of a given hierarchy will consistently identify themselves as part of that hierarchy in the way stated in the first clause. (We shall ignore the special status of the Lexemic hierarchy and interdependency nodes.) Any account that adopts the Convention will express the differences between the two relations as follows. In a network two nodes belonging to the same hierarchy will contain facts carrying the same hierarchy identifier, and will be linked by a hierarchy relation; on the other hand two nodes related by facts carrying different hierarchy identifiers will belong to separate hierarchies of linguistic information, and their relation will be defined as a network relation. This can be seen when we consider the representation of gender assignment discussed in **3.5.1** and **3.5.2**, and shown again here in (4.2) and (4.3).

(4.2)

```
NOUN:
    <syn gender> == GENDER:<"<sem sex>">
    ...
```

(4.3)

```
GENDER:
    <undifferentiated> == "<mor formal_gender>"
    ...
```

As we have said, the hierarchy identifier of the Inflectional hierarchy is the attribute `mor` and is found in paths throughout the Inflectional hierarchy. Since syntactic gender is information relevant to the Lexemic hierarchy, evaluating gender on the basis of morphological information is expressed by establishing a link between the Lexemic and Inflectional hierarchies. Due to the Hierarchy Identifier Convention we can track down the nature of the link. This is seen by the path in (4.3) which contains the attribute `mor`, the hierarchy identifier of the Inflectional hierarchy. Note from this that when a network relation is used in an evaluation, the evaluable path indicates which hierarchy is being related since, in accordance with the Hierarchy Identifier Convention, it will contain that hierarchy's identifying attribute.

Having introduced a convention associated with hierarchy relations, we now consider two constraints associated with them. We start with a constraint on the kind of relationship that can exist between a mother node and its daughter(s).

4.2.2. Generalization Violation

In **3.3.1** we showed that when fact sharing is limited to a certain number of nodes, one way to capture the generalisation was to set up a mother over those nodes. For example, the hierarchy captures the sharing of properties by `N_I` and `N_IV` (the oblique singular inflections) by setting up a super-node `N_O` from which both inherit. It is not at all difficult, however, to think up an alternative arrangement, as we have done in Figure 4.2. Here we dispense with the special generalising node `N_O`, and instead set up N_I as N_IV's mother. In other words, the similarities between N_I and N_IV are captured by a mother-daughter relationship, rather than a super-node relationship.

MOR_NOUN
<mor pl nom> == "<stem>" i

N_I
<mor sg nom> == "<stem>"
<mor sg gen> == "<stem>" a
<mor sg dat> == "<stem>" u
<mor sg inst> == "<stem>" om
<mor hard pl gen> == "<stem>" ov
<mor formal_gender> = masc

N_IV
<mor sg nom> == "<stem>" o
<mor pl nom> == "<stem>" a
<mor pl gen> == N_II
<mor formal_gender> == masc

FIGURE 4.2. An alternative inflectional class hierarchy

Though both hierarchies are equivalent in the results they yield, we shall claim that Figure 4.2 is inferior since it is less successful in representing the default generalizations that are there to be captured. We can measure this in a relatively straightforward manner by counting the number of times what is represented as the default generalization at a parent must be overridden by a daughter. In Figure 4.2 these are the paths in bold, namely: <mor sg nom>, <mor pl gen> and <mor formal_gender>[3]. In the previous hierarchy, however, no paths at the parent N_O are overridden by any of its daughters. We conclude that the super-node version of the hierarchy is more successful in stating what the generalizations are. In order to constrain the number of competing hierarchies, we introduce a principle of default generalization, which is given in (4.4).

(4.4)

Generalization Violation

For two nodes connected by a hierarchy relation there must be no more than one match between paths of the higher and lower node, and none if the higher node consists of only one path. (Brown forthcoming a)

Following this principle, Figure 4.2 is ruled out. The two nodes `N_I` and `N_IV` are connected by a hierarchy relation, i.e. are mother and daughter, and there is more than one path match between the two nodes. In other words, Generalization Violation bans hierarchies consisting of daughters which override more than one fact at their mothers. In this case, the relationship between two nodes would have to be stated in other than mother-daughter terms.

Finally, it should be noted that (4.4) leads us to say something linguistically significant regarding the number of declension classes needed for Russian nouns. Due to the similarities between classes I and IV traditional studies in Russian linguistics have recognized three classes (e.g. Vinogradov et al. 1953, Isačenko 1968, Švedova 1980). But for gender assignment based on declension class (see **3.4.2**) Corbett argues that four classes are needed (1982). Now by following (4.4) we can allow both approaches to be represented in the hierarchy: the four class approach motivated by gender considerations is 'seen' when we look up the hierarchy, and the three class approach motivated by inflectional homonymy is 'seen' when we look down . Thus in the words of Corbett and Fraser:

> "Looking down from the top, Russian has three noun declension classes (N_O, N_II and N_III); looking up from the bottom it has four (N_I, N_II, N_III and N_IV)." (Corbett and Fraser 1993: 129).

4.2.3. Paradigmatic Information Addition

A second constraint associated with relations between nodes of the same hierarchy is the principle of Paradigmatic Information Addition. This ensures that no node in a hierarchy may refer to a node which is empty of facts. The principle is stated in (4.5).

(4.5)

Paradigmatic Information Addition

No node may consist of only a hierarchy relation. (Brown forthcoming a)

To illustrate we can give an example where such a node may be required. Recall from chapter three that a node in Network Morphology marks the collection of facts about an item (**3.1**). A hierarchy with a node which is empty of facts (except for the fact that it inherits from another node) would therefore be a contradiction to the spirit of the framework. Nevertheless, such hierarchies are formally possible. We have just shown that the principle of Generalization Violation prevents the construction of an alternative Inflectional hierarchy for Russian where N_I is the mother of N_IV (instead of N_O). But there is a way of having N_IV as a descendent of N_I while at the same time respecting Generalization Violation. Generalization Violation specifies mother-daughter relationships only. This is why in Figure 4.2 we could not count the nominative plural in the measure of generalization, since the inheritance that is overridden is from a grandmother (MOR_NOUN). All we need therefore is a way of altering the relationship between N_I and N_IV from mother-daughter to grandmother-granddaughter. This is provided by a node N_INTERMEDIARY, which acts purely as a place holder in (4.6) to (4.8).

(4.6)

```
N_I:
    <> == MOR_NOUN
    <mor sg nom> == "<stem>"
    <mor pl gen> == "<stem>" ov
    <mor formal gender> == masc
    ...
```

(4.7)

```
N_INTERMEDIARY:
    <> == N_I.
```

(4.8).

```
N_IV:
    <> == N_INTERMEDIARY
    <mor sg nom> == "<stem>" o
    <mor pl gen> == "<stem>"
    <mor formal gender> == neut
    ...
```

The place-holder node N_INTERMEDIARY (4.7) has only one function, that is to come between N_I and N_IV; other than that, it adds nothing to the hierarchy. Such a node is empty of facts, but nevertheless is part of the hierarchy, and indeed an important part in this case. Though N_IV (4.8) overrides two facts at N_I (4.6) it does not contravene Generalization Violation because N_INTERMEDIARY lends it the status of granddaughter. From (4.7) we see, though, that the node N_INTERMEDIARY consists of only one spurious 'fact', its hierarchy relation. If such information does not count as a 'fact' according to Paradigmatic Information Addition (4.5) it has no place in the network.

Having explored hierarchy relations with regard to the Hierarchy Identifier Convention, and the principles of Generalization Violation and Paradigmatic Information Addition, we now take a closer look at network relations by examining the role they play in two previous Network Morphology accounts.

4.3. The role of network relations in Network Morphology

The ability to combine different levels of linguistic information as a part of an analysis is integral to the Network Morphology framework (Brown et al. 1996: 59), hence network relations invariably play a crucial role in any Network Morphology account. We look at the role network relations play in two accounts where the Inflectional hierarchy interacts with another hierarchy of linguistic information. A network relation connects the Inflectional hierarchy with a hierarchy of nominal stress in the first (Brown et al. 1996), and with a hierarchy of expressive morphology in the second (Hippisley 1996).

4.3.1. Network relations and Russian noun stress

To account for stress assignment of Russian nouns, Brown et al. (1996) assume stress patterns for nouns[4] and propose linking a noun's declension class with its stress pattern. (As we have seen, declension class is defined in the Inflectional hierarchy.) The stress patterns fit together in a special stress hierarchy. The interdependence of inflection with stress can therefore be expressed in terms of network relations between the inflectional and stress hierarchies.

By default, stress is on the stem in both the singular and plural forms of nouns. This basic pattern deviates in a limited number of ways yielding a total of eight patterns (including the default pattern). The full details of the patterns with examples can be found in Brown et al. (1996: 54-7), but important here is that the patterns can be given a hierarchical organization as in Figure 4.3 (which is based on Figure 7 in Brown et al. 1996: 74)[5].

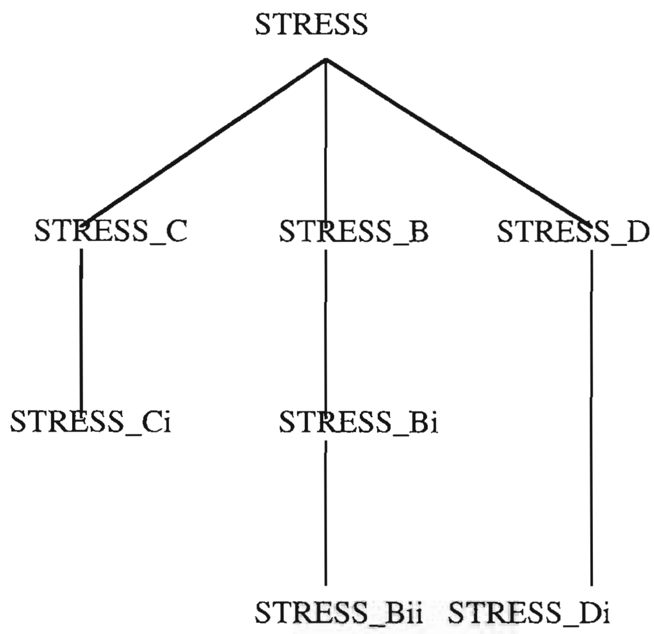


FIGURE 4.3. Stress hierarchy

The default that stress is on the stem, and that plural forms pattern as the singular forms is stated at `STRESS`. The nodes `STRESS_C`, `STRESS_B`, `STRESS_D` represent patterns of the first level of deviation from this default pattern. The stem stress default is overridden at `STRESS_B`, i.e. nouns of this pattern have ending stress throughout; at `STRESS_C` the stem stress default is overridden only in the plural forms, and in `STRESS_D` it is overridden only in the singular forms. A second level of deviation is represented by the patterns `STRESS_Ci`, `STRESS_Bi`, `STRESS_Di` and `STRESS_Bii` but exact details of these patterns are not important at this point. Based on information derived from Zaliznjak (1977) the patterns in Figure 4.3 can be organized according to the number of nouns participating in a particular pattern. Of 43996 nouns the default stress pattern (A) is inherited by the largest number of nouns, namely 40303. The second group is pattern B, with 2677, the third pattern C with 437, the fourth D with 327, and so on (see Table 2 in Brown et al. 1996: 57 for all patterns). However, if declension class is taken into consideration this ordering becomes muddled. On the one hand, the ordering above is not maintained by a single declension class; and on the other, each declension class has its own idiosyncratic ordering.

Indeed, for each class there is at least one pattern that does not apply. For example, for class III the second choice is not B but Ci (a deviant pattern of C in respect of the nominative plural). And the third choice is C only for class I; but for classes II and IV it is D, and for III it is B. The fourth choice is even more bizarre, since not only do all the declension classes differ, but none have D as their fourth choice (as might have been expected from the counts mentioned above). The full range of choices according to declension class are given in Table 4.1 (see Table 3 in Brown et al. 1996: 58 for original).

Declension / Stress Pattern	I	II	III	IV
A	1	1	1	1
B	2	2	3	2
C	3	n/a	n/a	4
D	5	3	n/a	3
Bi	6	4	n/a	5
Bii	n/a	5	n/a	n/a
Ci	4	7	2	6
Di	n/a	6	n/a	n/a

TABLE 4.1. Priorities for each declension

Table 4.1 clearly shows that each declension class imposes its own order of priorities of stress pattern. To capture this, each declension class node in the Inflectional hierarchy must appear with its own set of stress priorities. This is expressed by recording a list of indices at a declension class which map the priorities for that declension class to the correct nodes in the stress hierarchy. Illustrating with the index for the fourth priority, Figure 4.4 (based on Figure 7 in Brown et al. 1996: 74) shows how this index, recorded at the various declension class nodes, is expressed as a network relation between class nodes in the Inflectional hierarchy and nodes in the stress hierarchy.

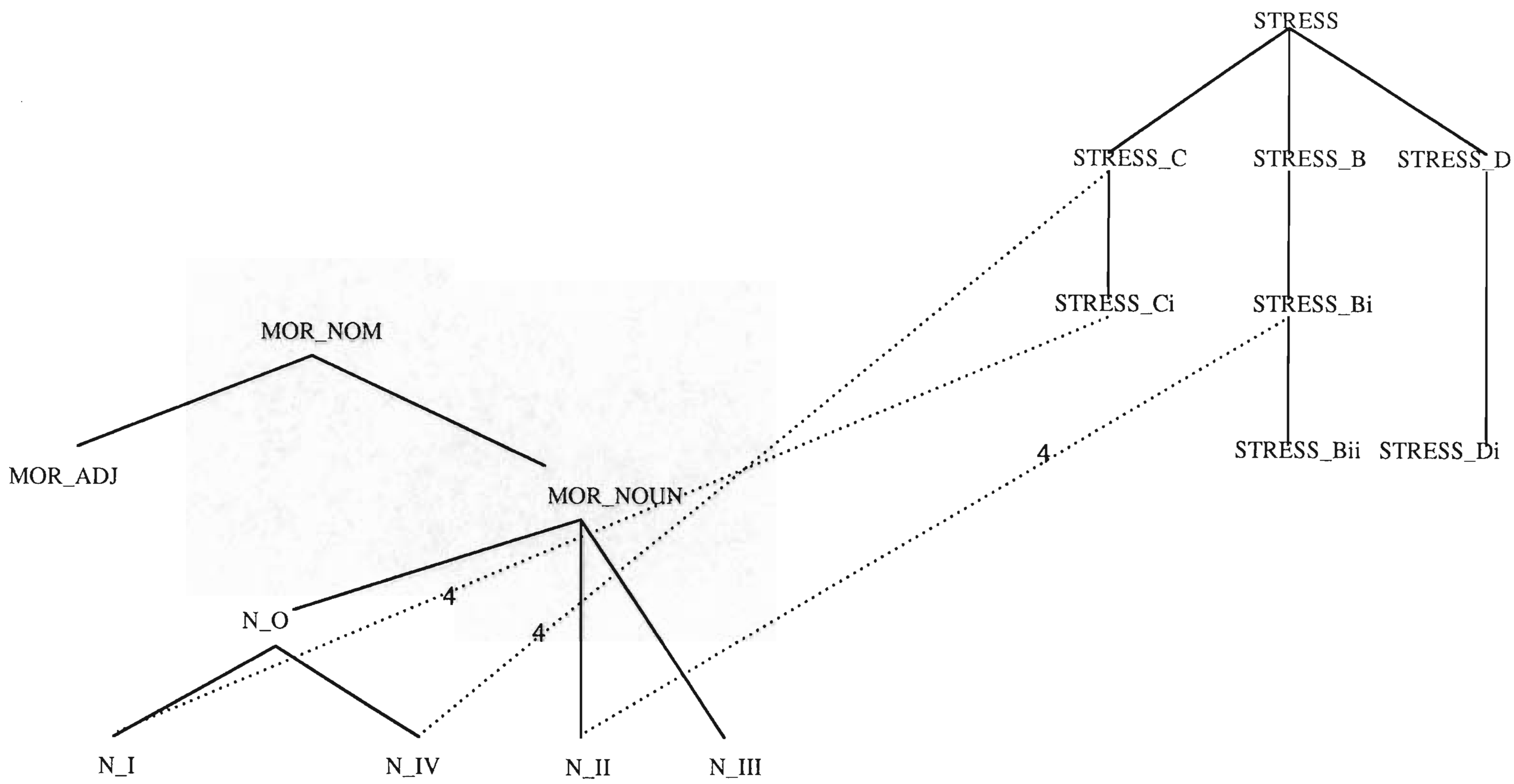


Figure 4.4. Index 4 as a network relation

One of the main points of indices in Brown et al. is to account for how the number of possible stress patterns of a noun is delimited by its membership of declension class (Brown et al. 1996: 53, 73, 80). In other words, how a noun cannot stray from the set of patterns laid down by its declension class. This falls out from an important aspect of network relations, namely that only facts that are available in the Inflectional hierarchy can be specified in network relations connecting the Inflectional hierarchy with another hierarchy[6]. Consider how the non-applicability of the fourth priority for class III (see Table 4.1) is expressed in Figure 4.4: no fourth index is recorded at N_III, hence there is no relation with the stress hierarchy for class III nouns. In other words, the fact about the fourth index is not available at N_III, and this predicts that no new class III noun can have a fourth stress pattern. By the same token, judging from Table 4.1 no class II noun can have stress pattern C.

To highlight the issue of a hierarchy making available the facts used in network relations, we consider the role of network relations in Hippisley (1996).

4.3.2. Network relations and expressive morphology[7].

Expressive morphology, the area of morphology that lends a diminutive, augmentative, pejorative or affectionate shade of meaning to the Base, is highly developed in Slavonic. In this regard Russian is no exception. Suffixes and the expressive categories they realise can be organized around the declension class of the Base. This is shown by the diminutives in Table 4.2 based on Stankiewicz (1968: 99).

Base	I	IV	V	II	III
	masc	neuter	neuter	feminine	feminine
	dom 'house' topor 'axe'	okn(o) 'window' zolot(o) 'gold'	pal´to 'coat' -	kn´ig(a) 'book' rabot(a) 'work'	šinel´ 'overcoat' krovat´ 'bed'
Deriv. dim	dom-´ik topor-´ik	okon-c(o) zolot-ec(o)	pal´t-ec(o) -	kn´iž-k(a) rabot-k(a)	šinel´-k(a) krovat´-k(a)

TABLE 4.2. Russian diminutives

To elucidate the correspondence between the declension class of the Base and the suffix used in diminutive derivation, we can abstract away from Table 4.2 to produce

Table 4.3. The question is how might the correspondence outlined in Table 4.3 be captured?

	Class I masc	Classes IV + V neut	Classes II + III fem
dim	-´ik	-c(o)	-k(a)

TABLE 4.3. Correspondence between declension class and diminutive suffix

The solution adopted is along similar lines of that used for the account of noun stress above. The Inflectional hierarchy (where the declension classes are encoded) is connected to an Expressive hierarchy (where diminutive suffixes are stored) by means of a network relation. But whereas in the noun stress account the information available in the Inflectional hierarchy for the network relation was the declension index, in the expressive account the information used is the formal gender.

Recall from our discussion of gender assignment in **3.5.1** that the association of declension and gender is captured by assigning each declension class node a value for gender, 'formal' gender. Now from Table 4.3 we see that the correspondence between declension class and diminutive suffix can be viewed as a correspondence between this formal gender value and the diminutive suffix, i.e. masculine formal gender corresponds to *-´ik*, neuter formal gender to *-c(o)* and feminine formal gender to *-k(a)*. Importantly, because facts about formal gender are stated at the declension class nodes and are therefore available in the Inflectional hierarchy, facts about formal gender are legitimate for a network relation between the Inflectional hierarchy and the expressive hierarchy.

The importance of this is seen when we contemplate an alternative account to one positing a network relation rooted in the Inflectional hierarchy. This would take the syntactic gender value of the noun to assign the diminutive. For example, adopting this approach the suffix *-k(a)* would be assigned to *kn´ig(a)* 'book' and *šinel´* 'overcoat' because both are syntactically feminine. What validates the network relation with formal gender, however, is nouns whose formal and syntactic genders differ. In these instances it is clear that the formal gender is used in determining the diminutive suffix. One such noun is *d´ad´(a)* 'uncle' which derives the diminutive *d´ad´k(a)*. The reason we know it is the formal gender that determines the suffix (see

Table 4.3) and not the syntactic gender is because its syntactic gender is masculine. This can be seen if we compare the examples in (4.9) to (4.11).

(4.9)	moj	rodn-oj	brat
	my.Masc.Nom.Sg	own-Masc.Nom.Sg	brother. Masc.Nom.Sg
	'my own (i.e. blood related) brother'		

(4.10)	moj-a	rodn-aja	sestr-a
	my-Fem.Nom.Sg	own-Fem.Nom.Sg	sister-Fem.Nom.Sg
	'my own sister'		

(4.11)	moj	rodn-oj	d´ad´-a
	my.Masc.Nom.Sg	own-Masc.Nom.Sg	uncle-Masc.Nom.Sg
	'my own uncle'		

Interestingly, Russian possessive adjective derivation can be accounted for by the same network relation. Possessive adjectives are derived from nouns mainly by suffixation of *-in* or *-ov*. A possessive adjective phrase has a similar reading to a construction with Noun Phrases in the genitive case as illustrated by comparing the readings of (4.12) and (4.13).

(4.12)	komnat-a	Mam-i
	room.Noun-Fem.Nom.Sg	Mummy-Fem.Gen.Sg
	'Mummy's room'	

(4.13)	Mam´in-a	komnat-a
	Mummy.PossAdj-Fem.Nom.Sg	room-Fem.Nom.Sg
	'Mummy's room'	

(4.14)	Otcov-i	slov-a
	father.PossAdj-Neut.Nom.Pl	Words-Neut.Nom.Pl
	'Father's words'	

In (4.13) the suffix *-´in* is used, but (4.14) shows a possessive adjective derived in *-ov*. The question is when to use *-´in*, and when *-ov*? In (16) the underlying noun is *mam(a)* 'mummy' which is feminine; and in (4.14) the underlying noun is *otec* 'father' which is masculine. It would appear, then, that the distribution is according to the gender of the deriving noun such that *-ov* attaches to masculine bases, and *-´in* to feminine bases. If gender is used to determine the derivational suffix, possessive adjective derivation begins to look as though it operates in a similar way to expressive derivation.

The important question is whether, like expressive derivation, the value that determines the stem formation should be stated as the formal gender or syntactic gender. The answer to this would presumably lie in the formation of a possessive adjective from a class II noun which is syntactically masculine, such as *d´ad´(a)* 'uncle', *pap(a)* 'daddy'. As it turns out, it is the suffix *-´in* that is used in the possessive adjective derivatives of these nouns, as the phrases in (4.15) and (4.16) show, demonstrating that formal rather than syntactic gender is used to determine the suffix[8]. From this we would also expect nouns from class III to derive the possessive adjective in *-´in* since class III nouns are formally feminine, and this is indeed what we see in (4.17) where the underlying noun in the possessive adjective form is class III *mat´*.

(4.15) d´ad´in-o uncle.PossAdj-Neut.Nom.Sg poučenj-o sermon-Neut.Nom.Sg

d´ad´in-o	poučenj-o
uncle.PossAdj-Neut.Nom.Sg	sermon-Neut.Nom.Sg

'uncle's sermon'
Gončarov, Obryv.

(4.16)

mam-a		poxož-a	na	kukl-u
mummy-Fem.Nom.Sg		similar-Fem.Nom.Sg	to	doll-Fem.Acc.Sg
a	košk-a	na pap´in-u		
and	cat-Fem.Nom.Sg	to Daddy.PossAdj-Fem.Acc.Sg		
šub-u				
fur coat-Fem.Acc.Sg				

'mummy looks like the doll, and pussy like daddy's fur-coat'
Čexov, Griša.

(4.17)

kn´ažn-a	rešil-a	ostav´it´
princess-Fem.Nom.Sg	decide.Past-Fem.Sg	leave.Inf
mater´in	dom	
mother.PossAdj.Masc.Acc.Sg	house.Masc.Acc.Sg	

'The princess decided to leave her mother's house'
Leskov, Zaxudalyj rod.

For network relations to be legal, then, the facts they refer to must be already available on the Inflectional hierarchy, and not derivable from it (Hippisley 1996:

221). Having discussed in some detail the nature of relations between nodes in a network, we now look at a central function of such relations in Network Morphology, namely capturing inflectional homonymy.

4.4. Relations between nodes and inflectional homonymy

In chapter three we showed how the relations between hierarchically arranged nodes allow for the sharing of morphological facts (**3.3.1**). Thus we captured some of the inflectional homonymy present in the Russian noun system by stating a fact once at a mother node, and allowing daughter nodes representing the various inflectional classes to inherit this fact by default. For example, the nominative plural in *-i* was shared among classes I, II and III (but overridden by class IV) by stating it as a fact at the mother node MOR_NOUN. This is then one of the ways in which Network Morphology encodes the rules of referral used by Zwicky (1985; 1987) for cases of inflectional homonymy. By considering how Network Morphology encodes rules of referral, in this section we explore the nature of the relations between nodes specifically for expressing inflectional homonymy. We begin by looking at cases where the homonymy can be stated in terms of a hierarchy relation. For convenience, we give the set of Russian noun inflections again in Table 4.4, which will be referred to in the section.

		I	II	III	IV
		zavod	karta	tetrad´	boloto
		'factory'	'map'	'exercise book'	'swamp'
SG					
	nom	zavod	kart-a	tertrad´	bolot-o
	acc	zavod	kart-u	tetrad´	bolot-o
	gen	zavod-a	kart-i	tetrad´-i	bolot-a
	dat	zavod-u	kart-e	tetrad´-i	bolot-u
	inst	zavod-om	kart-oj	tetrad´-ju	bolot-om
	loc	zavod-e	kart-e	tetrad´-i	bolot-e
PL					
	nom	zavod-i	kart-i	tetrad´-i	bolot-a
	acc	zavod-i	kart-i	tetrad´-i	bolot-a
	gen	zavod-ov	kart	tetrad´-ej	bolot
	dat	zavod-am	kart-am	tetrad´-am	bolot-am
	inst	zavod-am´i	kart-am´i	tetrad´-am´i	bolot-am´i
	loc	zavod-ax	kart-ax	tetrad´-ax	bolot-ax

TABLE 4.4. Russian noun inflection

4.4.1. Hierarchy and 'intra-hierarchy' network relations

Several cases of homonymy where a hierarchy relation is used have already been mentioned. Apart from the nominative plural, recall that the homonymous oblique singular of classes I and IV (see Table 4.4) is captured by setting up an abstraction node[9] N_O from which both directly inherit. The relation established between N_I and N_IV and their shared mother N_O is clearly a hierarchy relation. Another case where a hierarchy relation is used is the locative singular. From Table 4.4 we see that this is identical for classes I, II and IV. We can use the same strategy employed for the nominative plural: a fact about the locative singular is stated once at the mother node MOR_NOUN, inherited by default by the daughter nodes N_I, N_II, N_IV (and overridden by N_III), and thereby shared amongst these nodes by means of a hierarchy relation. Another case would be the dative, instrumental and locative plural, all of which are stated at MOR_NOUN, and all of which are inherited by the declension class daughters.

In **3.4.2** (and **3.4.3**) we considered another area of homonymy within the Russian noun system, namely the identical genitive plural for classes II and IV. Instead of a mother node, we established a sister-sister relationship between N_II and N_IV so that the fact about the genitive plural may be stated once at N_II, from where it is inherited by its sister N_IV. We showed that this was possible due to the fact that Network Morphology supports orthogonal multiple inheritance, allowing a node to have, in addition to its mother, a secondary source of inheritance. We represent morphological fact sharing in this situation as in Figure 4.5.

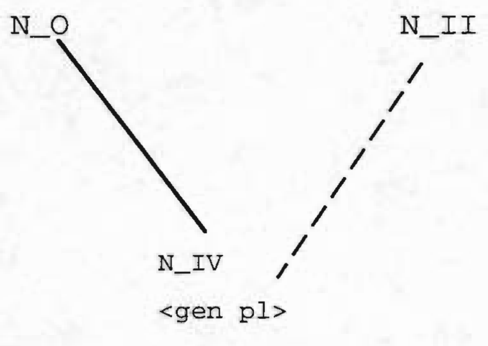


Figure 4.5. The genitive plural and the nodes N_IV and N_II

In Figure 4.5, how are we going to describe the relations represented by the lines emerging from N_IV? Clearly the unbroken line represents a hierarchy relation. This provides for the fact sharing of the oblique singular inflections housed at N_O, as we discussed above (**4.4.2**). The broken line must therefore be a network relation, and it therefore shows that network relations can be employed to capture homonymy. However, there is something special about this network relation: whereas the network relations discussed up till now have established links between hierarchies, the network relation in Figure 4.5 establishes a link between nodes within the same hierarchy. We previously said that relations within the same hierarchy are hierarchy relations; we should now revise this to say that because Network Morphology supports orthogonal multiple inheritance, relations between nodes in the same hierarchy need not be hierarchy relations. To distinguish these from the network relations discussed with relation to the gender assignment, stress and expressive morphology examples above we will adopt the term 'intra-hierarchy' network relation. And this type will then be distinguished from 'inter-hierarchy' network relations.

It should be clear from this discussion that homonymy is captured by hierarchy relations, and in cases of multiple inheritance, by 'intra-hierarchy' network relations. We can illustrate this situation with the node `N_III` which is represented in (4.18) and (4.19). In (4.18a) a hierarchy relation between `N_III` and `MOR_NOUN` allows `N_III` to participate in the sharing of facts about the nominative plural, and dative, instrumental and locative plural. The genitive singular is treated differently, however: in (4.18b) an intra-hierarchy network relation establishes a link between `N_III` and its sister node `N_II`, where the fact about the genitive singular is given (4.19).

(4.18)
```
N_III:
a.  <> == MOR_NOUN
b.  <mor sg gen> == N_II
c.  <mor sg dat> == "<mor sg gen>"
d.  <mor sg loc> == "<mor sg dat>"
     ...
```
(4.19)
```
N_II:
    <mor sg gen> == "<stem sg>" i
    ...
```

We end this sub-section by noting another type of relation that captures homonymy. (4.18) shows that morphological fact sharing may involve only part of a fact, namely the sharing of the fact's value (rather than its value plus features). The suffix *-i* is distributed as a value across a number of paths in `N_III`, to capture homonymy of the genitive, dative and locative singular for a class III noun. This is achieved by establishing an 'intra-node' referral. What is special about these types of referral is that the domain of the referral is a single declension class.

4.4.2. Constraining referrals

A referral may be restricted to a single node, for example using an 'intra-node' relation we see in (4.18) that `<mor sg loc>` refers to `<mor sg dat>` within the node `N_III`. Alternatively, using a hierarchy or intra-hierarchy network relation the referral may extend across nodes (for example `<mor sg gen>` refers to another node for its value). Further, the referring and the referred paths may have identical attributes, as with `<mor sg gen>`, or may not as is the case with intra-node referrals. Network Morphology restricts the possible range and composition of referrals to capture the difference between 'systematic' as opposed to 'accidental' homonymy of inflections[10] (Corbett and Fraser 1995).

We can imagine a hierarchy where referrals are unconstrained. For example one that follows Zwicky's (1987) proposal of grouping all possible affixes (and other morphological operations) of a language together in a Morphological Operation Inventory, which morphological rules then dip into. If we wished to go down this route (and we will argue shortly that we certainly do not) this would be captured in our framework by listing all affixes under a single node, to which morphological nodes refer. Thus the hierarchy would consist entirely of hierarchy referrals to a single node. This would have the undesirable effect of relating morphological rules which are generally thought of as totally unrelateable, purely on the basis of their common affixation. In other words there would be no attempt to distinguish systematic and accidental homonymy.

To cite an extreme case, Zwicky's Morphological Operation Inventory contains derivational as well as inflectional affixes (Zwicky 1987: 324). This means that our putative node of affixes would be made available to both the Inflectional hierarchy and Derivational hierarchy. The effect would be inflectional rules having an identity with word formation rules. For example, the inflectional rule for the genitive plural of class I nouns such as *stolov*, the rule for deriving relational adjectives such as *šumov(oj)* 'noise (adj)', and the rule for deriving possessive adjectives such as *ocov* 'father's' (as in '*ocovy slova*' 'father's words', see (4.17)) would all be related because they share the common suffix *-ov*. Clearly the Morphological Operation Inventory will make impossible any attempts to separate what appears to be systematic homonymy from what is accidental. In order to have referrals capture systematic cases only, referrals are constrained in Network Morphology by the Referrals Principle in (4.20).

(4.20)

Referrals Principle

A referral is a fact in which a path beginning with a particular hierarchy identifier refers to another path beginning with the same identifier (Brown forthcoming a)

The effect of the Referrals Principle is to limit the range of a referral to its own hierarchy. In other words referrals can be encoded by hierarchy relations or intra-hierarchy network relations, but not by inter-hierarchy network relations. For one thing this means that affixation for inflection cannot be extended to derivation, or vice versa, as in the *-ov* example above. We are therefore making a claim about the relation between inflection and derivation: though these are not discrete, they are nevertheless separate with regard to the nature of their morphological rules. We illustrate with the *-ov* example above in (4.21)[11].

(4.21)

```
N_I:
   <mor pl gen> == "<stem>" DERIV_DE_NOUN:<deriv adj rel>
   ...
```

(4.21) shows how relating a genitive plural inflection rule with a relational adjective formation rule violates the Referral Principle. Following the Hierarchy Identifier Convention (4.1), all paths in a separate derivational hierarchy must begin with an attribute that identifies that hierarchy. As we will see in chapter seven, the attribute is `<deriv>`. Since all paths in the Inflectional hierarchy are identified by `mor` in (4.21) the referred and referring paths have different hierarchy identifiers, and the referral is therefore deemed to be illegal.

4.5. Concluding remarks

We started the chapter by noting how Network Morphology divides up areas of linguistic knowledge according to separate, but interrelated, hierarchies. The focus of the chapter has therefore been on the relations between nodes of a hierarchy, and nodes belonging in different hierarchies, which we termed hierarchy relations and network relations respectively. Later we saw that in connection with multiple inheritance a special type of network relation can specify connections between nodes within the same hierarchy, what we called an intra-hierarchy network relation.

We showed that by adopting the Hierarchy Identifier Convention we can better keep track of the nature of the relation between nodes in DATR representations. Regarding hierarchy relations, a couple of principles were introduced that act to constrain the possible shape of a hierarchy, namely Generalization Violation and Paradigmatic Information Addition. And regarding network relations, by examining the role they play in Network Morphology accounts of stress and expressive morphology we saw that they were constrained by the type of facts contained in them: the fact referred to must be already available in the Inflectional hierarchy, and not derivable from it. Finally we have just seen how hierarchy relations and intra-hierarchy network relations are central to the way Network Morphology captures inflectional homonymy; but also how the Referrals Principle rules out the possibility of inter-hierarchy network relations playing a role in this area by relating inflectional and derivational rules.

Notes to chapter 4

[1] Brown elsewhere (Brown forthcoming) compares hierarchy and network relations with 'subset' and 'perspective' links respectively in Flickinger's framework (Flickinger 1987: 18-20). Perspective links connect a Part of Speech hierarchy with a Complementation hierarchy. Note that in the case of multiple inheritance within a hierarchy, only the maximal source of inheritance can be said to be in a hierarchy relation with its daughter, as we shall see in **4.4.1**.

[2] Note that Flickinger (1987: 19) adopted the same convention to distinguish subset and perspective links.

[3] From the discussion on stress below (**4.3.1**), we could add a fourth override since `N_IV` differs in its stress index.

[4] Following Red'kin (1971), Fedjanina (1976), Zaliznjak (1977), Corbett (1989).

[5] For the precise way in which the stress hierarchy is organized, see Figure 4 in Brown et al. (1996: 66-9) and discussion surrounding it.

[6] Hippisley (1994).

[7] Note that this discussion draws heavily on Hippisley (1996), where see for an account of the full set of expressive categories.

[8] It should be noted that not all Slavonic languages work in this way. Corbett lists Belorussian, Slovene, Czech, Slovak and Sorbian (Upper and Lower) among those which select the possessive adjective suffix on the basis of syntactic gender. For example, Upper Sorbian *starosta* 'headman' derives possessive adjective *starostowy* (1987: fn. 21). Corbett is careful to point out that in the system of possessive adjectives, syntactic gender based assignment is an innovation in Slavonic (1987: 315).

[9] See **3.2** for abstraction nodes.

[10] See Carstairs (1987: 93-101) for a discussion on keeping separate systematic and accidental homonymy in inflectional classes.

[11] Recall that `"<stem>"` represents a value retrieved from the lexical entry, and should not be viewed as part of the referral.

SECTION III

Lexeme-based Derivation

Chapter 5:
Derivation as 'lexeme formation'

As we have seen in the previous chapters, an important assumption Network Morphology makes is that the lexeme rather than the morpheme constitutes the minimal sign. In this section we look at the implications this choice has for derivation in a morphological framework. The first chapter explores the theoretical issues raised by a lexeme-based approach to derivation, when derivation is viewed as 'lexeme formation'[1]. This prepares the ground for a lexeme-based account of Russian person formation in the next chapter.

5.0. Introduction

In a morpheme-based approach, morphemes take centre stage, and what is all important is the role they play in language, namely how they combine to construct meaning units bigger than themselves, including complex words. In **1.1.2.1** we showed examples where meaning (or function) and the affix (or form) used to realise it is not one to one. To accommodate this situation morpheme-based models are forced to posit artefactual concepts such as 'zero morphs', 'empty morphs', 'superfluous morphs', and 'homonymous morphs'. A more satisfactory approach would be to locate meaning and form correspondences one level up, at the level of the word. In lexeme-based morphology 'lexemes' are the meaning units. Derivation is viewed as the way the overall meaning and overall phonology of a Base lexeme is related to the overall meaning and overall phonology of a Derivative lexeme. Morphological description will thus fall out from viewing how lexemes relate to one another.

This chapter explores the questions raised by a lexeme-based approach to derivation, in other words issues in 'lexeme formation'. To understand what lexeme formation entails, we begin in **5.1.** by defining the lexeme. We are then in a position to see how a lexeme-based approach naturally accommodates different types of derivation, namely transposition, zero affixation and category preserving derivation. In **5.2** the focus shifts from lexeme formation itself to the nature of the rules that can be used to account for lexeme formation, basing our discussion on Aronoff's work. In **5.3** we look in more detail at the various 'sound forms' of a lexeme, isolating for discussion the sound form that has morphological relevance, the stem. We end by considering inflectional morphology (**5.4**.), comparing Halle's (1973) morpheme-based account with the lexeme-based account assumed in Anderson (1982, 1992).

5.1. 'Lexeme formation'

In a lexeme-based model, derivational morphology is the mapping of form and meaning at the level of the word, or more specifically the 'lexeme'. To understand this we first need some notion of lexeme.

5.1.1. The 'lexeme' in lexeme formation

Lexemes are vocabulary items, but belonging only to the major lexical categories of verb, noun and adjective (as well as adverb) (Aronoff 1994: 10). The lexeme is an assembly of an item's phonology (form), syntax and meaning. Thus any manifestation of an item is covered by the lexemic representation of that item. As such, the lexeme constitutes the minimal sign of the language. As an example, consider the Russian word *stol* 'table' which we can recast as the lexeme STOL in (5.1). Note that it is conventional to denote lexemes in upper case (see Matthews 1991: 26). The lexeme's syntactic information is specified as noun, its semantics as the gloss 'table'[2], and its phonology as the sound form /stol/. In a morphological context, the sound form is the lexeme's stem (a lexeme has other morphologically non-relevant sound forms as we will see in **5.3**).

(5.1)

$$\text{STOL}\begin{cases}\text{syntax:}\\ \text{noun}\\ \text{semantics:}\\ \text{' table'}\\ \text{phonology (stem):}\\ \text{/stol /}\end{cases}$$

In addition each lexeme will be associated with a collection of 'grammatical words', which Aronoff defines as:

> "...a lexeme in a particular syntactic context, where it will be provided with morphosyntactic features...and with the morphophonological realization of these morphosyntactic features as bound forms." (Aronoff 1994: 11)

Thus, for example, some of the grammatical words belonging to the lexeme STOL would be $\text{stol}_{[\text{acc sg}]}$, $\text{stol}_{[\text{dat pl}]}$, $\text{stol}_{[\text{gen pl}]}$, etc. These grammatical words are phonologically realised as the 'word-forms' *stol*, *stol-am*, *stol-ov*. Inflectional morphology is the realization of morphosyntactic categories in that it is used in the spelling out of the lexeme's collection of grammatical words into word forms, and we will look more closely at this in **5.4**. Derivation, on the other hand, is the realization of derivational categories, and is used to spell out 'lexeme formation'. More specifically, it concerns the change in shape of the lexeme's stem, and the corresponding change in the syntactic and semantic information content specified by the derivational category. We can take for example *dobr(ij)* 'kind' and its Derivative *dobrot(a)* 'kindness'. We can state the relationship as one between the Base lexeme DOBRIJ and the Derivative DOBROTA 'kindness'. Morphologically the stem change of /dobr/ to /dobrot/ corresponds to the syntactic change of adjective to noun, and the semantic change of 'kind' to 'quality of being kind'. This example of lexeme formation is shown in (5.2).

(5.2)

$$\begin{array}{lcl} \text{Base} & \rightarrow & \text{Derivative} \\ \text{DOBRIJ}\left\{\begin{array}{l}\text{syntax:}\\ \text{adjective}\\ \text{semantics:}\\ \text{'kind'}\\ \text{phonology (stem):}\\ /\text{dobr}/\end{array}\right. & \rightarrow & \text{DOBROTA}\left\{\begin{array}{l}\text{syntax:}\\ \text{noun}\\ \text{semantics:}\\ \text{'quality of being kind'}\\ \text{phonology (stem):}\\ /\text{dobrot}/\end{array}\right. \end{array}$$

In a lexeme-based approach to morphology it should be noted that an affix is no longer an independent carrier of meaning, but simply the phonological segment which constitutes the change in the stem. Thus we can abstract the phoneme string /ot/ from the stem /x-ot/ and identify it as a suffix. This means that lexeme-based approaches can naturally account for non-affixal derivation since there is no expectation that stem changes will be a result of phoneme strings attaching to the right or left edges of the stem. Affixes have no special status, they are simply a type of change that can occur on a stem in lexeme formation. Other changes may involve ablaut or stress shift, for example. The important point is that it is the change in the stem that encodes the derivation, not the material used to bring about the change, as in a morpheme-based model.

5.1.2. Types of lexeme formation

From (5.2) we see changes at the syntactic, semantic and phonological levels of the Base. Because lexeme formation is broken down into three levels of change, it allows for the possibility of the information content of one of the levels to remain unaltered. In the next few sections we give examples from Russian showing derivation where at one level of description the lexeme is unaltered, corresponding to transposition, zero derivation, and category preserving derivation.

Transposition

It is common practice in descriptive works on Russian morphology to divide derivative adjectives into qualitative and relational[3]. Beard (1976: 108-9) notes that the semantics of qualitative adjectives is either 'having X' or 'similar to X' as a quality (where X is the semantics of the noun Base). An example he gives of each type is *kamen´ist(ij)* 'rocky' from *kamen´* 'rock', i.e. 'having rock(s)', and *repčat(ij)* 'turnip-like' from *rep(a)* 'turnip'. However, some adjectives have neither of these characteristics, for example *serebr´an(ij)* 'silver (adj)' is derived from *serebr(o)* 'silver (noun)', but does not mean 'like silver' or 'having silver'. In fact there is another Derivative *serebr´ist(ij)* 'silvery' which covers the sense of 'like X', as in *'serebr´ist(ij) topol´'* meaning 'silver poplar'. We can view these as instances of semantic preservation; such adjectives are termed 'relational'.

Adjectives such as *serebr´an(ij)* have no 'meaning' (other than the meaning that comes with being a noun). The derivation is purely syntactic, converting a noun into an adjective so that it can appear in a modified NP construction, for example *'serebr´an(aja) fol´g(a)'* meaning 'silver foil'. Hence the term relational since it "...designate[s] a relationship which characterises the noun modified as being *of*, *from*, or connected with something..." (Townsend (1975:209), which is exactly what an adjective signifies about the noun it modifies. A lexeme-based model would represent the transposition of *serebr(o)* > *serebr´an(ij)* as in (5.3), where the semantic level remains intact.

(5.3)

$$\text{Base} \qquad\qquad \rightarrow \qquad\qquad \text{Derivative}$$

$$\text{SEREBRO}\left\{\begin{array}{l}\text{syntax:}\\ \text{noun}\\ \text{semantics:}\\ \text{'silver'}\\ \text{phonology (stem):}\\ \text{/serebr/}\end{array}\right. \rightarrow \quad \text{SEREBR'ANIJ}\left\{\begin{array}{l}\text{syntax:}\\ \text{adjective}\\ \text{semantics:}\\ \text{'silver'}\\ \text{phonology (stem):}\\ \text{/serebr'an/}\end{array}\right.$$

Zero derivation

It would be perfectly feasible for a language to use lack of the alteration in the stem to encode a derivation. This is easily described in a lexeme-based model by stating that one level of the lexeme, the phonological level, has been preserved in the derivation. In other words, derivation not involving any stem change need not be an embarrassment precisely because it can be defined simply as that, derivation with no concomitant formal reflex. Recall from chapter one that zero derivation was mentioned as one of the possible morphological operation types used in Russian derivation (**1.2.1.3**). One example we discussed in some detail was the Base *zolot(o)* and its Derivative adjective *zolot(oj)*. In examples such as these, the directionality needs some motivation, and in this case we used the following argument for *zolot(o)* > *zolot(oj)*. In the noun, stress is on the first syllable of the stem (*zólot(o))* and in the adjective, the stress is on the ending (*zolot(ój))*. This type of stress shift is analogous to other affixal adjective derivation, for example *béreg* 'shore' > *beregovój* where the suffix *-ov* is being used to mark the derivation.

Thus in *zolot(o)* > *zolot(oj)* we can describe the derivation as a change at the syntactic level of noun to adjective, but the preservation of information content at the phonological level, the stem. Note that in this example semantics is also preserved i.e. *zolot(oj)* is a relational adjective. This is shown in (5.4). In a morpheme-based approach a zero morph would be used in cases such as these.

(5.4)

$$\begin{array}{ccc} \text{Base} & \rightarrow & \text{Derivative} \\ \text{ZOLOTO}\begin{cases}\text{syntax:}\\ \text{noun}\\ \text{semantics:}\\ \text{' gold'}\\ \text{phonology (stem):}\\ \text{/zolot /}\end{cases} & \rightarrow & \text{ZOLOTOJ}\begin{cases}\text{syntax:}\\ \text{adjective}\\ \text{semantics:}\\ \text{' relating to gold'}\\ \text{phonology (stem):}\\ \text{/zolot /}\end{cases} \end{array}$$

Category preserving derivation

A seemingly straightforward example of syntactic category preservation is the derivation of person nouns from noun Bases. For example *barabanšč´ik* 'drummer' is derived from the noun Base *baraban* 'drum', and *mogil´šč´ik* 'grave-digger' from the noun Base *mogil(a)* 'grave', and the syntactic specification is therefore preserved in the derivation. In cases such as these Isačenko notes that the nature of the semantic change is not completely clear. For example, as well as 'person who beats drums' *barabanšč´ik* can also denote 'person who makes drums'. In both there is the sense of 'person who relates to X', but the relationship is not specified by the derivation. Hence the term "Relators" Isačenko gives for suffixes such as *-šč´ik* (1969: 54). An example of a 'Relator' in Czech is also given: in the Derivative *vředář* derived from *v řed(y)* 'ulcers', the meaning is either 'person who relates to ulcers as a doctor' or 'person who relates to ulcers as a patient'.

5.2. WFRs in lexeme-based morphology

Following Chomsky (1970) and Halle (1973) the most important derivational model was Aronoff's (1976) monograph. Its importance for subsequent generative models has been noted in Spencer (1991: 81-2). Significant for us is that it represents the first detailed framework for derivation taking the lexeme as the minimal sign. At the heart of the model lies its WFRs, which we outline in this section.

5.2.1. Aronoff's WFRs: structural description and change

In proposing a lexeme-based model Aronoff is simply extending to derivation the 'Aspects' model's rejection of the morpheme in inflection (see chapter two), as noted in Scalise (1986: 40). This position is enshrined in the Word-Based Hypothesis in (5.5).

(5.5)

> All regular word-formation processes are word-based. A new word is formed by applying a regular rule to a single already existing word. Both the new word and the existing one are members of major lexical categories. (Aronoff 1976: 21)

It should be understood that by 'word' what is in mind is lexeme, as Aronoff is careful to point out in a later work (Aronoff 1994: 7). By the same token, Aronoff's Word Formation Rules can be regarded as rules of lexeme formation[4].

Because the lexemes they relate are complex we find that WFRs themselves are complex. A WFR's structure has two broad levels of complexity, one associated with its input, or Base lexeme (the 'existing word' in (5.5)); and the other with its output, or Derivative lexeme (the 'new word' in (5.5)). In Anderson's terms, the first is the WFR's 'structural description', and the second its 'structural change' (1992: 184). The structural change is what we discussed in **5.1** where a change is introduced at the syntactic, semantic and phonological levels of the lexeme. Affixation would therefore be characterised as the phonological part of the structural change of a WFR. What is meant then by the structural description of a WFR? The structural description refers to the series of conditions the WFR places on its input. The lexeme, or set of lexemes which meets these conditions, and hence on which the WFR operates, is the WFR's 'base' (Aronoff 1976: 46). Note that we now have two senses of base, one where it denotes a deriving lexeme, or class of deriving lexemes and their relation to a WFR; and the other where it denotes a deriving lexeme and its relation to its Derivative lexeme. We will reserve upper case Base for the latter when there is a need to distinguish the two.

Since a WFR's base can only be a lexeme, its structural description is delimited by what the properties of a lexeme can be. In other words, no reference can be made to the rules of syntax, phonology or semantics (Aronoff 1976: 46)[5]. A condition on a WFR's base will refer to one of the three levels of description of a lexeme, i.e. the syntactic, semantic or phonological level[6]. The structural description of a WFR therefore consists of three types of condition, a syntactic type, a semantic type and a phonological type. This is illustrated in (5.6), where c denotes 'condition on'. The mutuality between the base as input to the WFR, and the WFR as ascribing conditions on the base is denoted by the two-way arrow. The one-way arrow denotes the structural change as the output of the WFR. We briefly consider the three types of condition cx (syntactic), cy (semantic) and cz (phonological).

(5.6)

WFR

base	⇔	structural description	⇒	structural change
syntax:		syntax:		syntax:
x		cx		x →
semantics:		semantics:		semantics:
y		cy		y →
phonology:		phonology:		phonology:
z		cz		z →

Syntactic conditions

As an example of a syntactic condition we can consider the noun forming suffix *-ness* in English, as described in Aronoff (1976: 47-8). Derivatives in *-ness* invariably have adjective Bases, e.g. *redness* and *porousness*. No other Base is possible, for example there are no deverbal nouns in *-ness*, such as **feelness*. This can be captured by introducing a condition into the structural description of the *-ness* WFR stating that the WFR's base must have the syntactic category 'adjective'. Similarly in Russian, the suffix *-tel´* in person noun derivatives is restricted to verbal Bases, i.e. the verb *uč´i(t´)* 'teach' underlies *uč´itel´* 'teacher'. To capture this we simply specify the WFR with the correct syntactic condition. Derivatives in other productive person noun suffixes are also characterised by the syntactic category of the Base that underlies them. For example as we shall see in the next chapter, generally the suffix *-ec* attaches to adjectival Bases, hence *slep(oj)* 'blind' > *slepec*, and *-n´ik* to noun Bases, hence *pomošč´* 'help' > *pomoščn´ik*.

These suffixes *-n´ik*, *-ec* and *-tel´* are considered to be rivals since they are similar in the semantic and syntactic information they realise, i.e. noun and person. But as soon as we bring the syntactic category of the Base into consideration the rivalry ceases. Viewing WFRs as having a structural description (in addition to a structural change) allows us to set up three separate WFRs distinguishable on the basis of their structural description: for the *-ec* WFR this will be the condition that the base is an adjective, for the *-tel´* WFR that it is a verb, and for the *-n´ik* WFR that it is a noun. The fact that WFRs are distinguished by the syntactic specifications they place on the base is an important attribute of WFRs. This is expressed by what Aronoff calls the Unitary Base Hypothesis (UBH), given in (5.7).

(5.7)

Unitary Base Hypothesis

'The syntacticosemantic specification of the base, though it may be more or less complex, is always unique. A WFR will never operate on either this or that.' (Aronoff 1976:48)

By 'specification' Aronoff is referring to what we have called the structural description of the WFR. Note that since the specification is described as 'syntacticosemantic', the UBH is intended to cover structural descriptions which contain semantic as well as syntactic conditions, which we now discuss.

Semantic conditions

Compared to syntactic conditions semantic conditions appear to play a lesser role in a WFR's structural description. This may be because, as Scalise (1984: 45) notes, "relatively little work has been done in the area of semantic restrictions on the base." However, for the sake of completeness we consider an English example from Aronoff (1976: 47-8). The examples in (5.8) illustrate the semantic condition in the WFR that introduces the prefix *re-* (in the sense of 'again'). The ill-formedness of the sentence in (5.8b) can be explained by positing a *re-* WFR with a semantic condition stating that its base must carry with it the meaning 'change of state'. Now the meaning of 'punch' specific to (5.8b) does not entail a change of state in Bill, i.e. though he may be feeling unwell he is still Bill the boy next door. But 'change of state' is contained in the meaning of 'punch' when referring to the action of making holes in paper in (5.8c).

(5.8)

a. John punched Bill.

b. *John repunched Bill.

c. John punched the holes in the paper.

d. John repunched the holes in the paper.

A semantic condition appears also to be used in an area of Russian adjective formation. For the derivation of relational adjectives, there are (at least) two productive suffixes that are used, the suffix-*sk* as in *abbatsk(ij)* 'abbot (adj)' and *-ov* as in *šumov(oj)* 'noise (adj)'[7]. Table 5.1 lists examples of Derivatives in both these suffixes.

	Base	gloss	Derivative	gloss
a	abbat	abbot	abbatsk(ij)	abbot (adj)
b	baron	baron	baronsk(ij)	baron (adj)
c	avtor	author	avtorsk(ij)	author (adj)
d	advokat	barrister	advokatsk(ij)	barrister (adj)
e	šum	noise	šumov(oj)	noise (adj)
f	apel´s´in	orange	apel´s´inov(ij)	orange (adj)
g	bereg	coast	beregov(oj)	coastal
h	akul(a)	shark	akulov(ij)	shark (adj)
i	slon	elephant	slonov(ij)	elephantine

TABLE 5.1. Relational adjectives in *-sk* and *-ov*.

What is interesting about the relational adjective suffixes *-sk* and *-ov* is that their disjunction can be stated in terms of the semantic features of the Base. This has been observed in a number of surveys on Russian word formation. According to Švedova (1980: §630) and Townsend (1975: 218), for example, Bases selecting *-sk* are usually animate, which is the case for all the Bases marked (a) to (d) in Table 5.1. More specifically, such Bases denote persons, which would account for why the Bases (h) and (i) though animate select *-ov* (since they do not denote persons). We therefore assume that the semantic feature of 'person' determines which suffix is used in relational adjective formation.

Phonological conditions

Finally we turn to the third type of condition, the condition on the phonology of a base, i.e. on the shape of a lexeme's stem. Scalise (1984: 47-8) illustrates with Italian negative adjectives. He discusses the data given in Table 5.2.

1.	fortunato	lucky	sfortunato	unlucky
	leale	loyal	sleale	disloyal
	corretto	correct	scorretto	incorrect
	gradevole	pleasant	sgradevole	unpleasant
2.	umano	human	*sumano / disumano	inhuman
	onesto	honest	*sonesto / disonesto	dishonest
	educato	well-mannered	*seducato / diseducato	ill-mannered
	abitato	inhabited	*sabitato / disabitato	uninhabited

TABLE 5.2. Negative adjective derivation in Italian

In the first lot of examples *s-* prefixation has applied, whereas in the second lot *s-* prefixation fails to apply, and another prefix *dis-* applies in its stead. The restriction according to Scalise can be viewed as phonological, since what the first examples have in common is their stem shape, namely an initial consonant[8]. What is interesting about these examples is that just as a WFR with a syntactic type structural description accounted for suffix rivalry in our Russian examples, if we posit an *s-* WFR with a phonological-type structural description we can account for the *dis-* / *s-* prefix rivalry in Italian negative adjective formation. An example from German discussed in Bauer (1983: 89) concerns the rival diminutive suffixes *-chen* and *-lein*. Stems ending in /l/ will select the former, as in *ball* > *bällchen* 'ball', *spiel* > *spielchen* 'toy'; and those ending in /x/, /g/ or the phone [ng] select the latter: e.g. *bach* > *bächlein* 'stream', *zweig* > *zweiglein* 'branch', *ring* > *ringlein* 'ring'. Interestingly, phonological conditions are not covered by the Unitary Base Hypothesis (5.7) which only talks about semantic- and syntactic-type structural descriptions. With this picture in mind of the structure of WFRs, we turn to look at their purpose or function in the grammar.

5.2.2. Dual function of WFRs: generation and analysis

Aronoff (1976: 17-18) notes that just as the rules of syntax enumerate the set of possible sentences, so the rules of morphology, whatever else they do, should be expected to enumerate possible words. However, because sentences (the output of syntactic rules) are not listed, and lexemes (the output of WFRs) are, WFRs will require a secondary function: as well as checking what is possible, they will have to analyse what actually exists, i.e. the lexemes which have been listed. As Scalise (1986: 40-1) points out, whereas syntactic rules function to distinguish between what is possible and what is impossible, WFRs function to make an additional distinction, namely between what is possible and what is existing (or actual). Recall from **2.4.1** that Halle addresses the issue in word formation of possible and actual word by means of the Filter which marks potential words with the feature -lexical insertion. Aronoff's approach is to lend WFRs a secondary function, that of analysing already existing words. Moreover, this secondary function is motivated by the fact that WFRs differ from syntactic rules by being 'once-only' rules (Aronoff 1976: 22).

The primary function of a WFR will be that of synchronic lexeme formation, hence all WFRs will be productive in the 'available' sense of Corbin (1987: 176) (see discussion in **1.1.2.2**). Now when a synchronically possible lexeme, the output of a WFR, actually ends up being used in the language, unlike the case with a sentence it gets listed. In other words, once a speaker acquires a new lexeme via a WFR all subsequent uses of the lexeme by the speaker will be a matter of selecting it from his lexicon, rather than re-applying the WFR in a generative capacity. Hence the dual function of a WFR is a consequence of it being different in nature to a syntactic rule. Because WFRs are 'once-only' rules whose output is an actual lexeme, the second and all subsequent uses of the new lexeme will necessitate a secondary, analytical function of the WFR that created it. Having an analytical capacity allows WFRs to be used as redundancy rules over the set of existing lexemes, and in this way allows in a natural way for semantic drift of complex lexemes. In such instances a complex lexeme, just as any lexeme, acquires through the passage of time a special meaning no longer associated with the WFR that created it.

An example Aronoff (1976: 19) gives is *transmission*, in the special sense of 'mechanism for transmitting power from the engine to the wheels'. The question is how to capture the fact that *transmission* is only unproductive in terms of semantic transparency, Corbin's 'regularity' (see **1.1.2.2**). This is relatively straightforward a matter in the Aronovian model. We showed above that since the domain of a WFR is the lexeme, it has a syntactic and phonological level as well as a semantic level. Lexemes such as *transmission* are thus accounted for by the analytical function of an WFR, but only at its syntactic and phonological level; the semantic level is cast aside in favour of the idiosyncratic meaning. WFRs can therefore be used as a means of expressing partial redundancies between two derivationally related listed lexemes. Of course, where no semantic drift has occurred we can simply think of the WFR being used to express full redundancy, i.e. redundancy at all levels including the semantic level. This would be the case where the reading of transmission is transparent, i.e. the nominalization of *transmit*. A consequence of viewing lexical redundancy rules in terms of analytical WFRs is that what counts as redundancy in the lexicon is constrained: only information that can be stated in terms of a WFR can be counted as redundant, or as Aronoff puts it:

> "...the only sorts of facts which can count as redundancies or generalizations in the analysis of existing words are those which enter into the formation of new ones." (Aronoff 1976: 31)

5.3. Stems in lexeme-based derivation

Basing our discussion on Aronoff (1992b, 1994) we look in more detail at the formal domain of a WFR, i.e. the sound form of a lexeme on which a WFR acts. Aronoff (1992b: 14-16) notes that the formal part of a lexeme carries with it a number of notions which are important to disentangle. First, the 'root' is the form that is left when all morphologically added structure has been "wrung out". Second, a lexeme's 'citation form' is the special form used in lexicography as a place-holder or address, which we can think of as the entire lexeme in short-hand. Third, the 'lexical representation' is the analogue in the mental lexicon of the citation form[9]. Fourth, and finally, the stem is "that form of a lexeme to which a given affix is attached or on which a given realization rule operates" (1992b: 14). As we have seen above, the realization may be inflectional or derivational.

5.3.1. Multiple stems or multiple operations?

The stem is distinguished among the sound forms of a lexeme in that it alone is morphologically relevant: WFRs act on the stem, and not on the other sound forms. Furthermore, unlike the other sound-forms a lexeme may have more than one stem. To illustrate, consider the Russian noun *kot´onok* 'kitten' whose paradigm we give in Table 5.3. If we compare the nominative singular with the nominative plural, we see that for this lexeme there are two forms on which inflections may be realised. Moreover, the distribution of the two forms is systematic since the /kot´at/ form only appears in the plural paradigm, and the /kot´onok/ form only in the singular. How do we capture first the fact that there are two forms, and second that these forms are systematically distributed in the way that they are?

	Singular	Plural
nom	kot´onok-Ø	kot´at-a
acc	kot´onk-a	kot´at-Ø
gen	kot´onk-a	kot´at-Ø
dat	kot´onk-u	kot´at-am
inst	kot´onk-om	kot´at-am´i
loc	kot´onk-e	kot´at-ax

Table 5.3. Paradigm of word-forms of KOT´ONOK.

One way is to recognize that a lexeme has a stem inventory. We give the lexeme KOT´ONOK a stem inventory of two stems, /kot´onok/ and /kot´at/. To ensure the right stem is used for every morphosyntactic word, we label the stems such that the first is the one referred to in inflectional rules realizing singular, and the second in inflectional rules realizing plural. The lexeme KOT´ONOK would be represented as in (5.9).

(5.9)

KOT′ONOK {
syntax:
noun
semantics:
' kitten'
phonology (stem inventory):
stem sg / kot′onok/; stem pl / kot′at /

An alternative would be to have only /kot´onok/ as the stem, and then a series of operations associated with the rule for plural inflections: first truncate the stem to yield /kot/; then attach the *-´at* formative to yield /kot´at/; then supply the affixes. The two approaches are neatly summarised in Zwicky (1996) as a "trade-off between multiple operations and multiple stems."

5.3.2. Stems with multiple functions

The stems in (5.9) each have a special function attached to them, hence the labels 'sg' and 'pl'. There are, however, situations where a function label appears to be inappropriate since the stem has more than one function. Aronoff (1992b) claims that this is true for Latin verbs, and he argues that indices rather than functions should distinguish the set of stems that belong to a lexeme.

Latin verbs traditionally are treated as having a stem inventory, in the same way as KOT´ONOK in (5.9) above, since they display three distinct shapes throughout their paradigms. Taking the regular first conjugation verbs *am(ō)* 'love' and *laud(ō)* 'praise', Table 5.4 shows how the stems are distributed among the present infinitive active, the perfect active, and the perfect passive participle[10].

Present Active Infinitive	Perfect Active	Perfect Passive Participle
amā-re	amāv-i	amāt-us
laudā-re	laudāv-i	laudāt-us

TABLE 5.4. Stems of *am(ō)* and *laud(ō)*

Given the sample of categories in Table 5.4, we might assume that each stem is associated with a particular function, in the same way as /kot´onok/ was associated with singular and /kot´at/ with plural above. When we include the other categories this view is strengthened. For example, only perfect active tenses take the stem in the middle column: perfect, pluperfect, future perfect (all in indicative and subjunctive), as well as perfect infinitive[11]. A one-stem-to-one-function mapping seems to be what holds here, if imperfect can be counted as a function. Where it breaks down is in the third column. Aronoff shows that the stem in the third column of Table 5.4 is multifunctional since, in addition to the perfect passive participle, it is used to realise two other unrelated categories, as well as a number of derivational categories. Since no sole function can be identified with this stem, Aronoff proposes simply indexing it as the 'third' stem, on which the appropriate inflectional and derivational rules will operate. We can examine those categories which, in addition to the perfect passive participle, require the third stem.

Future active participle and the third stem

The first case pointed to is the future active participle, e.g. *amāt-ūr-us* 'about to love', *laudāt-ūr-us* 'about to praise'. However, one could try to argue with Matthews that for the future active participle verbs actually have a fourth stem in *-ūr*. What is important is that this fourth stem is 'parasitic' on the perfect passive participle stem. Thus Matthews claims "if one 'knows' the latter one can use this 'knowledge' to derive the former" (1972: 86). But Aronoff counters the parasitic stem approach by citing those verbs which have a future active participle but lack a route to get to it, i.e. have no perfect passive participle. This, of course, causes no embarrassment for an indexed stem approach. Such examples are easy to find among the intransitive verbs (since they will obviously lack passives). Examples from Aronoff (1992b: 9) are given in Table 5.5.

verb	perfect passive participle	future active participle
am(ō) 'love'	amāt-us	amāt-ūr-us
cale(ō) 'be hot'	*	calit-ūr-us
dole(ō) 'suffer pain'	*	dolit-ūr-us
iace(ō) 'lie'	*	iact-ūr-us

TABLE 5.5. Verbs with future active participle, but no corresponding perfect passive participle

The supine and the third stem

The second category requiring the third stem is the so-called 'supine'. This is a special form used in two syntactic constructions. First, in purpose clauses where it serves as the verb of purpose after a verb of motion. And second, as a specifier after adjectives. The supine is formerly distinguished in these two contexts by an accusative singular ending in the first, and an ablative singular in the second. The examples in (5.10) are taken from North and Hillard (1930: 82).

(5.10)

a. abi-ī dormit-um
depart-1st.Sg.Perf.Act sleep-Sup.Acc.Sg
'I went away to sleep'

b. mirabile dict-ū
wonderful say-Sup.Abl.Sg
'wonderful to relate'

The supine is thus clearly different in function from the perfect passive participle. Further, it is morphologically different because the case endings that are attached to it come from a different inflectional class: supines pattern like class IV *gradus* 'step', and participles like class II *servus* 'slave'. If we take the parasitic approach, do we say the supine is based on the perfect participle, or is it the other way around? For that matter, is the future participle based directly on the supine and indirectly on the perfect participle? Or is it the other way round? Put this way the question of directionality ends up looking like a question that has no real importance.

Derivatives and the third stem

The same stem that is used for the perfect passive participle, the future active participle, and now the supine, is found being used derivationally, namely in the derivation of Agent and Abstract nouns, and Desiderative, Intensive and Iterative verbs. Table 5.6 is based on Aronoff (1994: 38) and shows derivations based on this single stem, which is indexed as the third stem. Note that Intensives do not have an affix (the fourth group of examples in Table 5.6).

	Verb Base	gloss	stem	Derivative	
1. Agent noun	can(ō)	sing	cant-	cant-or	singer
	vinc(ō)	conquer	vict-	vict-or	conqueror
2. Abstract noun	cogit(ō)	think	cogitāt-	cogitāt-io	thought
	conveni(ō)	meet	convent-	convent-io	meeting
3. Desiderative verb	ed(ō)	eat	ēs-	ēsuri(o)	be hungry
	em(ō)	buy	empt-	empturi(o)	want to buy
4. Intensive verb	iaci(ō)	throw	iact-	iact(o)	fling
	volv(ō)	roll	volūt-	volūt(o)	tumble about
5. Iterative verb	scrīb(ō)	write	script-	script-it(o)	write often
	vide(ō)	see	vīs-	vīs-it(o)	see often

TABLE 5.6. Derivatives based on the third stem

These can only be accounted for by positing a single stem on which all these derivational categories are based, since semantically there is no good reason to view one as more basic than the other. The conclusion to be drawn from the above is that in the stem inventory of verbs, one stem, the third stem, is associated with multiple functions which can be summarised in (5.11). In other words, stems may have multiple functions.

(5.11)

third stem
- perfect passive participle (infl)
- future active participle (infl)
- supine (infl)
- Agent (deriv)
- Abstract (deriv)
- Intensive (deriv)
- Desiderative (deriv)
- Iterative (deriv)

We have shown that lexemes may have a set of stems rather than a single stem, and that stems may have more than one function associated with them. For this reason it would make sense to assign stems indices which the rules of inflection and lexeme formation may refer to. The WFRs discussed in **5.3** would therefore be modified to account for this. There is another issue which the above throws up. If the stem in (5.13) carries an index, then what characterizes it is not that it has many functions, but rather that it has no function at all (Aronoff 1992b: 18). This is an example of 'pure' morphology, or 'morphology by itself' (Aronoff 1994) . Stems, then, do not only have implications for WFRs but the morphological component itself.

5.4. Lexeme-based inflection

We end this chapter with a few words on inflection in a lexeme-based approach to morphology. Recall that Halle (1973) is important because it is the first serious suggestion of what a model for generative morphology might look like. Inflection is not distinguished from derivation, and both are placed in the lexicon. However, it must also be remembered that in the Structuralist tradition it assumes the morpheme to be the minimal sign. Anderson (1982), on the other hand, suggests splitting inflection from derivation, on theoretical grounds. This is a move made possible by viewing the word as the minimal sign. After briefly comparing Halle and Anderson's treatment of inflection within the grammar, we look at what characterises lexeme-based inflectional rules.

5.4.1. Inflection and the grammar

Since in Halle morphemes are the basic units, whether derivational or inflectional, there is no theoretical reason why inflection should not be achieved in the same way as derivation, i.e. by an item-and-arrangement style rule (Halle 1973: 6)[12]. The lexicon contains a list of morphemes, and rules which arrange them to form words, including morphosyntactic words, i.e. all their inflected forms (Halle 1973: 9). Halle is therefore able to assign inflection to the same component of grammar as derivation, offering as independent justification for this move the fact that inflection can be just as 'lexical', i.e. idiosyncratic as derivation[13]. But given that lexical insertion is prior to surface structure where morphosyntactic properties of a word are ultimately decided, how can one ensure that the correct inflected form is the input of the lexical insertion rule? The extremely awkward solution Halle comes up with is to insert the entire set of inflected forms of a given word, and then have a transformation delete all except the relevant form (Halle 1973: 9).

Anderson (1982) offers a much neater solution by espousing a word-based approach. He distinguishes inflection from derivation by viewing inflections as "what is relevant to syntax" (1982: 587). Rather than unifying derivation and inflection in the lexicon, he reserves the lexicon for derivation only. Splitting morphology and locating the two parts in different areas of the grammar accounts for the fact that inflection and derivation behave differently. If inflection is assigned to the syntactic component, a theoretical reason is found for the chief distinguishing inflectional characteristic of productivity: it follows from the productivity of syntactic rules of government and agreement (Anderson 1982: 591). Lexical insertion has a stem as its input, which is subsequently inflected according to the morphosyntactic properties that are assigned to it. In this way inflection as what is relevant to syntax is accounted for, and deleting a whole list of superfluous words, which in the case of Finnish might run into thousands, is avoided. This solution is available to Anderson and not Halle because inflections are not lexical entries, but inflections on a lexeme's stem according to morphosyntactic feature specifications. The minimal sign is the word which has a paradigm of inflected stems corresponding to the paradigm of morphosyntactic features that are relevant to that word. What then are the morphological rules that account for a lexeme's set of morphosyntactic words?

5.4.2. 'Within-lexeme' rules

Morphology involves the lexeme in two ways. First, when change in meaning and change in form is registered between a lexeme and another lexeme, i.e. 'lexeme formation' as illustrated in (5.2) above. And second, when the change is registered within the lexeme itself. Lexeme formation is 'inter-lexemic' morphology, whereas inflection is 'intra-lexemic'. To capture this Zwicky (1992: 333) distinguishes two sets of morphological rules, 'within-lexeme' rules and 'between-lexeme' rules (examples of which would be Aronoff's WFRs above). In both inter- and intra-lexemic morphology the form change that is registered is on the lexeme's stem. Whereas in inter-lexemic morphology, or lexeme formation, the change in stem registers a new lexeme, in intra-lexemic, or inflectional morphology the stem changes are realisations of the set of morphosyntactic words of a lexeme. Hence the set of morphosyntactic words of the Russian lexeme KN´IGA 'book' will be realised by inflections on the stem /kn´ig/. The relationship between a set of morphosyntactic words within a lexeme is paradigmatic: they are "the members of the paradigm of a particular lexeme." (Aronoff 1994: 11). It is exactly this relationship that the Word and Paradigm model captures, which as its name suggests relates the set of word-forms of a word to morphosyntactic properties by taking the word as the minimal sign. And this is precisely the system Anderson adopts for the inflectional side of his model of generative morphology. As an illustration we can consider the paradigm representation of the word-forms of *kn´ig(a)* in Table 5.7.

	sing	pl
nom	kn´ig-a	kn´ig-i
acc	kn´ig-u	kn´ig-i
gen	kn´ig-i	kn´ig-Ø
dat	kn´ig-e	kn´ig-am
instr	kn´ig-oj	kn´ig-am´i
loc	kn´ig-e	kn´ig-ax

Table 5.7. Paradigm of word-forms of *kn´ig(a).*

Borrowing the notation from Matthews (1991: 126-7), the morpheme being realised by the word form *kn´igam* from Table 5.7 would be as in (5.12), i.e. the dative plural of the lexeme KN´IGA.

(5.12)

$$\begin{bmatrix} \text{Pl} \\ \text{Dative} \\ \text{KN'IGA} \end{bmatrix}$$

In (5.13) we have the rule relating morphosyntactic Properties and the way in which a lexeme's stem is changed to mark them. In other words, in (5.13) we have an example of a within-lexeme rule. Note that uppercase X represents any lexeme, and lower case x its stem (my modification). Recall that this type of rule is represented as a path:value pairing in Network Morphology, where the value is complex including stem in its description (**3.1**).

(5.13)

$$\begin{bmatrix} \text{Pl} \\ \text{Dative} \\ \text{X} \end{bmatrix} \quad \rightarrow \quad [\text{x}] + /\,\text{am}\,/$$

In (5.12) and (5.13) we see that the lexeme is part of the description of the rule, as we would expect in lexeme-as-minimal-sign morphology. Note also that the left hand side of (5.13) combines two morphosyntactic properties, one of number and the other of case. Hence the portmanteau morphs which were an embarrassment for morpheme-based morphology (see **1.2.2**) are naturally accounted for as part of the rule description. Matthews (1991: 179) terms formatives like *-u* in (5.6) 'cumulative exponents', and views them simply as the inflectional version of one-form-to-many-meaning asymmetry.

5.5. Concluding remarks

We have shown that in a lexeme-based model derivation is the mapping of form with meaning (and syntax) at the level of the lexeme. We saw that the lexeme was an assembly of an item's form(s), meaning and syntax. Types of derivation such as transpositions, zero affixation and (syntactic) category preserving derivation are simply viewed as a change or preservation at one (or more) of these levels. To account for lexeme-based derivation, or lexeme formation, we introduced Aronovian-style WFRs. Due to the Word-Based Hypothesis, such rules have words (or lexemes) as both input and output. This means that WFRs are complex in the same way as lexemes are complex. They were shown to have a set of conditions on the base (the structural description) as well as specifications for the output (the structural change). The kinds of conditions match the levels of the input lexeme, and we gave examples of semantic, syntactic and phonological conditions, the former two defined by the Unitary Base Hypothesis. We saw also that WFRs have an analytical as well as a generative function, and in that capacity act as redundancy rules over the lexicon. We ended our discussion on lexeme formation by considering stems in lexeme-based derivation, showing that a lexeme may have more than one stem. In some cases a stem may be associated with more than one morphological function, and for this reason there is a good argument for indexing the lexeme's set of stems. Finally for completeness we looked briefly at inflection in a lexeme-based model.

Having set out the issues raised in lexeme formation, we are ready to present a lexeme-based account of Russian person formation.

[1]The term 'lexeme formation' is found being used in Matthews (1991: 37).

[2]In theory the lexical semantics of the item would be specified at the semantic level of the lexeme, but for the present study we shall be satisfied with the gloss in most cases.

[3] For example Townsend (1975: 209).

[4]Note that WFRs in Aronoff are exclusively rules that relate two lexemes (Aronoff 1994: 15), unlike the WFRs in Halle (1973) which are inflectional as well.

[5]Note that non-reference to syntactic rules is what Zwicky calls the 'Principle of Syntax-free Morphology' (1992: 354).

[6]In the next chapter we examine a fourth level, namely the morphological level, and discuss 'morphological' conditions.

[7] The picture is further complicated by the suffix *-n* which is productive in deriving relational adjectives as well as qualitative adjectives and can therefore be seen as a dual purpose adjective suffix.

[8]Scalise also lists apparent counterexamples such as *civile* 'polite' > **scivile* but *incivile* 'impolite', *sano* 'healthy' > **ssano* but *insano* 'unhealthy'. These can be dismissed, he observes, by viewing them as violating the initial consonant cluster constraint in Italian.

[9]However, unlike the citation form a lexical representation may end up never actually occurring as a surface form of the lexeme (1992: 16).

[10]Note that vowel length is phonemic in Latin, and long vowels are indicated as such with a macro.

[11]Though the first column includes past and present tenses, it is nonetheless associated with one function if we consider that all the forms that attach to it are imperfect (active and passive): present, future, imperfect of indicative mood; present, imperfect of subjunctive mood; present of imperative, infinitive and participle (Aronoff 1992: 29-30). Note that Latin lacks a future subjunctive.

[12]Though some discussion is given over to WFRs for derivation, Halle gives no actual examples of WFRs for inflection

[13] Inflectional idiosyncrasies cited are discussed in **1.1.2.2**. For example, in Russian there exits a set of verbs lacking first person singular non-past forms.

Chapter 6:
Russian Person Derivation as Lexeme Formation

6.0. Introduction

Russian person formation is highly productive, as we mentioned in chapter one (**1.2.2**). It represents prototypical derivation in that on the one hand the morphological operation type used to encode it is affixation, and on the other it involves drastic change in semantics, along with a change of syntactic category. By carefully examining the productive derivational types, we can establish the WFRs that could be used to describe Russian person derivation. In this way we offer a lexeme-based account of the data.

We discuss derivation in the more productive suffixes, and for each we follow a set procedure. First we identify the conditions on the Base. As we showed in the previous chapter, these may be syntactic (primarily the Base's syntactic category), semantic and phonological. In deverbal derivation we further identify secondary syntactic conditions, namely conditions on the Base's aspect and transitivity. And in certain cases we propose a fourth type of condition, namely a 'morphological' condition. Taking these together we are able to assemble the WFR's structural description, i.e. the set of conditions a WFR imposes on its input. This is then fitted together with the structural change, i.e. the specification of the change in the Base at the syntactic, semantic and phonological levels (see **5.2.1**), to make up the full WFR.

Exceptions will be those items which though not meeting the specified conditions nonetheless serve as bases to a WFR. For example, a syntactic exception would be a verbal Base that is the input to a denominal WFR. Exceptions to WFR's can therefore be characterised in terms of which condition is being overridden, and for each WFR we list examples representing exceptions in this way.

6.1. Person suffixes in Russian

There are numerous suffixes used to derive Person nouns. For example Cubberley (1994) identifies well over fifty such suffixes in the 1980 Academy Grammar (Švedova 1980). A sample of suffixes and items derived in them is listed in Table 6.1 from Cubberley (1994: 111-12) (where we have added the Bases).

Suffix	Base		Derivative	
-ak	rib(a)	'fish'	ribak	'fisherman'
-ač	trub(a)	'trumpet'	trubač	'trumpeter'
-un	bega(t´)	'run'	begun	runner
-ant	muzik(a)	'music'	muzikant	'musician'
-´an´in	sever	'north'	sever´an´in	'northerner'
-´or	b´ilet	'ticket'	b´ilet´or	'ticket-collector'
-ator	av´iac´ij(a)	'aviation'	av´iator	'aviator'
-´ič	Moskv(a)	'Moscow'	Moskv´ič	'Muscovite'
-an	vel´ik(ij)	'great'	vel´ikan	'giant'
-´ar	ovc(a)	'sheep'	ovč´ar	'shepherd'
-ok	xod´i(t´)	'walk'	xodok	'walker'
-´in	L´itv(a)	'Lithuania'	l´itv´in	'Lithuanian'

TABLE 6.1. A sample of person forming suffixes in Russian

The suffixes we investigate are those described as productive in the literature. In chapter one we showed that following Corbin (1987: 176) there are three senses of productive (**1.1.2.2**). 'Profitability' corresponds simply to the number of words derived by the morphological operation; 'availability' signifies the synchronic use of the operation; and 'regularity' denotes its semantic transparency. Given that our aim is a synchronic account of the derivational system of Russian our interest is in productively 'available' and 'regular' person derivation. Though there are various ways of measuring the availability of a given morphological operation, for example Baayen and Lieber's (1991) study of English is based on the hapaxlegomena occurring in large corpora, this is not the main aim of our study. Instead we simply follow the consensus of opinion in the main descriptive works on Russian. The suffixes in Table 6.2 therefore represent what generally is considered to be the productive suffixes used in Russian person derivation. In the following sections we look in turn at each of the suffixes in Table 6.2.

-tel´	grab´i(t´)	steal	grab´itel´	thief
-´ist	traktor	tractor	traktor´ist	tractor driver
-´ik	frontov(oj)	front-line	frontov´ik	front-line soldier
-n´ik	vest´	news	vestn´ik	herald
-šč´ik	baraban	drum	barabanšč´ik	drummer
-(l´)šč´ik	r´isova(t´)	draw	r´isoval´šč´ik	draughtsman
-ec	skup(oj)	stingy	skupec	skinflint

TABLE 6.2. The productive person formation suffixes

6.2. The *-tel´* WFR

Examples of person *-tel´* nouns with their Bases are given in Table 6.3. Conditions on *-tel´* formation are syntactic as well as phonological.

dar´i(t´)	give (present)	dar´itel´	donor
grab´i(t´)	steal	grab´itel´	thief
xran´i(t´)	preserve	xran´itel´	custodian
terza(t´)	torment	terzatel´	tormentor
podžiga(t´)	set on fire	podžigatel´	arsonist
zauša(t´)	abuse	zaušatel´	abuser
p´isa(t´)	write	p´isatel´	writer

TABLE 6.3. Nouns in *-tel´*

Syntactic conditions

There are several syntactic conditions that can be placed on *-tel´* formation. Bases must be verbs first and foremost. Two secondary conditions are that they must be transitive, and they must have imperfective aspect[1]. All the Bases in Table 6.3 meet these conditions. For example *xran´itel´* 'custodian' has the transitive and imperfective verb Base *xran´i(t´)* 'keep'.

Phonological conditions

In *-tel´* suffixation we find that out of the several stems contained in the verb lexeme, one type is (nearly) always selected over the others. Because the stem is the morphologically relevant sound form of the lexeme (**5.3**), we can view stem-selection as a condition on the Base lexeme at a phonological level, i.e. a phonological condition. The stem selected is the 'infinitive' stem; all the Bases in Table 6.3 are given in the infinitive form and we can clearly see *-tel´* attaches to this same stem. To represent this condition in a lexeme-based model, we need to consider the possibility of an indexed stem inventory for verbs, so that the WFR can be associated with one of the indexes (see discussion in **5.3.2**). Indexed stem inventories have been proposed for Russian verbs in a very recent article by Sadler, Spencer and Zaretskaya (1997).

6.2.1. Indexed stems and *-tel´* formation

In descriptions of the Russian verbal system it is traditional to identify two stems on which rules realizing inflectional categories are based. Timberlake (1993: 850), for example, talks about the two-stem approach as being 'convenient' for describing Russian verbs (though at the same time noting Jakobson's famous alternative one-stem account (1948)). He outlines this approach as follows:

> "Verbs commonly display two major stem alternants, the present allostem, used for the present tense, imperative and present participles, and the past/infinitive allostem, used for past, infinitive, past (active) participle and (past) passive participle."

Table 6.4 shows both stems of three verbs belonging to three different groups, which are inflected for non-past first person singular, and infinitive. Note that Roman numerals denote the two conjugation classes; in the first conjugation there are a number of sub-groups, and these are labelled in terms of the present stem[2].

Class	Root	Infinitive Stem	Present Stem	Gloss
I -aj	del-	dela-(t´)	delaj-(u)	'do'
I-ov	tolk-	tolkova-(t´)	tolkuj-(u)	'demand'
II	reš-	reši-(t´)	reš-(u)	'decide'

TABLE 6.4. Verb allostems.

Leading on from the two-stem tradition, Sadler et al. (1997) propose an indexed stem account of Russian verbs based on Aronoff (1994). Though their paper chiefly concerns the inheritance of the verb's argument structure in deverbal nominalizations, their account relies on assigning to verbs four indexed stems. In other words, they add two stems to the inventory assumed in traditional accounts. The four stems (when Stem 0 is counted) are given in Table 6.5. If we compare Table 6.5 with Table 6.4 we see that 'infinitive' and 'present' stem appear to correspond to Stem 1 and Stem 2. What is novel is the additional stems Stem 0 and Stem 3.

Stem 0	Stem 1	Stem 2	Stem 3
del-	dela-	delaj-	delan-
tolkov-	tolkova-	tolkuj-	tolkovan-
reš-	reši-	reš-	rešen-

TABLE 6.5. Sadler et al.'s indexed verb stems.

Stem 0 resembles the root in Table 6.4, but the authors are at pains to point out in an earlier version of the paper (1994) that there is a distinction (e.g. 1994: 22). To illustrate with the examples in the Tables above, the root of *tolkova(t´)* is *tolk-*; but in Table 6.5 we see that its Stem 0 is the more complex *tolkov-*. This is because in derived verbs Stem 0 is the root plus a verb forming suffix. Subsequent derivation from the verb takes place on this stem, rather than the root; in other words, Stem 0 is selected for derivation. For example, *tolkova(t´)* derives *tolkovn´ik* 'interpreter' (rather than **tolkn´ik*). It should be noted, however, that the root will by default coincide with Stem 0 in underived verbs. This is the case for example with *dela(t´)*, which derives the result noun *del(o)* 'deed' (through zero derivation). A special stem reserved for derivation is not a new idea in Russian studies. Two separate approaches relying on 'derivational' stems, as distinct from 'inflectional' stems, can be found in Stankiewicz (1962) and Worth (1967).

Stem 3 is a more radical proposal which takes its lead from Aronoff's account of Latin and his use of the 'third' stem (see **5.3.2**). They propose lifting the category past participle passive, e.g. *sdelan(o)* 'done (neut sg)', out of the domain of the infinitive stem (their Stem 1) and associating it with another stem, Stem 3. This is a logical step if the /n/ is viewed as a stem forming element rather than as part of the inflection realising the category. Hence *sdelano* is viewed as *sdelan-o* and not *sdela-no*. This same stem is used for another category, namely productive deverbal nominalization: examples such as *delan´ijo* 'doing', *tolkovan´ijo* 'interpreting' are analysed as *delan-´ij(o)*, *tolkovan-´ij(o)* where the /n/ is part of the stem, and the /´ij/ is the nominalizing suffix. A priscianic approach, where one form is derived from the other, will not work for the same sorts of reasons it does not work for Latin (see **5.3.2**). In Russian imperfective verbs cannot form a past passive participle, yet they freely nominalize, e.g. **trebovan(o)* but *trebovan´ij(o)* 'demanding'. An attempt to derive the participle from the nominalization will also fail. Russian has alternative ways of nominalizing, and verbs capable of forming the participle may have nominalizations in a rival suffix. For example *pobel´i(t´)* 'whitewash' derives *pobelk(a)* 'whitewashing' with the rival nominalizing suffix *-k* (which is based on Stem 0); nonetheless it is able to form the participle *pobel´en(o)*.

Adopting this approach we can represent *tolkova(t´)* as in (6.1). At the phonological level we see a stem inventory of four indexed stems. Derivation in *-n´ik* takes place on Stem 0, i.e. *tolkovn´ik*; derivation in *-tel´* is based on Stem 1, i.e. *tolkovatel´*; and nominalization on Stem 3, i.e. *tolkovan´ij(o)*. Stem 2 is reserved for the inflectional categories non-past, imperative and present participle.

(6.1)

TOLKOVAT′ {
syntax:
verb; imperfective; transitive
semantics:
' interpret'
phonology (stem inventory):
0 / tolkov/; 1 / tolkova/; 2 / tolkuj/; 3 / tolkovan /

Given this, the *-tel´* WFR with its structural description (i.e. its set of conditions) is represented in (6.2). 'Condition on' is denoted by 'c'. 'The primary syntactic condition is on syntactic class, and the secondary ones are on aspect and transitivity[3]. Note that the phonological condition is really the selection of an indexed stem. (Note that lack of a semantic condition is indicated by a gap after 'c' in the semantics slot.)

(6.2)

-tel´ WFR

structural description	⇒	structural change
syntax:		syntax:
c (primary) verb; (secondary) imperf, trans		verb → noun
semantics:		semantics:
c		X → ' person who Xes'
phonology:		phonology:
c stem 1		stem 1 → stem 1 - tel′

6.2.2. Exceptions to the *-tel´* WFR

Exceptions will come in the shape of Bases which do not meet the conditions specified in (6.2), but nonetheless derive nouns in *-tel´*. No exceptions to the primary syntactic condition that Bases are verbs are known to the author. There are, however, cases where the secondary conditions are not met. In Table 6.6 we list transitivity exceptions (i.e. where the Base is intransitive), and in Table 6.7 aspect exceptions (i.e. where the Base is perfective).

stranstvova(t´)	wander	stranstvovatel´	'wanderer'
ob´ita(t´)	dwell in	ob´itatel´	'inhabitant'
sorevnova(t´)s´a	compete with	sorevnovatel´	'competitor'
ži(t´)	live	žitel´	'inhabitant'

TABLE 6.6. Nouns in *-tel´* with intransitive Bases

oform´i(t´)	put into shape	oform´itel´	stage decorator
ozelen´it´	plant with tree	ozelen´itel´	garden planter
pobed´i(t´)	conquer	pobed´itel´	conqueror

TABLE 6.7. Nouns in *-tel´* with perfective Bases

Very rarely do we find cases not satisfying the phonological condition on Stem 1. In such cases that there are, a special stem in /´i/ is used, as shown in Table 6.8. The extra stem in /´i/ cannot be said to be built on Stem 0 since for *vojova(t´)* that would be **vojov-´i-* (this item belongs to I-*ov* like *tolkova(t´)*); it must therefore be based on the root. We will return to this and related issues in our discussion on stem formation in the next chapter. Note that *vojitel´* also represents a syntactic exception since its verb Base is intransitive, as does *spas´itel´* since its Base is perfective.

spas(t´i)	save	spas´itel´	'saviour'
vojova(t´)	wage war	vojitel´	'warrior'
smotre(t´)	watch	smotr´itel´	'supervisor'

TABLE 6.8. Phonological exceptions to the *-tel´* WFR rule.

6.3. The -*´ist* WFR

The suffix -*´ist* is the most productive of a small group of suffixes of foreign origin. The history of the suffix for marking person derivation goes back to the end of the Old Russian period (Azarx 1984: 93). Examples are given in Table 6.9. In the environment of -*´ist* stem final consonants are palatalized and stress is invariably attracted to the suffix where it remains fixed throughout all inflections, e.g. *metáll* > *metall´íst*, *metall´íst(a)* (gen sg), etc.

metall	metal	metall´ist	metal worker
mašin(a)	machine	mašin´ist	machinist
tank	tank	tankist	tank crew member
traktor	tractor	traktor´ist	tractor driver
kurs(i)	courses	kurs´ist	student taking courses
velos´iped	bicycle	velos´iped´ist	cyclist
Šeksp´ir	Shakespeare	šeksp´ir´ist	expert on Shakespeare

TABLE 6.9. Nouns in - *´ist*

Syntactic conditions

Input lexemes to the - *´ist* WFR must meet the syntactic condition of belonging to the class of nouns, and this is shown for the examples in Table 6.9. Note that this condition operates without exception.

Other conditions

There is a curious condition on - *´ist* attachment which is mentioned in the literature, namely that Bases must be of foreign origin[4]. This can be seen with all the examples in Table 6.9. Bases must therefore be marked with a feature +foreign which the WFR will be sensitive to. But what is this feature? Since it is neither syntactic or phonological information, we might wish to consider it a semantic feature. This would lead to specifying it at the semantic level and incorporating it as a semantic condition in the structural description of the - *´ist* WFR. By so doing we would be claiming that the feature +foreign is the same kind of feature as those used in our examples of semantic conditioning in chapter five (**5.7.1**). Recall that for English *re-* prefixation the semantic condition was that the Base must be +change of state, and for Russian *-sk* suffixation the Base must carry the feature +person. It should be noted, however, that whereas +person and +change of state are clearly part of the item's lexical semantics, it is not clear that this is the same role played by the feature +foreign. In other words, +foreign is really not semantics. Ideally in addition to the syntactic, phonological and semantic levels we need a 'fourth' level of lexemic description where such features are stored (maybe a stylistics level?). For present purposes, though, we will view this as part of the lexeme's semantics with the knowledge that this is far from satisfactory.

We represent the - *´ist* WFR as in (6.3) with the syntactic condition that Bases must be nouns, and what we have tentatively called the semantic condition that Bases must be

+foreign. Note that in the structural change the semantic change is defined in the same way as Isačenko's 'Relators' (**5.1.2**), i.e. 'person related in some way to the Base'.

(6.3)

- *´ist* WFR

structural description	⇒	structural change
syntax:		syntax:
c noun		noun → noun
semantics:		semantics:
c + foreign		X →' person related to X'
phonology:		phonology:
c		stem → stem -´ist

6.3.1 Exceptions to the - *´ist* WFR

As we said, there are no exceptions to the condition on syntactic category. The only possible exceptions to the - *´ist* WFR will be those disregarding the semantic condition on +foreign. Table 6.10 lists examples which are exceptional in this way. Note that in this group are included native proper names.

oč´erk	essay	oč´erkist	essayist
sv´az´	communication	sv´az´ist	signaller
šaxmat(i)	chess	šaxmat´ist	chess-player
Puškin	Pushkin	puškin´ist	expert on Pushkin

TABLE 6.10. Nouns in - *´ist* with Bases of native origin

6.3.2. Nouns in - *´ist* and abstract lexemes

Before leaving - *´ist* we should note that - *´ist* Derivatives are productively related to abstract nouns in the foreign suffix - *´izm*. Examples are given in Table 6.11.

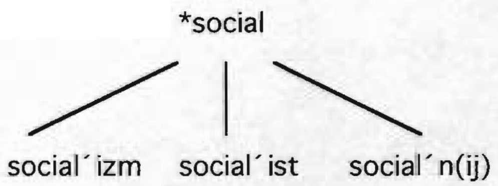
al´truizm	altruism	al´truist	altruist
dual´izm	dualism	dual´ist	dualist
kollekt´iv´izm	collectivism	kollekt´iv´ist	collectivist
internacional´izm	internationalism	internacional´ist	internationalist

TABLE 6.11. Person nouns in - *´ist* and - *´izm*

There are two ways of accounting for this productive relationship. We may view one lexeme in the relationship as the Base and the other its Derivative. This is the approach adopted for example in Švedova (1980: §343) and followed in Tixonov (1985) where the-*´izm* lexeme is the Base. There are three problems with this approach. First, the directionality is not motivated. For one thing, examples exist in -*´ist* which do not have a Base in -*´izm*, e.g. *tank* > **tankizm* > *tankist*. Second it is not clear whether *altruizm* 'altruism' semantically underlies the person noun *altruist* 'altruist'. Reversing the roles of Base and Derivative fares no better. Third and finally a powerful truncation rules is required, whichever item is chosen as the Base.

Alternatively, to avoid directionality the relationship between the types could be viewed as sisters. For example, Vinogradov et al. (1953: 225), and Galkina-Fëdoruk et al. (1957: 241), amongst others, describe *dual´izm* 'dualism' as 'parallel' to *dual´ist* 'dualist'. To capture this Isačenko proposes what amounts to a ghost lexical entry from which the -*´ist* and -*´izm* entries are derived (1969:52). This is represented in (6.4).

(6.4)



The abstract Base is unspecified for word class, but Isačenko notes that it is at least specified as being non-verbal. To capture this all we need do is state that lexical entries are by default nouns, including abstract lexical entries. The -*´ist* and -*´izm* WFRs will have this condition built into their structural descriptions. What is interesting is that there is a third type that can be derived from the abstract item, the adjectival Derivative in -*n*, for example *social´n(ij)* 'social'. Now -*n* suffixation is restricted to noun Bases too, for example *šumn(ij)* 'noisy' is derived from the noun *šum* 'noise', and *mestn(ij)* 'local' from the noun *mest(o)* 'place', etc.

Abstract lexemes therefore have a place in our account, but we will put three important restrictions on their use. First, they are underived Bases. In other words, in a derivational chain they cannot serve to link a Base and a Derivative. For example, the Derivative *dokazatel´stv(o)* must be derived directly from the verb *dokaza(t´)* and not via an abstract (and non-existent) Derivative **dokazatel´*. Second, abstract lexemes must be unspecified for syntactic category. They will therefore always be treated as nouns by WFRs, since they will inherit the category noun by default. It follows from this that only WFRs that can accept nouns can accept abstract lexemes as inputs. Third and finally, abstract lexemes must be borrowings and therefore have the feature +foreign. In this way their abstractness corresponds to their non-assimilation into the language system.

6.4. The *-´ik* WFR

Examples of *-´ik* derivation are given in Table 6.12. Note that the suffix *-´ik* palatalizes the Base stem's final consonant, for example *sezonn(ij)* 'seasonal' > *sezonn´ik* 'seasonal worker'.

sezonn(ij)	seasonal	sezonn´ik	seasonal worker
krovn(ij)	blood (adj)	krovn´ik	blood relative
oružejn(ij)	weapons (adj)	oružejn´ik	gunsmith
obšč´estvenn(ij)	social	obšč´estvenn´ik	social worker
vetren(ij)	empty-headed	vetren´ik	empty-headed person
ažurn(ij)	open-work textile (adj)	ažurn´ik	textile worker

TABLE 6.12. Person nouns formed in *-´ik*

Syntactic condition

The syntactic condition is that Bases must belong to the class of adjectives, and we can see this from all the Bases in Table 6.12.

Phonological conditions

It is observed in the literature that *-´ik* productively attaches to Base stems in /n/ and /ov/[5] which we can state as a phonological condition. In Table 6.12. all the Bases have stems in /n/. In Table 6.13 we give examples of Base stems in /ov/.

peredov(oj)	foremost	peredov´ik	lead worker (factory)
frontov(oj)	front-line	frontov´ik	front-line soldier
pravov(oj)	legal	pravov´ik	jurist
strojov(oj)	combatant	strojov´ik	combatant soldier
gorlov(oj)	throat	gorlov´ik	throat specialist

TABLE 6.13. Nouns in *-´ik* with Bases in *-ov*.

Other conditions

Another condition we find in the literature is that the Base must not only be an adjective, but more specifically a derived adjective[6]. We can see this to be the case for all the examples in Table 6.12. For example *krovn´ik* 'blood relative' is derived from the adjective *krovn(ij)* 'blood (adj)' which is itself derived from the noun *krov´* 'blood' in the adjective forming suffix *-n*. In Table 6.12 *gorlov(oj)* 'throat (adj)' is a relational adjective derived in the suffix *-ov* (from *gorl(o)* 'throat'). Derivatives with Bases derived in *-´an* are listed in Table 6.14.

neft´an(oj)	oil (adj)	neft´an´ik	oil-industry worker
drov´an(oj)	fire-wood (adj)	drov´an´ik	fire-wood merchant
serebr´an(ij)	silver (adj)	serebr´an´ik	silversmith
vod´an(oj)	water (adj)	vod´an´ik	water sprite

TABLE 6.14. *-´ik* nouns derived from Bases in *-´an*.

To incorporate a condition that the Base must be in *-n*, *-ov* or *-´an* we require the WFR to make reference to the morphological structure of the Base. To meet this we will adopt in addition to semantic, syntactic and phonological conditions what Aronoff calls 'morphological' conditions.

6.4.1. Nouns in *-´ik* and 'morphological' conditions

Aronoff observes that some suffixation rules seem to be sensitive to the presence of a particular suffix in the Base. For example, *-ity* is productive with Base stems of the shape Xic and Xal, as in *electricity, modality* (1976: 53). To account for this Aronoff posits a 'morphological' condition as part of the *-ity* WFR such that inputs must contain the suffixes *-ic* and *-al*. These and the other examples in Marchand (1969) (where affixation depends on the affix that a Base is derived in) would be accounted for in the same way. The problem is that morphological conditions require access to the internal (morphological) structure of a Base but this access is prohibited by Lexical Morphology's 'Bracket Erasure Convention' (BEC) (Kiparsky 1982: 11; 1983: 5). This states that brackets representing the structure of a Derivative are 'erased' when that Derivative becomes the input of a WFR. Or in Kiparsky's words, "...morphological...processes cannot be sensitive to internal structure" (Kiparsky 1983: 5)[7].

Recall from the beginning of chapter one Fabb's (1988) attack on lexical morphology. Examples such as the ones cited by Aronoff lead him to happily abandon the BEC altogether. But this misses the spirit behind the BEC, which is that it cannot be assumed that speakers carry entire derivational histories as part of their knowledge of words. To keep the spirit of the BEC we will adopt a modified form. WFRs are not blind to the internal structure of the Base, but are blind to the internal structure of the Base's Base. This is the position of Siegel which leads her to formulate the Adjacency Constraint (1977: 192), which is used to account for Derivatives in the prefix combination *un-dis-*. She notes that examples such as **undishonest* at first suggest a morphological condition that *un-* may not be attached to Bases in *dis-*. Yet examples can be found where *un-dis-* is acceptable, such as *undistinguished* and *undisheartened.* The Adjacency Constraint states that a morphological condition may only be on material that has been introduced by the immediately preceding WFR. Or as Lieber puts it in terms of her constituent structure framework:

> "No sub-categorization frame can state a dependency between X and Y if there is more than one bracket between X and Y." (Lieber 1980: 60)

To see the implications of the Adjacency Constraint, the *un-dis-* examples above are given with their derivational histories in (6.5a, b, c).

(6.5)

a. honest > dishonest > *undishonest

b. hearten > dishearten > disheartened > undisheartened

c. distinguish > distinguished > undistinguished

Assuming the Adjacency Constraint, a morphological condition can be used to restrict *un-* from attaching to Bases in *dis-*. Examples (6.55b, c) would not be considered counterexamples since *dis-* has not been introduced by the immediately preceding WFR. In (6.5b), for *undisheartened* the immediately preceding WFR is a deverbal adjective formation rule which introduces the suffix *-ed*. So though *dis-* is adjacent to *un-* it is not 'morphologically' adjacent. In (6.5c) the Base *distinguished* is being viewed as (synchronically) underived; in other words *dis-* has not been introduced by a WFR and hence is irrelevant in terms of a morphological condition.

Assuming therefore morphological conditions, but at the same time restricting their application following the Adjacency Constraint, we formulate the *-´ik* WFR as in (6.6). The phonological condition relies on the input's stem being analysed into an underlying stem and suffix. For example, with *sezonn´ik* 'seasonal worker' this would be *sezon* and *-n*.

(6.6)

- *´ik* WFR

structural description	⇒	structural change
syntax:		syntax:
c adjective		adjective → noun
semantics:		semantics:
c		X → ' person related to X'
morphology:		phonology:
c stem ((Base stem) - n OR - ov OR -´an)		stem → stem -´ik

6.4.2. Exceptions to the - *´ik* WFR

Exceptions to the WFR in (6.6) will either be syntactic, i.e. Derivatives whose Bases belong to other than the class of nouns, or 'morphological'. There are only two examples known to the author where the Base belongs to the class of verbs, namely *poruč´ik* 'lieutenant' derived from *poruč´i(t´)* 'entrust' and *nit´ik* 'moaner' from *ni(t´)* 'to moan'. Table 6.15 lists examples where the Base is a noun.

sotn´(a)	hundred (group)	sotn´ik	lieutenant (Cossack)
solodovn´(a)	malthouse	solodovn´ik	malthouse worker
spletn´(a)	gossip	spletn´ik	gossip (person)
č´ud(o)	wonder	č´ud´ik	eccentric

TABLE 6.15. Syntactic exceptions to the - *´ik* WFR.

There a number of examples where the morphological condition is not met. Examples in Table 6.16 show that underived adjective Bases are possible. Note that *agrarn(ij)* and *skromn(ij)* are underived despite the stem final /n/.

star(ij)	old	star´ik	old man
agrarn(ij)	agrarian	agrarn´ik	agriculture specialist
skromn(ij)	modest	skromn´ik	modest person

TABLE 6.16. Morphological exceptions to the - *´ik* WFR

6.5. The *-n´ik* WFR

Examples of nouns in *-n´ik* are given in Table 6.17. Note the allomorphy with *-n´ik* suffixation. The Base's stem final consonant is palatal if it is /l/ or a velar, and non-palatal if other. Thus *sokol* 'falcon' > *sokol´n´ik*, *katorg(a)* 'penal solitude' > *katoržn´ik* 'convict' but *vest´* 'news' > *vestn´ik* 'herald'. Recall that this is what we called the C^{1a} grade in chapter one (**1.2.3**).

bariš	profit	barišn´ik	profiteer
izmen(a)	betrayal	izmenn´ik	traitor
klevet(a)	slander	klevetn´ik	slanderer
skit	monastery	skitn´ik	monk
sokol	falcon	sokol´n´ik	falconer
vest´	news	vestn´ik	herald

TABLE 6.17. Person nouns in *-n´ik*

Syntactic conditions

The main condition on *-n´ik* formation is a syntactic one, namely that Bases belong to the class of nouns. This is illustrated by all the example in Table 6.17. However, we must be careful not to confuse *-n´ik* nouns derived from noun Bases, with-*´ik* nouns derived from adjective Bases in *-n*, as in the case of *krovn(ij)* 'blood' > *krovn´ik* '(blood) relative'. In this case the /n´ik/ segment is not a suffix but a combination of the final consonant of the Base and the suffix -*´ik*. To determine the correct analysis, as a first step we establish whether or not for a given item there are any adjectives in *-n* that could act as its Base. If not, the derivation must be in *-n´ik*. This is the case for all the examples in Table 6.17. Because of the high productivity of the adjective forming suffix *-n*, in a good number of cases an adjectival Base in *-n* is available. We must then look to the semantic composition of the Derivative[8]. For example *škol´n´ik* 'pupil' has formally two possible derivations due to the existence of the adjective *škol´n(ij)* 'school (adj)'. The derivation from the noun *škol(a)* in the suffix *-n´ik* is preferred because *škol´n´ik* is semantically related to a Base denoting the actual place, rather than an adjective of the place[9].

In Table 6.18 we give examples where an adjective Base in *-n* is available, but the semantic interpretation favours a noun Base. For example a *bortn´ik* 'wild honey farmer' is someone who deals with referents denoted by the Base *bort´* 'wild bee hive', etc.

bort´	bortn(ij)	wild bee hive	bortn´ik	wild honey farmer
butilk(a)	butiloč´n(ij)	bottle	butiloč´n´ik	glass blower
katorg(a)	katoržn(ij)	penal servitude	katoržn´ik	convict
liž(a)	ližn(ij)	ski	ližn´ik	skier
peč´al´	peč´al´n(ij)	grief	peč´al´n´ik	sympathizer

TABLE 6.18. Semantically determined derivation in *-n´ik*.

Phonological conditions

There are no phonological restrictions as such on the Base's stem. However, for some items we might posit a separate stem selected for *-n´ik* derivation. For example *los´* 'elk' derives *los´atn´ik* 'elk hunter' with the formative *-´at* intervening between the root and the deriving suffix, and we would view /´at/ a part of the stem. Examples of this are given in Table 6.20.

los´	los´at-	elk	los´atn´ik	elk hunter
medved´	medvežat-	bear	medvežatn´ik	bear hunter
volk	volč´at-	wolf	volč´atn´ik	wolf hunter
tel´onok	tel´at-	calf	tel´atn´ik	calf-herd

TABLE 6.20. Person nouns in -n´ik derived from Bases in /´at/

A noun such as *los´* 'elk' has two stems in this analysis. One stem is the default, used in all inflection and the majority of derivation (Stem 0, see **6.2.1** above). The second stem, however, is selected by the *-n´ik* WFR. We represent this as in (6.7).

(6.7)

LOS′ {
syntax:
noun
semantics:
' elk'
phonology (stem inventory):
0 / los′/; 1 / los′at /

It will be recalled from **5.3.1** that stems in *-´at* are used in plural inflection. The example we gave was the Russian for 'kitten' which has the form *kot´onok* for singular, and *kot´at(a)* for plural. Now for *tel´atn´ik* in Table 6.20 we give the Base lexeme TEL´ONOK a second stem in *-´at.* which will be used for two functions, plural inflection, and person derivation in *-n´ik.* Note that like the third stem in Latin, and Stem O and Stem 3 posited for Russian verbs in **6.2.1**, this stem is used both in inflection and derivation[10]. Given these conditions we represent the *-n´ik* WFR as in (6.8).

(6.8)

-n´ik WFR

structural description	⇒ structural change
syntax:	syntax:
c noun	noun → noun
semantics:	semantics:
c	X → ' person related to X'
phonology:	phonology:
c stem 1	stem 1 → stem1 - n´ik

6.5.1. Exceptions to the *-n´ik* WFR

The main exceptions are syntactic ones where Bases are verbs rather than nouns. These are listed in Table 6.21. Note that for these examples derivation must be taking place on the verb's Stem 0, the evidence being *balova(t´)* 'spoil' > *balovn´ik* 'spoilt child', and *koč´ova(t´)* 'wander' > *koč´ovn´ik* 'wanderer' (see **6.2.1**), where the Stem 0 is /balov/ and /koč´ov/ respectively.

balova(t´)	spoil	balovn´ik	spoilt child
prestup´i(t´)	transgress	prestupn´ik	criminal
svod´i(t´)	procure	svodn´ik	procurer
koč´ova(t´)	wander	koč´ovn´ik	nomad

TABLE 6.21. Nouns in *-n´ik* with verb Bases

6.6. The *-šč´ik* WFR

As we said in the previous chapter, the meaning associated with *-šč´ik* derivation is 'person related in some way to X'. The main relation seems to be profession. For example, *mebel´* 'furniture' derives *mebelšč´ik* 'furniture maker', and *tramvaj* 'tram' derives *tramvajšč´ik* 'tram worker'. Allomorphy is C[1a] (as with *-n´ik*) e.g. *ban´(a)* 'bath house' > *banšč´ik* 'bath house attendant', but *mebel´* 'furniture' > *mebel´šč´ik* 'furniture maker'. These and further examples are given in Table 6.22.

baraban	drum	barabanšč'ik	drummer
mebel'	furniture	mebel'šč'ik	furniture maker
beton	concrete	betonšč'ik	concrete worker
mogil(a)	grave	mogil'šč'ik	gravedigger
mramor	marble	mramoršč'ik	marble cutter
tramvaj	tram	tramvajšč'ik	tram worker
flejt(a)	flute	flejtšč'ik	flautist
ban'(a)	bath house	banšč'ik	bath house attendant

TABLE 6.22. Person nouns in *-šč'ik*

The suffix *-šč'ik* has an allomorph *-č'ik* which is selected if the Base stem final consonant is /t/ or /d/, and there is no consonant preceding[11]. For example, *vodoprovod* 'plumbing' > *vodoprovodčik* 'plumber'. Examples are given in Table 6.23.

vodoprovod	plumbing	vodoprovodč'ik	plumber
gazet(a)	newspaper	gazetč'ik	newspaper seller
pulem'ot	machine gun	pulem'otč'ik	machine gunner

TABLE 6.23. Person nouns in the allomorph *-č'ik*

Syntactic conditions

Bases of *-šč'ik* nouns are themselves nouns, as can be seen from all the examples in Tables 6.22 and 6.23 above. Apparent counterexamples are given in Table 6.24. where the Base appears to be a verb. According to Isačenko, however, the stress of the *-šč'ik* nouns indicates that they are derived from what is a nominalization of the verb, rather than the verb itself (1969: 51). The example given is *zabastóvšč'ik* where the stress position is inherited from *zabastóvk(a)* and not the ending stress verb *zabastová(t')*, *zabast(úju)*, etc. In the Table the nominalizations are listed alongside their verb Bases and stress is indicated. Given this, we can clearly see that the *-šč'ik* noun inherits its stress from the deverbal noun rather than the verb in all these examples (although *vídumšč'ik* 'inventor' is not a clear cut case, since stress remains fixed on the stem initial syllable throughout).

lakirová(t´)	varnish	lakiróvk(a)	varnish	lakiróvšč´ik	varnisher
osmotré(t´)	inspect	osmótr	inspection	osmótršč´ik	inspector
víduma(t´)	invent	vídumk(a)	invention	vídumšč´ik	inventor
kop´írova(t´)	copy	kop´iróvk(a)	copying	kop´iróvšč´ik	copyist
zabastová(t´)	strike	zabastóvk(a)	strike	zabastóvšč´ik	striker

TABLE 6.24. Nouns in *-šč´ik* with apparent verb Bases

Isačenko follows this morphophonological argument with a semantic one: *zabastovšč´ik* means 'person related to *zabatovk(a)*', i.e. someone who organizes or participates in a strike, rather than 'person who strikes' (1969: 51). We will accept Isačenko's analysis and the truncation rule he proposes to delete the /k/, and in the next chapter we will show how truncation is incorporated into our account by proposing that certain lexemes have in their stem inventory a truncated stem.

Phonological conditions

As with *-n´ik* formation there are cases where the derivation could be said to be taking place on a stem other than the default stem. This second stem may be in *-ov*, examples of which we give in Table 6.25.

les	forest	les-ov-šč´ík	forester
starj(o)	old clothes	starj-ov-šč´ik	old clothes dealer
skob(a)	clamp, shackle	skob-ov-šč´ík	clamp builder
kalandr	calander (machine)	kalandrovšč´ik	calander operator

TABLE 6.25. Person nouns in *-šč´ik* with Bases in /ov/

In some accounts it is noted that the *-ov-šč´ik* complex coincides with monosyllabic stems[12]. This suggests an alternative to an indexed stem analysis, where there are two suffix allomorphs, and the choice between them is governed by number of syllables of the Base's stem. However, though monosyllabicity may be a sufficient condition for the *-ov-šč´ik* allomorph it is not a necessary one since there are monosyllabic Bases in Table 6.22 which are derived in the simple *-šč´ik*. In fact it is not even a sufficient condition since polysyllabic stems such as *kalandr* select the complex *-ov-šč´ik* (Table 6.25)[13].

Given these conditions, we represent the *-šč´ik* WFR as in (6.8). Note that a default that Stem 1 inherits from Stem 0 will capture the fact that Bases with a separate stem on which the derivation is based represent the minority, which we use in the next chapter.

(6.8)

-*šč´ik* WFR

structural description ⇒ structural change

syntax:	syntax:
c noun	noun → noun
semantics:	semantics:
c	X → ' person related to X'
phonology:	phonology:
c stem 1	stem 1 → stem 1 -šč´ik

6.6.1. Exceptions to the -*šč´ik* WFR

Possible exceptions to the -*šč´ik* WFR are syntactic ones where the Base is either an adjective or verb. We have already seen that what appear to be verb Bases are in fact nominalizations of the verbs. Examples of -*šč´ik* nouns derived from adjectives are given in Table 6.26. Note the truncation of /n/ in the Base's stem in the derivation *pod´onšč´ik* 'day labourer', derived from the phrase '*pod´onn(aja) rabot(a)*' meaning 'day labour' according to Švedova (1980: §286).

4a	č´asov(oj)	clock (adj)	č´asovšč´ik	watchmaker
b	lampov(ij)	lamp (adj)	lampovšč´ik	lamp maker
d	pod´onn(ij)	by the day	pod´onšč´ik	day labourer

TABLE 6.26. Nouns in -*šč´ik* with adjective Bases

6.7. Person derivation in -*l´šč´ik*

Both the 1953 and 1980 Academy Grammars list a separate suffix -*l´šč´ik* which productively derives person nouns from verb Bases, for example *nos´il´šč´ik* 'porter' from *nos´i(t´)* 'carry', *r´isoval´šč´ik* 'draughtsman' from *r´isova(t´)* 'draw'[14]. The similarity of this suffix to -*šč´ik* has of course not gone unnoticed, and in many accounts it is viewed as a complex ('derived') variant of -*šč´ik*[15]. We follow, however, Isačenko's analysis where the /l/ formative intervening between the Base's stem and the suffix -*šč´ik* is actually part of the stem rather than part of the suffix (1969: 56-7). In our lexeme-based account we are therefore claiming that a verb Base, in addition to the stems already posited in **6.2.1**, has an extra stem in /l/. This stem we index as

Stem 4. Stem 4 is selected by what we shall call the *-(l´)šč´ik* WFR, and which we shall distinguish from the *-šč´ik* WFR above, following the Unitary Base Hypothesis. Examples of *-(l´)šč´ik* Derivatives and their Bases are given in Table 6.27.

r´isova(t´)	draw	r´isoval´šč´ik	draughtsman
korm´i(t´)	feed	korm´il´šč´ik	feeder
reza(t´)	cut	rezal´šč´ik	cutter
steklova(t´)	turn into glass	stekloval´šč´ik	glass maker
t´anu(t´)	pull	t´anul´šč´ik	stretching machine operator
polo(t´)	weed	polol´šč´ik	weeder
seja(t´)	sow	sejal´šč´ik	sower
plat´i(t´)	pay	platel´šč´ik	payer
tr´as(t´i)	shake	tr´as´il´šč´ik	shaking-machine operator

TABLE 6.27. Person nouns in *-l´šč´ik*

6.7.1. A separate *-(l´)šč´ik* WFR

Recall from the previous chapter that the Unitary Base Hypothesis requires each WFR to be uniquely identified with a set of Bases. To illustrate Aronoff discusses *-able* derivation in English (1976: 48). He gives examples where the Base is a noun, as in *sizeable*, and where it is verb, e.g. *doable*. Is the *-able* WFR a counterexample to the Unitary Base Hypothesis, since the sets of Bases associated with it are not unique? To answer this Aronoff argues for two homophonous *-able* suffixes belonging to two separate *-able* WFRs. These WFRs are distinguished by their structural description: one has a condition on verb Bases, the other on noun Bases. Their structural change is also different. The deverbal *-able* WFR introduces the semantics 'capable of being Xed' whereas the denominal *-able* WFR has the semantics 'characterized by X'.[16]

In the same way we claim that there is a distinction between *-šč´ik* and *-l´šč´ik* derivation based on syntactic category: *-šč´ik* attaches productively to noun Bases (as we showed in the previous section), whereas *-(l´)šč´ik* derivation takes place on verbs[17]. This has been quantitatively verified in Katlinskaja's (1983) study of the *-ščik* and *-l´šč´ik* nouns listed in Lazova's (1974) Reverse Dictionary. She found that of the 220 nouns in *-(l´)šč´ik*, 94% were derived from verbs. We therefore propose a separate *-(l´)šč´ik* WFR which is distinguished from the *-šč´ik* WFR in terms of the conditions it imposes on its input, in accordance with the Unitary Base Hypothesis. Moreover, the structural change of the WFR will be different: the semantic information that the *-(l´)šč´ik* WFR introduces is 'person who Xes', whereas with the

-šč´ik WFR it was 'person related to X'. In addition to syntactic category, the *-(l´)šč´ik* WFR has morphosyntactic conditions, as well as a condition on the Base's stem.

Syntactic conditions

As we have seen, the primary syntactic condition is that the base must be a verb. Secondary conditions are that the verb must be imperfective, and that it must be transitive[18]. All the examples in Table 6.27 have Bases meeting these conditions. Note that this is the exact same set of conditions that was specified for the *-tel´* WFR (example 6.2).

Phonological conditions

As we said above the WFR operates on what we propose is Stem 4 of the verb Base, which we can think of as the WFR's phonological condition. The lexemic representation of *r´isova(t´)* 'draw' with its stem inventory is given in (6.9).

(6.9)

R'ISOVAT' {
syntax:
verb; imperfective; transitive
semantics:
' draw'
phonology (stem inventory):
0 / r'isov/; 1 / r'isova/; 2 / r'isuj/; 3 / r'isovan/; 4 / r'isoval /

As well as the *-(l´)šč´ik* WFR selecting Stem 4 to derive *r´isoval´-šč´ik* 'draughtsman', we claim that Stem 4 is selected by the rule that derives adjectives in *-n* to account for *r´isoval´n(ij)* 'drawing (adj)' as in the phrase '*r´isoval´noe pero*' meaning 'lettering pen'. Thus Stem 4 is associated with (at least) two functions, as with the other indexed verb stems. In some accounts, for example Gvozdev (1961: 191), what we have called Stem 4 is claimed to be the past tense form in *-l*. However, examples can be found where the verb's past tense is clearly not being used for this purpose, for example *tr´as(t´i)* 'shake' has past *tr´as* but derives *tr´as´il´šč´ik* 'shaking-machine operator', and *plat´i(t´)* 'pay' has past *plat´il*, but derives *platel´šč´ik* 'payer'. Furthermore, there is no sense of pastness associated with nouns in *-(l´)šč´ik*, as Gvozdev admits. This suggests that a morphomic account with an indexed stem is preferable. Note that, by default, Stem 4 will be formed by adding /l/ to Stem 1; in the case of *tr´as(t´i)* and *plat´i(t´)* the formation of Stem 4 will be lexically specified.

Given the above conditions, the *-(l´)šč´ik* WFR is represented as in (6.10).

(6.10)

-(l´)šč´ik WFR

structural description	⇒	structural change
syntax:		syntax:
c (primary) verb; (secondary) imperf, trans		verb → noun
semantics:		semantics:
c		X → ' person who Xes'
phonology:		phonology:
c stem 4		stem 4 → stem 4 - šč´ik

6.7.2. Exceptions to the *-(l´)šč´ik* WFR

No exceptions to the primary syntactic condition are known to the author. However, exceptions can be found to the secondary morphosyntactic conditions. Table 6.28 lists Derivatives whose Bases are intransitive, and in Table 6.29 the Bases are perfective.

gul´a(t´)	walk	gul´al´šč´ik	walker
kata(t´)s´a	drive	katal´šč´ik	driver
plaka(t´)	cry	plakal´šč´ik	mourner
bole(t´)	be a fan of	bolel´šč´ik	fan

TABLE 6.28. Nouns in *-l´šč´ik* with intransitive Bases

sklepa(t´)	fasten	sklepal´šč´ik	operator of fastening-machine
skida(t´)	throw	skidal´šč´ik	thrower (for loading goods)

TABLE 6.29. Nouns in *-l´šč´ik* with perfective Bases

6.8. The *-ec* WFR

Before formulating the *-ec* WFR it should be noted that its productivity is questioned in the literature. For example neither Galkina-Fëdoruk et al. (1957: 241) nor Vinogradov (1971: 99) regard derivation in *-ec* as a productive process, apart from in one special case where the Base is in *-sk*. Examples in *-ec* are given in Table 6.30.

podl(ij)	ignoble	podlec	scoundrel
skup(oj)	stingy	skupec	skinflint
znakom(ij)	familiar	znakomec	acquaintance
upr´am(ij)	obstinate	upr´amec	obstinate person
slep(oj)	blind	slepec	blind person
mudr(ij)	wise	mudrec	wise person
č´orn(ij)	black	č´ernec	monk
sč´astl´iv(ij)	lucky	sč´astl´ivec	lucky person
len´iv(ij)	lazy	len´ivec	lazy-bones
l´ub´im(ij)	favourite	l´ub´imec	favourite (noun)

TABLE 6.30 Person nouns in *-ec*

Syntactic conditions

Bases belong to the class of adjectives, as can be seen in the examples in Table 6.30. Recall that this is the same condition as in the *-´ik* WFR.

Morphological conditions

We shall claim that the morphological conditions on *-ec* formation are that the Base stem must not be in the suffixes *-n*, *-ov* or *-´an*. This keeps the *-´ik* and *-ec* WFRs mutually exclusive (see **6.4.1** for morphological conditions of the *-´ik* WFR). Examples meeting these conditions are given in Table 6.30: Bases are underived, as in *skup(ój)* 'stingy' > *skupec* 'skinflint; or in /n/ where the /n/ is not a suffix, as in *č´orn(ij)* 'black' >*černec* 'monk'; or derived but in a suffix other than *-n*, *-ov*, or *-´an*, for example *sč´astl´iv(ij)* 'lucky' > *sč´astl´ivec* 'lucky person' (where the Base is an adjective derived in the qualitative suffix *-l´iv*). Finally, derivation from Bases in *-sk* is the most productive. For example, *martenovec* 'open hearth baker' from the adjective *martenovsk(ij)* in the phrase '*martenovskaja peč´* 'open hearth furnace'; likewise, *marofonec* from '*marafonsk(ij) beg*' marathon (race)'[19]. The relational suffix is truncated in derivation from *-sk* Bases.

Assuming the conditions above, the *-ec* WFR is represented as in (6.11).

(6.11)

-ec WFR

structural description	⇒	structural change
syntax:		syntax:
c adjective		adjective → noun
semantics:		semantics:
c		y →' person related to y'
morphology:		phonology:
-c ((Base stem) - n OR - ov OR -'an)		stem → stem - ec

Note carefully the way in which the morphological conditions are stated in the WFR's structural description. They are specified purely in negative terms, which is denoted by '- c'.

Before closing this sub-section, we should note that the relationship between adjectives in *-sk* and corresponding person nouns in *-ec* is highly productive. It is widely found for example in terms for countries and peoples, such as *makedonsk(ij)* 'Macedonian' and *makedonec* 'person from Macedonia'. However, it should be noted that apart from a derivational relationship, there are two other approaches to account for this productive relationship. In one of these a separate noun Base is found. In the Macedonian example, the Base would be *Makedon'ij(a)* ; this Base then derives the *-sk* and the *-ec* items, where the element /'ij/ must be truncated for both derivations. The other approach is similar except that co-derivation is based on an abstract item. This is proposed both in Isačenko (1969: 52) and Worth (1967: 2280).

The approach we favour is X-*sk* > X-*ec* based on the directionality arguments outlined in Darden (1988). His main arguments are as follows. First, *-ec* is anyway productively added to adjective Bases, as we also have shown (1988: 91). Second, stress behaviour tends to favour derivation from a *-sk* Base. For example, in the set *árm'ij(a)* 'army', *arméjsk(ij)* 'army (adj), *arméec* 'soldier' clearly stress in the *-ec* form follows the adjective and not the noun (1988: 91-3). And third, velar palatalization appears to indicate derivation from the adjective (1988: 93-4). Derivation in *-sk* based on stems in a velar may or may not cause mutation. Where they do not, the Derivative in *-ec* does not usually either, e.g. *Arkadak*, *arkadaksk(ij)*, *arkadakec*. However on occasion it does, e.g. *Viborg*, *viborgsk(ij)*, *viborgec* or *vibořec*. The choice is only open to the *-ec* form though, suggesting it is derived from the adjective in *-sk*, and not the other way round.

6.8.1. Exceptions to the *-ec* WFR

Syntactic exceptions are represented by Bases which are verbs. Examples are given in Table 6.31 . Note that in such examples the suffix appears to attach to the Stem 0 of the verb, the default stem for derivation. Each verb's Stem 0 is given in the second column.

boro(t´)s´a	bor-	fight	borec	fighter
vixod´i(t´)	vixod-	go out	vixodec	emigrant
gres(t´i)	greb-	row	grebec	oarsman
p´isa(t´)	p´is-	write	p´isec	scribe
igra(t´)	igr-	play	igrec	player

TABLE 6.31. Nouns in *-ec* with verb Bases

Another set of syntactic exceptions are those Derivatives whose Bases are nouns. A number of these are nominalizations in *-(n)´ij(o)*, as shown in Table 6.32[20]. Other examples of noun Bases come from Townsend (1975: 172), but note that each has a Derivative in *-sk* , and we claim that this is the true Base, in which case these examples are no longer exceptions. For example we propose *gor(á)* > *górsk(ij)* > *górec*, following Darden's stress argument.

gor(a)	mountain	gorec	mountain-dweller
Len´in	Lenin	len´inec	Leninist
Kanada	Canada	kanadec	Canadian
Korej(a)	Korea	korejec	Korean
poraž-en´ij(o)	defeat	poraženec	defeatist
prosvešč´-en´ij(o)	education	prosvešč´enec	educationalist
poruč´-en´ij(o)	message	poruč´enec	messenger
soprot´ivl-en´ij(o)	opposition	soprot´ivlenec	opposer

TABLE 6.32. Nouns in *-ec* with noun Bases

There is a range of exceptions to the morphological conditions stated on the *-ec* WFR. One kind of exception is where the Base is in the suffix *-n*. Examples of this are listed in Table 6.33 where the *-n* is truncated before *-ec*.

poslann(ij)	sent	poslanec	envoy
oborvann(ij)	torn	oborvanec	ragamuffin
part´ijn(ij))	political party (adj)	part´ijec	party member
stud´ijn(ij)	art school (adj)	stud´ijec	art school student

TABLE 6.33. Nouns in *-ec* with Bases in the suffix *-n*.

Having outlined the WFRs that can be used to account for Russian person formation, in the next chapter we consider their treatment in our declarative account of Russian derivation.

Notes to chapter 6

[1]e.g. Vinogradov et al. (1953: 222), Panov (1968: 176).

[2]Note that a number of classifications have been proposed for Russian verbs. See for example Isačenko (1960: 45-97) for 'productive' classes and (1960: 97-113) for 'unproductive', Pirogova (1969), Zaliznjak (1977: 77-79), and more recently Kempgen (1989).

[3]In the structural change note that at the syntactic level no mention is made of aspect and transitivity. In derivation verbal morphosyntactic features are neutralized. However in certain cases it appears that imperfective aspect is inherited in the complex event reading of the derived noun, according to Sadler et al. (1997). This is restricted (in the main) to *-n´ij(o)* nominalizations where the verb Base is a secondary imperfective (usually in *-iv*) (Sadler et al. 1997: 189-91).

[4]e.g. Galkina-Fëdoruk et al. (1957: 241), Unbegaun (1957: 74) .

[5] e.g. Vinogradov et al. (1953: 217), Galkina-Fëdoruk et al. (1958: 241), Townsend (1975: 173).

[6]e.g. Vinogradov et al. (1953: 217), Galkina-Fëdoruk et al. (1957: 241).

[7]For example the rule introducing the English suffix *-ism* having no sensitivity to whether the Base is derived or underived (1983: 5).

[8]Gvozdev (1961: 191), Townsend (1975: 173, f.n. 2).

9 Gvozdev (1961: 191) illustrates this point with the Derivative *fokusn´ik* 'conjurer' which must be derived from the noun *fokus* 'trick', and not the adjective *fokusn(ij)* 'focal', i.e. in photography. This is in fact not a very good example, because the adjective is itself a Derivative of a separate homonymous Base *fokus* meaning 'focus'.

[10]However, the /´at/ stem is only used for plural inflection if the lexeme denotes young of animal. Of course, for the majority of noun Bases the simple stem is used. This can be captured by a stem formation rule that states that by default Stem 1 inherits from Stem 0, as we shall see in the next chapter.

[11]Panov (1968: 184, fn. 13), Čurganova (1973: 155-6).

[12]e.g. Švedova (1980: §331), Katlinskaja (1983: 542).

13 Katlinskaja (1983: 546) qualifies the phonological condition by stating that monosyllabic stems must be -sonorant (citing Reformatskij 1967: 325).

[14]Vinogradov et al. (1953: §292); Švedova (1980: §214).

[15]e.g. Vinogradov et al. (1953: §292); Townsend (1975: 175).

[16]Another difference is that only the output of the deverbal *-able* WFR subsequently derives abstract nouns in *-ity*, e.g. *doability*, but not **sizeability*, instead *sizeableness*. The reason for *fashionability* as well as *fashionableness* is that *fashionable* can have either a deverbal or denominal interpretation, i.e. is the output of both WFRs.

[17]e.g. Švedova (1980: §214).

[18]See for example Galkina-Fëdoruk (1957: 241), Švedova (1980: §214), Katlinskaja (1983: 544, 547).

[19]Examples from Vinogradov and Švedova (1964: 58).

[20]See Vinogradov et al. (1953: 215).

SECTION IV

Declarative Lexeme Formation

Chapter 7:
Declarative word formation rules

In Section II we outlined the Network Morphology framework and in Section III we presented a lexeme-based account of the Russian data assumed by the framework. We are now in a position to offer a Network Morphology account of the derivation of Russian nouns denoting 'person'. The present chapter shows how those WFRs for Russian person derivation proposed in chapter six can be given a declarative interpretation within the Network Morphology framework. The following chapter explores exactly how the generalisations residing in the derivational system can best be captured, while at the same time allowing for exceptionality to be stated. The DATR fragments associated with both chapters appear in full in the appendices, and constitute our formalised account of the data.

7.0. Introduction

The person WFRs proposed for Russian in chapter six, whose theoretical underpinnings were discussed in chapter five, are given a declarative interpretation. We showed in chapters three and four that Network Morphology is a network of orthogonally related hierarchies, the main ones being the Lexemic hierarchy and the Inflectional hierarchy. WFRs, their structural change and structural description, are declaratively encoded in a third hierarchy, the Derivational hierarchy.

In **7.1** we introduce the Derivational hierarchy and the way a WFR's structural change is encoded, and then we detail how the structural descriptions of the various WFRs posited in chapter six are incorporated. In **7.2** we look at phonological conditions in terms of how stem indexing is encoded. Syntactic conditions are discussed in **7.3** and semantic and morphological conditions in **7.4** and **7.5** respectively.

7.1. Introducing the Derivational hierarchy

The Derivational hierarchy, like the Inflectional hierarchy, is orthogonal to the Lexemic hierarchy. Recall that the leaf nodes of the Lexemic hierarchy are the lexical entries themselves, representing lexemes. What distinguishes derived lexemes from underived is that for derived entries the stem is not specified; instead it is inherited partly from the lexical entry representing its Base, and partly from the Derivational hierarchy. The Lexemic and Derivational hierarchies are connected via network relations, and in this way a Derivative lexical entry can inherit the structural change of a WFR in the form of a suffix which is recorded in the Derivational hierarchy.

7.1.1. Lexical entries: underived and derived

Both derived and underived lexical entries contain facts corresponding to the three levels of description of a lexeme, but they differ in the way these facts are given. Examples of the lexical entries for the underived lexeme *atom* 'atom' and the derived *atomn´ik* 'atomic scientist' are represented in (7.1) and (7.2) respectively. Syntactic class for underived entries is inherited from the syntactic class node in the Lexemic hierarchy, as can be seen for `Atom` in (7.1). For derived entries this is specified as derived information, as is semantics. In fact, since the derived semantic feature person infers the derived syntactic category noun we only need state `<deriv sem feature>` if this inference is recorded in the hierarchy. This is expressed by the `SEM_SYNCAT` node (7.3). The phonological level of a derived lexical entry, i.e. its stem, is partly determined on the basis of this information. (Note that though (7.2) does not show this, it will be made clearer how this is achieved as we proceed.)

(7.1)

```
Atom:
    <> == NOUN
    <root> == atom
    <stem> == <root>[1]
    <gloss> == atom
    ...
```

(7.2)

```
Atomn´ik:
    <> == LEXEME
    <deriv sem feature> == person
    ...
```

(7.3)

```
SEM_SYNCAT:
    <person> == noun
    ...
```

For derived lexical entries the stem is therefore inherited information, whereas it is specified for underived. The stem is inherited from two sources, the Derivational hierarchy (via the Lexemic hierarchy) for the suffix part, and the lexical entry's Base for the root part. We begin by discussing inheritance from the Derivational hierarchy. The Derivative *atomn´ik* inherits from the node `LEXEME` to express the fact it is a lexeme (7.2). From here it receives the definition of its stem, represented in (7.4). It should therefore be carefully noted that `Atomn´ik` is the lexeme's label, and does not denote the fact that for this item the suffix *-n´ik* is assumed to be lexically specified. Note that in the next section we will modify (7.4) to accommodate stem indexing.

(7.4)

```
LEXEME:
   <stem> == "<base stem>" "<deriv suffix>"
   ...
```

(7.4) expresses that the stem of a complex lexeme is analysed as consisting of two parts. The first part corresponds to what is taken to be the stem of the lexeme's Base; the second is the phonological material introduced in the derivation. This is shown in the theorem list of `Atomn´ik` in (7.5c, d, e), Note that the sentences are extensional as represented by the single equals. To avoid confusion we give extensional sentences in bold type.

(7.5)

```
a. Atomn´ik:<deriv sem feature> = person.
b. Atomn´ik:<deriv syn cat> = noun.
c. Atomn´ik:<deriv suffix> = n´ik.
d. Atomn´ik:<base stem> = atom.
e. Atomn´ik:<stem> = atom n´ik.
f. Atomn´ik:<gloss> = atomic scientist.
```

The value for `<deriv suffix>` (7.5c) is found in the Derivational hierarchy, as we shall see. But the value for `<base stem>` (7.5d) will be found at a lexical entry representing the Derivative's Base. This means we need to allow for Derivative lexical entries to have Base lexical entries available as a source of inheritance, as well as the node LEXEME. This can be achieved if we recall that Network Morphology supports multiple inheritance (see **3.4**). Figure 7.1. shows how, for its stem, the Derivative `Atomn´ik` multiply inherits from LEXEME and its Base `Atom`.

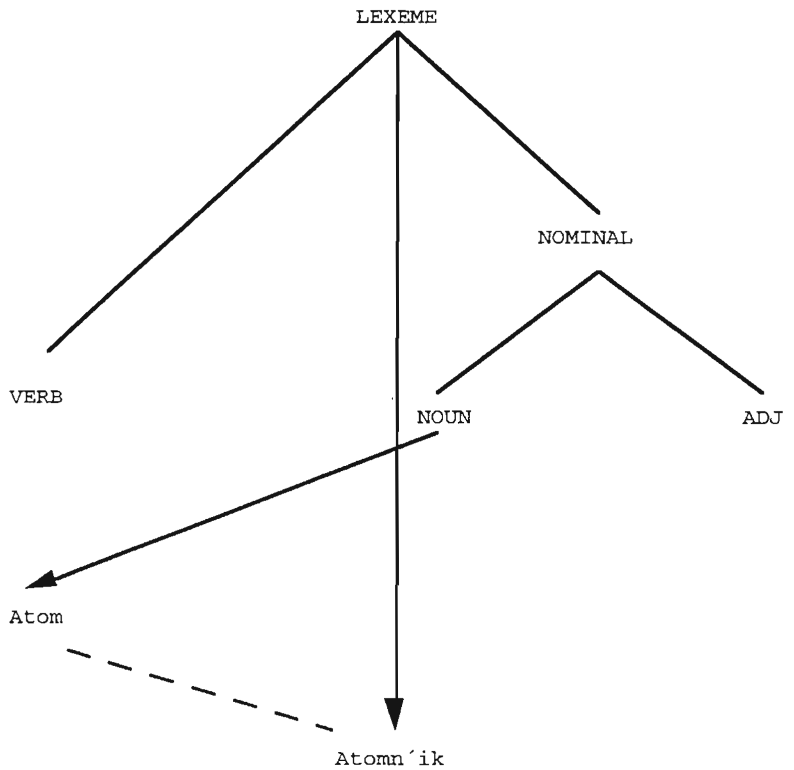


FIGURE 7.1. The Derivative `Atomn´ik` multiply inheriting from `LEXEME` and `Atom`

The DATR representation of Figure 7.1. is given in (7.6) to (7.8).

(7.6)
```
LEXEME:
    <stem> == "<base stem>" "<deriv suffix>"
    ...
```
(7.7)
```
Atom:
    <> == NOUN
    <stem> == atom
    ...
```
(7.8)
```
Atomn´ik
    <> == LEXEME
    <base> == "Atom:<>"
    ...
```

From Figure 7.1. and its DATR representation we see that what distinguishes derived and underived lexical entries is their main source of inheritance. For `Atomn´ik` it is the top node in the Lexemic hierarchy, the node LEXEME. This is represented by the empty angled brackets in (7.8)[2]. All syntactic category nodes are by-passed which expresses that Derivatives need not be marked for syntactic class, since this information is assumed to be encoded in the derivation. For example, part of person derivation is the introduction of the syntactic category "noun" (as expressed by the inference in (7.3)). Taking this one step further, a particular derivation will also include inflectional class information. For example, *otkritk(a)* need not be marked as belonging to class II, but this information can instead be recorded as part of the statement about *-k(a)*[3]. On the other hand, underived lexical entries require their syntactic category to be given, and in accordance with current Network Morphology accounts this is expressed by marking them to inherit from syntactic category nodes in the Lexemic hierarchy. Atom therefore maximally inherits from NOUN.

In Figure 7.1 the dashed line expresses that for Atomn´ik the lexical entry Atom is the secondary source of inheritance[4]. An explanation of how the Base lexical entry is represented as the secondary inheritance source in (7.8) is in order. The equation <base> == "Atom:<>" expresses that all paths at Atom, including the path <stem>, are inherited by Atomn´ik and re-labelled with the prefix attribute base. Hence the value for the path <stem> at Atom (7.7) is inherited as the value of the labelled path <base stem> for Atomn´ik. At Atomn´ik the value for <base stem> will therefore be atom.

Figure 7.1 and the DATR examples (7.6) to (7.8) show that both derived and underived lexical entries inherit from the Lexemic hierarchy. Recall from **4.3.** that in Network Morphology the Lexemic hierarchy represents the level of linguistic description of the lexeme. As such it is central to a hierarchy representing morphological information, and just as we showed the way it interacts the Inflectional hierarchy in chapter four, we now look at its interaction with the Derivational hierarchy.

7.1.2. The Lexemic and Derivational hierarchies

The lexeme-based nature of Network Morphology is expressed by the way lexical entries inherit maximally from the Lexemic hierarchy, and the way the Lexemic hierarchy is linked to morphological hierarchies for morphological information about lexical entries. It will be recalled from chapter four that the relation between the Lexemic hierarchy and the Inflectional hierarchy was used to highlight the two types of inter-node relation in Network Morphology, hierarchy relations and network relations. Figure 4.1 is repeated here as Figure 7.2, and represents the interaction of the two hierarchies, where the unbroken lines express hierarchy relations and the broken lines network relations. Recall from **4.1** that whereas hierarchy relations define a hierarchy, network relations express how hierarchies interact within the same network.

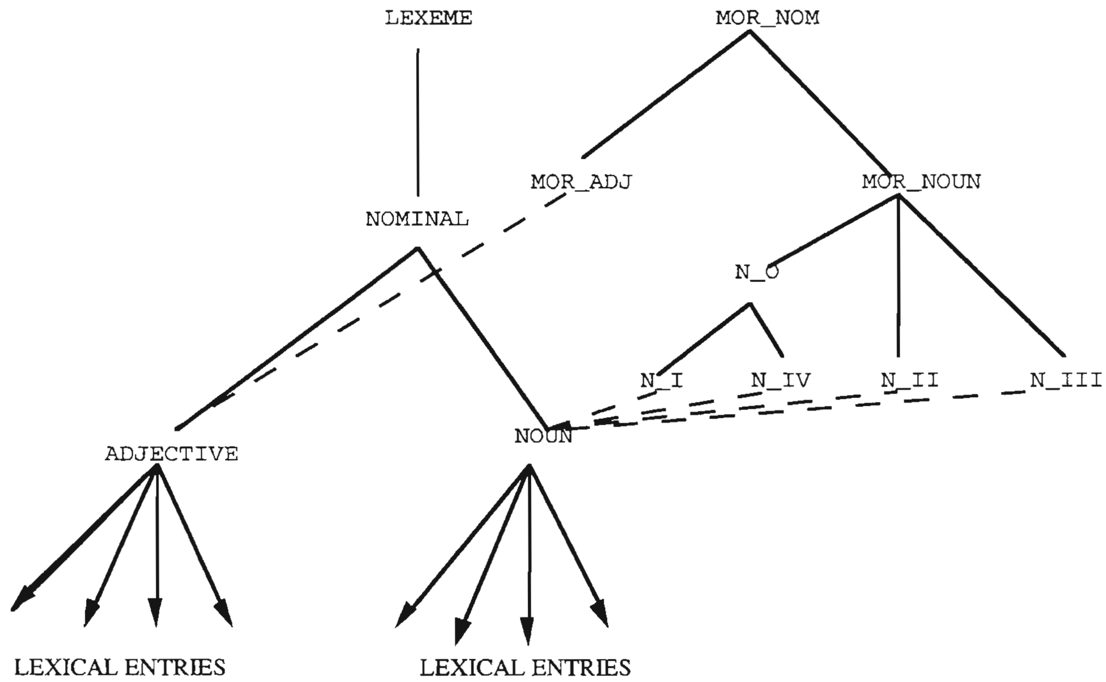


FIGURE 7.2. The Lexemic hierarchy and the inflectional hierarchy[5]

If the nature of the interaction between two hierarchies representing two linguistic levels is to be found in the nature of the network relations between them, to see how the Lexemic hierarchy interacts with the Derivational hierarchy we need to explore the nature of the network relations between these two hierarchies. Consider first the way in which the Inflectional hierarchy extends the Lexemic hierarchy in the sense that it holds additional information about lexemes, namely their inflectional behaviour. In this way the fundamental shape of the Inflectional hierarchy is determined by the Lexemic hierarchy, as can be seen from the projection effect in Figure 7.2. Since the Derivational hierarchy describes additional information about a lexeme's derivational patterns, we would expect the shape of the Derivational hierarchy to be determined by the Lexemic hierarchy, and for this to be expressed in the network relations running between the two hierarchies. Figure 7.3. shows the Derivational hierarchy as a projected image of the Lexemic hierarchy, with the network relations between the two hierarchies in place.

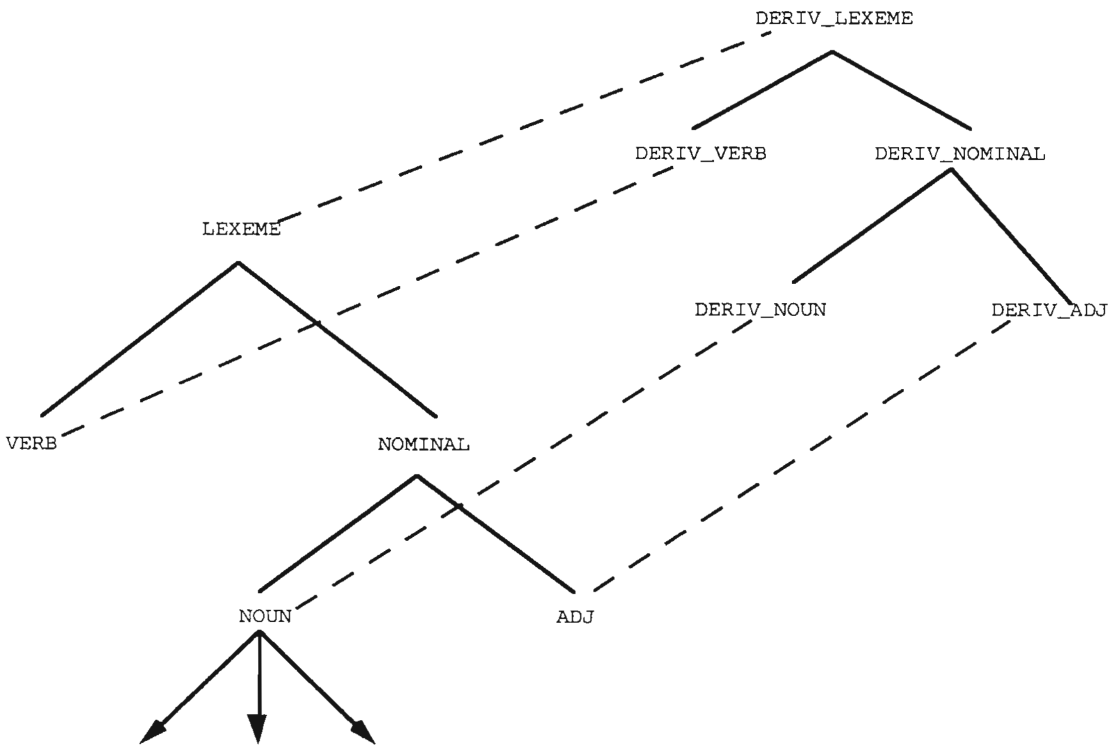


FIGURE 7.3. The Derivational hierarchy as a projected image of the Lexemic hierarchy

Recall from chapter four that to distinguish the network and hierarchy relations we adopt the Hierarchy Identity Convention which requires a single identifying attribute to appear in first position. This distinguishes nodes of facts of one hierarchy from nodes of facts belonging to another. We showed that the hierarchy identifier attribute for the Inflectional hierarchy is `mor`, and as an example used the evaluation of syntactic gender. This we represent again in (7.9).

(7.9)

```
NOUN:
    <syn gender> == GENDER:<"<sem sex>">
    ...


GENDER:
    <undifferentiated> == "<mor formal gender>"
    ...
```

To meet the Hierarchy Identifier Convention in our derivational account we use the attribute `deriv` as the identifier for the Derivational hierarchy. (7.10) represents how the network relation from the node LEXEME in the Lexemic hierarchy to the top-most node DERIV_LEXEME in the Derivational hierarchy is via a path containing the hierarchy identifier `deriv`.

(7.10)

```
LEXEME:
    <deriv> == DERIV_LEXEME
    ...
```

(7.10) expresses that at the most general level, information about lexemes of a derivational nature is referred to the node DERIV_LEXEME in the Derivational hierarchy, and that this derivational information is identified as such by having paths prefixed by deriv. This means that evaluations in the Lexemic hierarchy based on a network relation from the Derivational hierarchy will contain a path prefixed with deriv, just as we saw a path prefixed with mor identifying the Inflectional hierarchy as the relevant hierarchy in the evaluation of gender. Now in the evaluation of a complex lexeme's stem in (7.6) we see how the node LEXEME in the Lexemic hierarchy requires the evaluation of the query lexical entry's Base's stem, and the suffix used in the derivation. The last value is inherited from the Derivational hierarchy. The fact that this is a network relation to the Derivational hierarchy, and not another hierarchy, is expressed by the Derivational hierarchy's identifying attribute appearing in first position in the evaluable path, i.e. "<deriv suffix>".

Having established <deriv suffix> as a path in the Derivational hierarchy, we now see how the Derivational hierarchy evaluates such paths. In other words, we look at how suffixes introduced by WFRs are defined by the Derivational hierarchy, and thus how the structural change of a WFR is declaratively encoded.

7.1.3. Structural change of WFRs in the Derivational hierarchy

Recall from **5.2.1** that structural change specifies the change in a Base's syntactic category, and concomitant change in its semantic make-up, which corresponds to a change in stem shape. The Derivational hierarchy matches the suffix used in the derivation with derived syntactic and semantic information. This is shown in (7.11) and (7.12) which expresses the structural change of the *-tel´* WFR (see **6.2**).

(7.11)

```
NODE_1:
    <deriv suffix> == NODE_2:<"<deriv syn cat>"
                              "<deriv sem feature>">
    ...
```

(7.12)

```
NODE_2:
    <noun person> == tel´
    ...
```

First, the paths in (7.11) express the three types of information introduced in a derivation, the suffix, the syntactic category and the semantic feature. Note that the attribute deriv identifies this information as derived information. Derivative lexical entries are assumed to have values for the paths <deriv syn cat> and <deriv sem> as we saw in the theorem list for Atomn´ik in (7.5a, b). These values are retrieved from the query lexical entry to evaluate what suffix the query lexical entry will inherit. The structural change is thus encoded by matching the derived syntactic and semantic features that are recorded at a Derivative lexical entry with a particular suffix. (7.11) shows that the Derivational hierarchy represents the match as an evaluation, where (7.12) expresses that a query lexical entry which has been specified as derived with the syntactic class Noun and the semantic feature Person will inherit the suffix *-tel´*.

In (7.8) the equation containing the path <base> at Atomn´ik expresses that by default all facts stated at Atomn´ik's Base are inherited. This means that in principle any of the features of the Base may be used in the Derivational hierarchy for evaluations. A candidate base (or input) for a particular WFR must be shown to fulfil conditions imposed by the WFR in order to be considered a legitimate base. In the remaining sections we show how the structural description of WFRs is declaratively encoded by allowing reference to be made to the Base's phonological, syntactic, semantic and 'morphological' features.

7.2. Incorporating phonological conditions

In the previous chapter in **6.2.1** we showed that the *-tel´* WFR is sensitive to the stem type of its input verb, and out of the stems that make up the verb's inventory Stem 1 is (nearly) always selected. Stem 1 is also used for a number of the inflectional categories, for example infinitive and past. We viewed stem selection as a phonological condition since the stem is the morphologically relevant sound form of the lexeme (**5.3**). In this section we look at phonological conditions in our declarative model in terms of stem selection and stem formation. First we show that though stem selection may be stated lexically, in the case of the *-tel´* WFR where the selection is part of the rule a more economical alternative is to state it in the Derivational hierarchy. We then look at the stems themselves and show how the relations between them can be expressed by declarative 'stem formation rules'. Because in some cases these rules generalise over whole classes, the rules are also stored in the hierarchy.

7.2.1. Encoding stem selection

In **6.2.1** we demonstrated that verbs can be represented as lexemes with an inventory of stems. Each stem is indexed, and an index corresponds to a range of morphological functions, following Aronoff. The verb *tolkova(t´)* 'interpret' was represented as (7.13).

(7.13)

TOLKOVAT′ $\left\{\begin{array}{l}\text{syntax:}\\ \text{verb; imperf; trans}\\ \text{semantics:}\\ \text{' interpret'}\\ \text{phonology (stem inventory):}\\ \text{0 / tolkov/; 1 / tolkova/; 2 / tolkuj/; 3 / tolkovan /}\end{array}\right.$

To capture deverbal person derivation in *-tel´* being based on Stem 1, one approach would be to list all the stems in the Base lexical entry, and have the Derivative lexical entry select the appropriate stem. The actual suffix is inherited from the hierarchy, as we showed above. This is represented in (7.14) and (7.15) where the selection of Stem 1 by the Derivative is expressed by the fact (7.15c) at `Tolkovatel´`, and Stem 1 is lexically listed in the Base in (7.14d). In actual fact (7.14) is modified in the next section in favour of a more economical representation of stem information.

(7.14)

```
Tolkovat´:
   a. <> == VERB
   b. <root> == tolk
   c. <stem 0> == tolkov
   d. <stem 1> == tolkova
   e. <stem 2> == tolkuj
   f. <stem 3> == tolkovan
   ...
```

(7.15)

```
Tolkovatel´:
   a. <> == LEXEME
   b. <base> == "Tolkovat´:<>"
   c. <base stem> == "Tolkovat´:<stem 1>"
   d. <deriv sem feature> == person
   ...
```

In **6.5.** we argued that the complex suffix *-´at-n´ik* could be interpreted as derivation in simple *-n´ik* based on a special stem in /´at/ of the Base. Stems in /´at/ are anyway posited for plural inflection of nouns denoting young of animals (e.g. *kot´onok, kot´at(a)*), as we saw in **5.3.1**. The Derivative *los´atn´ik* 'elk hunter' and its Base *los´* 'elk' are represented in (7.16) and (7.17). Note that (7.16) will be modified in the next section to make it less redundant.

(7.16)

```
Los´:
    <> == NOUN
    <stem 0> == los´
    <stem 1> == los´at
    ...
```

(7.17)

```
Los´atn´ik:
    <> == LEXEME
    <base> == "Los´:<>"
    <base stem> == "Los´:<stem 1>"
    <deriv sem feature> == person
    ...
```

One crucial difference between derivation in *-n´ik* and derivation in *-tel´* with regard to stem selection is that stem selection is regular with the suffix *-tel´* since almost without exception *-tel´* attaches to Stem 1, whereas there are only a handful of *-n´ik* words based on the /´at/ stem. To encode stem selection as part of the rule we specify it in the Derivational hierarchy, as represented in (7.18) and (7.19). Comparing (7.18a) with the earlier (7.4) we note the additional evaluable path `"<index>"`. This expresses that a derived stem[6] is defined not as a suffix added to simply the Base's stem, but more specifically it is defined as a suffix added to a particular indexed stem of the Base. This can be Stem 1, 2, 3, etc. In other words, it assumes that Base lexical entries have a range of indexed stems. Which indexed stem is selected is expressed by (7.18b) and (7.19). In (7.18b) we see that the index of the stem depends on the type of derivation, i.e. the syntactic category of the Base and the semantics of the derivation. In (7.19a) we can see that for example deverbal person derivation (which is productively realised by the suffix *-tel´*) will be based on stems with index 1. Note the default (7.19b) that any other type of derivation, represented by the empty angle brackets, will be based on Stem 0. Recall from **6.2.1** that for example the *-k* nominalizations such as *pobelk(a)* 'whitewashing' are based on Stem 0 (i.e. /pobel/).

(7.18).

```
LEXEME:
    a. <stem> == "<base stem "<index>">" "<deriv suffix>"
    b. <index> == STEM_SELECTION:<"<base syn cat>"
                                          "<deriv sem feature>">
    c. <base stem> == "<root>"
       ...
```

(7.19)

```
STEM_SELECTION:
    a. <verb person> == 1
    b. <> == 0
       ...
```

It should be noted that stem selection is expressed independently of *-tel´* suffixation. Stem 1 is associated with the function 'deverbal person formation', and not directly with the suffix *-tel´*. Since deverbal person formation is productively realized by *-tel´*, in one sense the stem selection could be viewed as part of the *-tel´* WFR. But by separating the function from its realisation we are more closely expressing Aronoff's 'morphomic' level. If we wished to express correspondence of stem with inflectional categories, we would simply add a referral at `STEM_SELECTION` such as `<mor inf> == <verb person>`. In this way we capture disparate functions being united by a single index at the morphomic level.

7.2.2. Encoding stem formation

As we noted, the Base lexical entries in (7.14) and (7.16) specify their inventory of stems in a somewhat redundant fashion. To capture the similarity of the stems we can encode stem formation rules in the hierarchy. Derivation based on Stem 0 is the default, and we saw how this is represented in (7.19b), which we can think of as the stem selection default. An example was given in **6.2.1** where the derivation of the result noun *del(o)* from the verb *dela(t´)* is based on Stem 0. In terms of stem formation, the first generalization we need to capture is that by default Stem 0 coincides with the root. This is represented in (7.20).

(7.20)
```
NOUN:
    <stem 0> == "<root>"
    ...

VERB:
    <stem 0> == "<root>"
    ...
```

Given this, (7.16) can be modified as (7.21). By default a Base lexical entry's 'basic' stem (Stem 0) coincides with its root. In the case of `Los´` the complex stem `<stem 1>` is specified as the basic stem `<stem 0>` plus the formative `´at`. We noted in **6.2.1** that for some verbs Stem 0 must be distinguished from the root. This is the case for *tolkova(t´)* which derives the alternative person noun *tolkovn´ik* based on /tolkov/. Now /tolkov/ is distinct from the root stem /tolk/ and will therefore have to be specified as such in the lexical entry, as done in (7.14b, c) above.

(7.21)
```
Los´:
    <> == NOUN
    <root> == los´
    <stem 1> == <stem 0> ´at
    ...
```

The formal relationship between stems in a lexeme's stem inventory is therefore captured by expressing them as referrals to one another. For `Tolkovat´` we modify (7.14) as (7.22). This expresses that Stem 0 /tolkov/ and Stem 2 /tolkuj/ are both based on the root stem /tolk/; in turn Stem 1 /tolkova/ is based on Stem 0 /tolkov/, and Stem 3 /tolkovan/ is based on Stem 1 /tolkova/.

(7.22)

```
Tolkovat´:
   a. <> == VERB
   b. <root> == tolk
   c. <stem 0> == <root> ov
   d. <stem 1> == <stem 0> a
   e. <stem 2> == <root> uj
   f. <stem 3> == <stem 1> n
   ...
```

The node represented in (7.22) expresses lexically specified stem formation. But the pattern in (7.22) will be repeated for a whole class of verbs, what we labelled the I-*ov* class in **6.2.1**. To capture this we push the facts in (7.22) up the Lexemic hierarchy and declare them at a node `VERB_I_OV` (7.24), which inherits from `VERB` (7.23). Ultimately we would establish nodes for all the classes in this fashion. In fact a Network Morphology account of verbal inflection along these lines has already been put forward by Dunstan Brown in a number of papers (Brown 1995, forthcoming a). Note that Stem 0 coinciding with the root stem is the default for verbs (7.23c), but this is overridden in the I-*ov* class where the formative /ov/ added to the root encodes Stem 0.

(7.23)

```
VERB:
   a. <> == LEXEME
   b. <syn cat> == verb
   c. <stem 0> == "<root>"
   ...
```

(7.24)

```
VERB_I_OV:
   <> == VERB
   <stem 0> == "<root>" ov
   <stem 1> == "<stem 0>" a
   <stem 2> == "<root>" uj
   <stem 3> == "<stem 1>" n
   ...
```

Having discussed the incorporation of phonological conditions in terms of encoding stem selection and stem formation rules, we turn to the declarative encoding of syntactic conditions.

7.3. Incorporating syntactic conditions

To illustrate the incorporation of syntactic conditions we look at how the *-n´ik*, *-tel´* and *-´ik* WFRs as discussed in **6.5**, **6.2.1** and **6.4.1** are declaratively encoded. We showed in (7.6) and (7.8) that a Derivative lexical entry such as `Atomn´ik` is referred to `DERIV_LEXEME` for derivational information via `LEXEME`. To capture the relevance of its Base's syntactic category, a network relation links `DERIV_LEXEME` to the node in the Lexemic hierarchy that stands for the syntactic category of the query lexical entry's Base. For example, this would be `NOUN` if the query lexical entry were `Atomn´ik`, since its Base `Atom` is a noun. This is shown by the network relations in Figure 7.4.

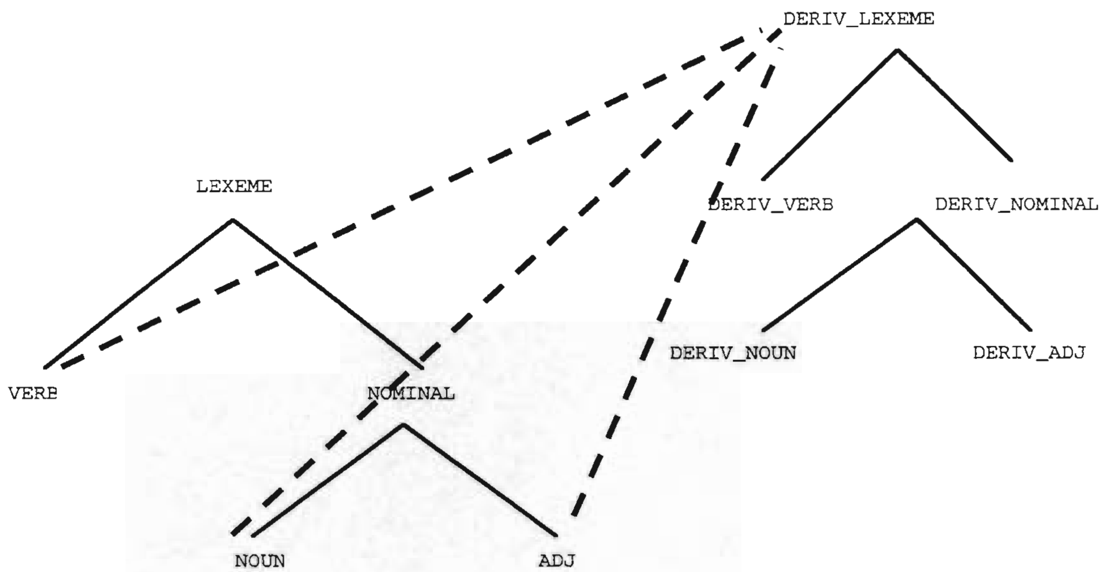


FIGURE 7.4. Network relations from the Derivational to the Lexemic hierarchy

The DATR representation of Figure 7.4 is given in (7.25) and (7.26). In (7.25) at `DERIV_LEXEME` the value for `<deriv suffix>` is expressed as being dependent in the first instance on the value of the path `<base syn cat>`, i.e. the syntactic category of the lexical entry's Base. Note that the value for `<base syn cat>` will be made available to Derivative lexical entries in the same way as the value for `<base stem>` was (see discussion relating to Figure 7.1).

(7.25)

```
DERIV_LEXEME:
   <deriv suffix> == SYNCAT_INTERDEPENDENCY:<"<base syn cat>">
   ...
```

The interdependency node SYNCAT_INTERDEPENDENCY (7.26) contains interdependent defaults relating syntactic category information to the appropriate node in the Lexemic hierarchy. Taken together, (7.25) states that the query lexical entry's suffix depends on the syntactic category of its Base. If it is a noun, (7.26a) states that the subsequent evaluation is from a path at NOUN. This expresses the network relation from DERIV_LEXEME to NOUN in Figure 7.4.

(7.26)

```
SYNCAT_INTERDEPENDENCY:
   a. <noun> == NOUN:<deriv suffix>
   b. <adj> == ADJ:<deriv suffix>
   c. <verb> == VERB:<deriv suffix>.
```

(7.26a) states that a reference is made to the path <deriv suffix> at the syntactic category node NOUN. As can be seen in (7.27) to (7.29), all syntactic category nodes have a path <deriv>. Now these paths in turn refer to DERIV_NOUN, DERIV_ADJ and DERIV_VERB in the Derivational hierarchy. In other words, they are used to link syntactic category nodes in the Lexemic hierarchy with parallel nodes in the Derivational hierarchy from where derivational information in the form of suffixes is eventually inherited. We can represent this diagrammatically as links going the other way (Figure 7.5).

(7.27)

```
NOUN:
   <deriv> == DERIV_NOUN
   ....
```

(7.28)

```
ADJ:
   <deriv> == DERIV_ADJ
   ...
```

(7.29)

```
VERB:
   <deriv> == DERIV_VERB
   ...
```

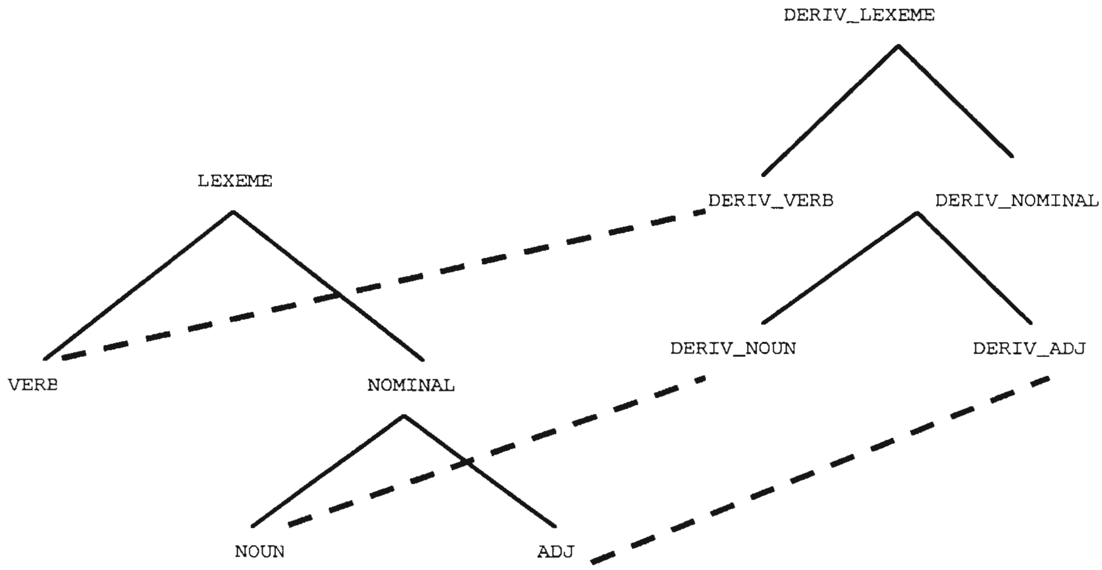


FIGURE 7.5. Network relations from the Lexemic to the Derivational hierarchy

We can now illustrate with `Atomn´ik` how the syntactic category of a Base is used to determine the suffix. In (7.8) we see that `Atomn´ik` inherits from `LEXEME`, and in (7.10) that at `LEXEME` any path beginning `<deriv>`, including `<deriv suffix>`, is referred to `DERIV_LEXEME`. At `DERIV_LEXEME` it is stated that the suffix depends on `Atomn´ik`'s Base's syntactic category (7.25). The interdependency node refers further evaluation to `NOUN` (7.26a) since `Atomn´ik`'s Base, `Atom`, is a noun. (7.30) to (7.32) express the link from `NOUN` in the Lexemic hierarchy to `DERIV_NOUN` in the Derivational hierarchy, from where `n´ik` is eventually inherited (7.32). Note that '`DERIV_DE_NOUN`' expresses 'derived from noun'.

(7.30)

```
NOUN:
   <deriv> == DERIV_NOUN
   ...
```

(7.31)

```
DERIV_NOUN:
   <deriv suffix> == DERIV_DE_NOUN:<"<deriv syn cat>"
                                   "<deriv sem feature>">
   ...
```

(7.32)

```
DERIV_DE_NOUN:
   <noun person> == n´ik
   ...
```

For the *-tel´* and *-´ik* WFRs, where the syntactic conditions are on verb and adjective Bases respectively, similar nodes are used, as represented in (7.33) and (7.34).

(7.33)

```
DERIV_DE_ADJ:
   <noun person> == ´ik
   ...
```

(7.34)

```
DERIV_DE_VERB
   <noun person> == tel´
   ...
```

7.4. Incorporating semantic conditions

We showed in **7.1.1** (example (7.4)) how the Base's stem is required for the evaluation of a Derivative's stem. We represent the earlier (7.7) and (7.8) again as (7.35) and (7.36) to take into account our discussion of stems in **7.2**. Note again that in (7.36) `Atomn´ik` is the lexeme's label, and the item is of course unspecified for derived suffix. We have just seen how the evaluation of a Derivative's suffix depends on the Base's syntactic category; as we showed in the previous chapter, there appears to be one case where reference to the Base's semantics is needed in Russian person formation, namely in derivations in *-´ist*. A more clear-cut case of a semantic condition is adjective *-sk* formation, which we detailed in **5.2.1**. In this section we show how the semantic conditions of both the *-´ist* WFR and *-sk* WFR are declaratively encoded in the framework.

(7.35)

```
Atom:
   <> == NOUN
   <stem 0> == atom
   ...
```

(7.36)

```
Atomn´ik
   <> == LEXEME
   <base> == "Atom:<>"
   ...
```

7.4.1. Semantic conditions and the *-´ist* WFR

In chapter six we saw that the suffix *-´ist* is restricted to Bases of foreign origin, for example *mašin´ist* 'machine worker' from *mašin(a)* 'machine' (**6.3**). The *-´ist* WFR is represented again in (7.37), showing this restriction in terms of a semantic condition.

(7.37)

-*'ist* WFR

structural description	⇒	structural change
syntax:		syntax:
c noun		noun → noun
semantics:		semantics:
c + foreign		X →' person related to X'
phonology:		phonology:
c		stem → stem -'ist

To capture the condition on semantic features in the evaluation of a suffix, the Derivational hierarchy requires that a value for the path <sem feature> be available at a Derivative lexical entry. Since all path:value pairs are inherited by a Derivative from its Base, to meet this the Base is required to list the relevant semantic information. The Base and its Derivative are represented in (7.38) and (7.39).

(7.38)

```
Mašina
   <> == NOUN
   <root> == mašin
   <sem feature> == foreign
   ...
```

(7.39)

```
Mašin'ist
   <> == LEXEME
   <base> == "Mašina:<>"
   ...
```

The value for the path <base sem feature>, i.e. the Base's semantic feature, is then referred to in the Derivational hierarchy in the evaluation of the path <noun person> (7.40). This is stated at the node DERIV_DE_NOUN, and the actual evaluation takes place at a special node DE_NOUN_PERSON 'person noun derived from noun' (7.41). This node states that if the semantic feature of the Base is foreign, then the suffix 'ist is inherited, otherwise the suffix inherited is n'ik.

(7.40)

```
DERIV_DE_NOUN:
   <noun person> == DE_NOUN_PERSON:<"<base sem feature>">
   ...
```

(7.41)

```
DE_NOUN_PERSON
    <foreign> == ´ist
    <> == n´ik
    ...
```

7.4.2. Semantic conditions and the *-sk* WFR

As we showed in **5.2.1** in relational adjective derivation the selection of the suffix *-sk* over *-ov* depends on whether or not the Base denotes a person (or geographical area). (7.43) shows the lexical entry for the Base *abbat* 'abbot', with the value person for the path <sem feature>. (7.44) gives the Derivative *abbatsk(ij)* which inherits all path:value statements from Abbat using the path <base>, including the path:value pair <sem feature> == person. This is re-labelled as <base sem feature> == person (see discussion relating to Figure 7.1).

(7.43)

```
Abbat:
    <> == NOUN
    <sem feature> == person
    ...
```

(7.44)

```
Abbatskij:
    <> == LEXEME
    <base> == "Abbat:<>"
    <deriv sem feature> == rel
    ...
```

The nodes in (7.45) and (7.46) show how sk is inherited on the basis of the semantic feature in a similar way to the inheritance of ´ist above. Note that the ordering of the attributes in (7.45) expresses 'adjective, and more specifically adjective which is relational (as opposed to, say, qualitative)'. Note that DE_NOUN_REL expresses 'relational adjective derived from noun'.

(7.45)

```
DERIV_DE_NOUN:
    <adj rel> == DE_NOUN_REL:<"<base sem feature>">
    ...
```

(7.46)

```
DE_NOUN_REL
    <person> == sk
    <place> == <person>
    ...
```

In order to account for relational adjectives derived in the competing suffix *-ov*, the Derivational hierarchy simply expresses that any value for `<base sem feature>` other than `person` will result in `ov` being inherited. This is represented by the empty path at `DE_NOUN_REL` shown in (7.47). (7.47) thus expresses that the suffix inherited to derive relational adjectives is *-ov* by default, unless the Base's semantic value is `person` (or `place`).

(7.47)

```
DE_NOUN_REL:
   <person> == sk
   <place> == <person>
   <> == ov.
```

7.5. Incorporating morphological conditions

By incorporating the relevance of the Base's syntactic category and semantic features we have shown how the Derivational hierarchy encodes Aronoff's (1976: 48) Unitary Base Hypothesis (UBH) as a constraint on lexeme formation[7]. Recall from chapter six that a fourth type of condition that characterizes a WFR's structural description is the condition on the Base's morphological structure. This was shown for derivation in *-´ik* in (**6.4.1**), and derivation in *-ec* (**6.8**).

7.5.1. The *-´ik* WFR and morphological conditions

The suffix *-´ik* productively attaches to derived adjective Bases in *-n*, *-ov* and *-´an*, and we gave examples of this in **6.4**. One such example was *krovn´ik* 'relative' which is derived from the relational adjective *krovn(ij)*, which is itself a Derivative in *-n* of *krov´* 'blood'. We represent the *-´ik* WFR again in (7.48) which, amongst other things, states the morphological condition that Base stems contain one of these three suffixes.

(7.48)

-*´ik* WFR

structural description ⇒ structural change

syntax:	syntax:
c adjective	adjective → noun
semantics:	semantics:
c	X → ' person related to X'
morphology:	phonology:
c stem ((Base stem) - n OR - ov OR -´an)	stem → stem -´ik

(7.49) to (7.51) show how the Derivational hierarchy represents the morphological conditions specified in the structural description of the WFR in (7.48). The nodes (7.49) and (7.50) together express that if the Base is an adjective the person suffix depends on the suffix that the Base is derived in. The facts stored at the node DE_ADJ_PERSON (7.51) state that if this suffix is *-n* as in *krovn(ij)* 'relative', or *-ov* as in *frontov(oj)* 'front line', or -*´an* as in *serebr´an(ij)* 'silver', the person suffix will be -*´ik*. Note that two of the three morphological conditions are represented as referrals to the condition that Bases must be in *-n*; this expresses derivation from *-n* Bases being the most productive, in the 'profitable' sense (see **6.1**).

(7.49)

```
DERIV_ADJ:
    <deriv suffix> == DERIV_DE_ADJ:<"<deriv syn cat>"
                                    "<deriv sem feature>">
    ...
```

(7.50)

```
DERIV_DE_ADJ:
    <noun person> == DE_ADJ_PERSON:<"<base deriv suffix>">
    ...
```

(7.51)

```
DE_ADJ_PERSON:
    <n> == ´ik
    <ov> == <n>
    <´an> == <n>
    ...
```

As we pointed out in our discussion of morphological conditions in **6.4.1** we assume that the internal (morphological) structure of Bases must be accessed. This is expressed in our Network Morphology account by representing morphological conditions as conditions on information that is inherited from the Derivational hierarchy, i.e. derivational information. This is expressed in (7.50) by having an evaluable path that contains both the attribute `base` and the hierarchy identifier attribute `deriv`. The first attribute expresses that the information is Base information; the second attribute marks the Base information as being specifically morphological information, in other words information from the Derivational hierarchy. A constraint on how much internal structure a rule is allowed to access is Siegel's Adjacency Constraint (see **6.4.1**). To respect the Adjacency Constraint we ensure that morphological conditions are restricted to immediate Bases, and not beyond. In (7.50) we see that the morphological condition for *-'ik* formation is expressed by the evaluable path <base deriv suffix>. First to note is the hierarchy identifier attribute `deriv` prefixed to `suffix`. This expresses that the value for paths containing `suffix` will be found within the Derivational hierarchy, and this reflects the fact that the Adjacency Constraint will not permit reference to more than the suffix and its base. Second to note is the attribute `base` in the evaluable path, which identifies the suffix as a property of the immediate Base of the query lexical entry. Now the mechanism used for inheriting facts from the Base, that of inheriting all path:value pairs and prefixing them with the attribute `base`, ensures that the query lexical entry is inheriting from the immediate Base and no further. To illustrate consider the derivational chain *krov' > krovn(ij) > krovn'ik* represented in (7.52) to (7.54).

(7.52)

```
Krov':
    <> == NOUN
    <root> == krov'
    ...
```

(7.53)

```
Krovnij:
    <> == LEXEME
    <base> == "Krov':<>"
    <deriv syn cat> == adj
    <deriv sem feature> == undefined[8]
    ...
```

(7.54)

```
Krovn´ik:
   <> == LEXEME
   <base> == "Krovnij:<>"
   <deriv sem feature> == person
    ...
```

The paths that `Krovn´ik` inherits, and then labels with `base`, are all the paths at `Krovnij`. Because this will include the path `<base>` at `Krovnij`, this means that in theory information about `Krovn´ik`'s Base's Base could be queried in contravention of the Adjacency Constraint. Now such a query would require paths of the type `<base base>`, since any information inherited beyond `Krovn´ik`'s Base must itself have paths prefixed by `base`. An adherence to the Adjacency Constraint will therefore be reflected by the absence of paths of the type `<base base>`.

7.5.2. The *-ec* WFR and morphological conditions

Recall from **6.8** that the *-ec* WFR was represented as a negative version of the *-´ik* WFR. In other words, legitimate Bases are viewed as the very Bases that are illegitimate for *-´ik* derivation. The *-ec* WFR is given again in (7.55), with the negative condition ('-c') that Bases are not derived in *-n*, *-ov*, or *-´an*. This implies that underived Bases, as well as Bases derived in the productive *-sk* suffix, are legitimate, as well as Bases derived in unproductive suffixes. Examples can be found in the tables in **6.8**.

(7.55)

-ec WFR

structural description	⇒	structural change
syntax:		syntax:
c adjective		adj → noun
semantics:		semantics:
c		y →' person related to y'
morphology:		phonology:
-c ((Base stem) - n OR - ov OR -´an)		stem → stem - ec

To express the morphological conditions in (7.55) we make use of the empty angle brackets. This is represented in (7.56e), which states that apart form the suffixes in (7.56b-d), any other suffix infers derivation in *-ec*. Note that this includes lack of a suffix, and in this way expresses the possibility of derivation from underived Bases, as in *č'orn(ij)* 'black' > *černec* 'monk'.

(7.56)

```
DERIV_DE_ADJ:
   a. <noun person> == DE_ADJ_PERSON:<"<base deriv suffix>">
   ...

DE_ADJ_PERSON:
   b. <n> == 'ik
   c. <ov> == <n>
   d. <'an> == <n>
   e. <> == ec.
```

7.5.3. The *-ec* WFR and truncation

The nodes represented in (7.56) will ensure that adjective Bases in *-sk* are legitimised for *-ec* derivation, and hence will account for *kanadsk(ij)* > *kanadec* (see **6.8** for arguments supporting this directionality). However, we need in addition to account for the regular truncation of the suffix *-sk* to avoid **kanadskec*. In an interesting article by Isačenko it is claimed that truncation is a feature of some Russian derivation, but when it occurs it is restricted to the deletion of material that can be identified as a suffix (Isačenko 1972: 98[9]). Isačenko distinguishes truncation due to the avoidance of juxtaposing like with like (*'ustranenie udvoennyx suffiksov'* 1972: 97) from truncation as a regular feature of the derivation. An example of the former would be the qualitative adjective suffix *-ovat(ij)*, as in *krasnovat(ij)* 'reddish', based on a relational adjective in *-ov*. For example *rozov(ij)* 'pink' derives *rozovat(ij)* 'pinkish', and not **rozovovat(ij)*. An example of the latter would be derivation of person nouns from nominalizations in *-k*, such as *zabastovk(a)* 'strike' > *zabastovšč'ik* 'striker' where the suffix *-k* is truncated[10]. Isačenko's term for this is 'morphological truncation' (*'morfologičeskoe usečenie'* 1972: 103).

Given that morphological truncation involves the subtraction of a suffix, our approach to truncation is to propose that, as part of their stem inventory, lexemes contain a special 'truncated' stem, which we label Stem -1. This stem is defined as Stem 0 minus the suffix that derived it. In light of this we consider the relationship between the items in the derivational chain *Kanad(a)* > *kanadsk(ij)* > *kanadec* as represented in (7.57) to (7.59). Note that for ease of exposition we have also listed a number of extensional sentences, i.e. expressions of facts belonging to lexical entries which are inferred from the theory (the facts that appear in a theorem list). These are represented by a single equals sign in DATR, and for expository purposes we have given them in bold type.

(7.57)

```
Kanada:
    a. <> == NOUN
    b. <stem 0> = kanad
       ...
```

(7.58)

```
Kanadskij:
    a. <> == LEXEME
    b. <base> == "Kanada:<>"
    c. <deriv sem feature> == rel
    d. <base stem> = kanad
    e. <stem 0> = kanadsk
    f. <deriv suffix> = sk
    g. <stem -1> == kanad
       ...
```

(7.59)

```
Kanadec:
    a. <> == LEXEME
    b. <base> == "Kanadskij:<>"
    c. <base stem> == "Kanadskij:<stem -1>"
    d. <deriv sem feature> == person
    e. <stem 0> = kanadec
       ...
```

In (7.59c) we see lexically specified stem selection, as we did for Los´atn´ik in (7.17). The stem selected from the Base Kanadskij is what we have termed Stem -1, the truncated stem, and this is lexically specified in (7.58g). However, if we look at the extensional sentences at the node Kanadskij we see that the value for <stem -1> coincides with that of <base stem> (7.58d), since Stem -1 is simply a derived stem minus the suffix it is derived in. We can capture this by the referral <stem -1> == <base stem>. Now we can think of this as a type of stem 'formation' similar to what we did for verb stem inventories in (7.24), and push it further up the hierarchy for general application. Isačenko talks about morphological truncation as a phenomenon occurring in all major word classes, and we therefore state Stem -1 formation at LEXEME as in (7.60). Recall that derived lexemes inherit directly from LEXEME (**7.1.1**). As we have seen stem is defined as the stem of the Base plus the suffix (7.60a). Stem -1 is then viewed as simply the stem deprived of the suffix (7.60b).

(7.60)

```
LEXEME:
    a. <stem> == "<base stem "<index>">" "<deriv suffix>"
    b. <stem -1> == "<base stem 0>"
    ...
```

To conclude this section on morphological conditions, we have shown how reference is made to the elements that define `<stem>` as represented in (7.60a). To account for derivation in *-´ik* and *-ec* reference is made to the path `"<deriv suffix>"`; in this way we encode a WFR's morphological conditions on what suffix its base has been derived in. To account for truncation, we propose a stem formation rule where reference is made to the path `"<base stem 0>"`. In both regards we violate the Bracket Erasure Convention, but respect the Adjacency Constraint. With regard to truncation this is because the truncated form is interpreted as one of the stems belonging to an item's Base lexeme.

7.6. Concluding remarks

We have shown how in our declarative account of derivation lexical entries, representing lexemes, inherit from the Lexemic hierarchy from where they are referred to the Derivational hierarchy for their derived suffix. This constitutes our account of the structural change of a WFR. The syntactic and semantic information introduced by a WFR is stated in the lexical entry and is used to determine the phonological information, which in (productive) Russian person derivation is a suffix. Inheritance of a suffix also depends on phonological, syntactic, semantic and 'morphological' information belonging to a lexical entry's Base, and much of the chapter has been taken up with how the structural description of a WFR is encoded in our declarative account. Finally we also discussed how truncation is incorporated as a type of stem formation.

[1]The stem coinciding with the root is captured by a referral. Note that stems are discussed in detail in **7.2** where modifications to this are made.

[2]For discussion of how empty angle brackets represent in DATR the main inheritance source, see **3.3.2**, **3.4.3**.

[3] Note that inflectional class information being inherited in the course of derivation is not covered in our account.

[4] See **4.4.1** for dashed lines representing secondary inheritance sources in multiple inheritance.

[5]Figure 7.2 is based on Brown et al. (1996: 72).

[6]Recall from **7.1.1** that derived lexical entries inherit directly from `LEXEME`, hence `<stem>` here refers to a derived stem. Stem information for underived items will be specified at the syntactic class nodes in the lexemic hierarchy, from which underived lexical entries directly inherit.

[7] The UBH and discussion surrounding it can be found in **5.2.1**.

[8]The path `<deriv sem feature>` is given as undefined in (7.53). This expresses that adjective formation in *-n* serves for both relational and qualitative adjective formation. See appendix for exactly how this is worked out in the hierarchy

[9]"*Usečeniju podležat liš´ morfologičeskie edinicy, a ne prosto cepočki fonem*", "Only morphological units are subject to truncation, and not just any phoneme string."

[10]For discussion of the directionality, and other examples like this, see **6.6.1**.

Chapter 8:
Encoding exceptionality

8.0. Introduction

The inheritance between nodes in Network Morphology is default, hence the WFRs proposed in the previous chapter express generalizations about the derivational system of Russian. Exceptions to WFRs are products of word formation which do not follow the productive pattern. Since the declarative WFRs we propose are essentially generalizations over synchronically productive word formation, exceptionality is expressed as overriding in some way the generalizations stated by the WFR. In this section we look at the possible ways in which a WFR can be overridden, reflecting the exact nature of an item's exceptionality.

One type of exception will be represented by an item which overrides the phonological level of the structural change of a WFR, in other words where conditions are satisfied but the suffix is not inherited. Another type will be where though one of the conditions is not satisfied, the Base nonetheless inherits from the hierarchy. We have seen that conditions may be syntactic, semantic, phonological and morphological, hence we will need to account for items which are exceptional at any of these levels. In chapter six for each WFR proposed we listed examples representing exceptions to these conditions.

In this chapter we compare exceptions to the structural change of a WFR with exceptions to a WFR's structural description. We subdivide this latter category further into examples of syntactic, semantic, phonological and morphological exception.

8.1. Exceptions to the WFR's structural change

A lexical item may be derived in a suffix that is no longer in productive use, in other words the item is exceptional as regards the WFR's structural change (specifically at the phonological level). A number of unproductive person suffixes were listed at the beginning of chapter six. As an example, we consider the unproductive suffix *-ač* found in Derivatives denoting persons, a sample of which we list in Table 8.1[1].

trub(a)	trumpet (noun)	trubač	trumpeter
tr´uk	trick (noun)	tr´ukač	trickster
l´ix(oj)	spirited	l´ixač	roadhog
lovk(ij)	adroit	lovkač	dodger
rva(t´)	tear up	rvač	self-seeker[2]
tka(t´)	weave	tkač	fabric-maker

TABLE 8.1. Person nouns derived in the unproductive suffix *-ač*

The Bases of the *-ač* words in 8.2 have been identified using Tixonov (1985) and we see that they may be nouns, adjectives or verbs. Thus the Unitary Base Hypothesis is not respected, which is as we might expect since we assume that only productive WFRs adhere to the UBH[3]. To represent Derivatives such as those in Table 8.1 we specify that the suffix inherited from the Derivational hierarchy is overridden by the lexically specified suffix. In this way we express morphological blocking. This is shown in (8.1) and (8.2) which represent *trubač* 'trumpeter' and its Base *trub(a)* 'trumpet'.

(8.1)

```
Truba:
    <> == NOUN
    <stem 0> == trub
    ...
```

(8.2)

```
Trubač:
a.  <> == LEXEME
b.  <base> == "Truba:<>"
c.  <deriv sem feature> == noun
d.  <deriv suffix> == ač
    ...
```

Because Network Morphology supports specifically default inheritance, we can express exactly how `Trubač` is exceptional, namely containing a suffix that is not considered to be productive. The difference between (8.1) and (8.2) on the one hand, and other representations of Derivatives and their Bases that we have met so far on the other, is the fact in (8.2d) representing the lexical specification of *trubač*'s suffix. We can think of this as Network Morphology's way of expressing Kiparsky's Elsewhere Condition to account for unproductive word formation (1983: 14-15). The more specific lexical 'rule', represented by the fact in (8.2d), has precedence over the general productive WFR, represented by a fact about person suffixation in the Derivational hierarchy.

Apart from the fact in (8.2d) the representation of *trubač* and its Base is similar to that of other Derivatives and Bases. As with other Derivatives, `Trubač` multiply inherits from its Base (8.2b) and the node `LEXEME` (8.2a) in the Lexemic hierarchy. Thus features contained in its Base will be inherited by default, just as is the case with other Derivatives. `Trubač` will also inherit the generalisations stated in the Lexemic hierarchy such as the evaluation of the stem in terms of Base stem and suffix, and the inference of `noun` from the semantic feature `person` (see **7.1.1**). Our account therefore pinpoints the exact nature of the item's exceptionality, the fact that the suffix it is derived in is no longer in use to derive person nouns.

8.2. Exceptions to the WFR's structural description

For each WFR constructed in chapter six we gave examples of exceptions to the WFR at the level of its structural description. In other words, items which, though not meeting the specified conditions, nonetheless serve as Bases to a WFR. Since conditions can be characterized as syntactic, semantic, phonological and morphological, exceptions can be characterized in terms of the condition that it is overriding. How do these compare with the exceptions in Table 8.1?

The lexical items *rva(t´)* 'tear up' and *tka(t´)* 'weave' in Table 8.1 meet the conditions required by the *-tel´* WFR since they are imperfective and intransitive. What characterises their exceptionality is their not inheriting from the Derivational hierarchy, contrary to expectation. A structural description exception is in a sense an opposite type of exception: what characterises its exceptionality is the actual inheritance from the Derivational hierarchy, contrary to expectation. In other words, what is being overridden is not the inheritance of the suffix, but the condition associated with the suffix.

We can illustrate with Derivatives in *-tel´* which do not the meet the condition of transitivity that the *-tel´* WFR imposes on its base. Examples of this kind were given in chapter six, and are listed again in Table 8.2.

stranstvova(t´)	wander	stranstvovatel´	'wanderer'
ob´ita(t´)	dwell in	ob´itatel´	'inhabitant'
sorevnova(t´)s´a	compete with	sorevnovatel´	'competitor'
ži(t´)	live	žitel´	'inhabitant'

TABLE 8.2. Nouns in *-tel´* with intransitive Bases

The question is, how do we mark these items so that they inherit *-tel´* despite not satisfying the condition? There are two approaches. In the first we can simply mark the suffix lexically, as we did with the *-ač* examples above. This is represented in (8.3) and (8.4) for *stranstvovatel´* 'wonder'. (Note that extensional sentences, i.e. facts inferred from the theory, are given in bold; in (8.3) the value inferred for `<stem 1>` is stated at the node VERB_I_OV in the Lexemic hierarchy (see **7.2.2**).) The problem with this approach is it that it fails to distinguish the exceptionality in *rvač* from the exceptionality in *stranstvovatel´*. In the former case the fact about the suffix does not appear anywhere in the Derivational hierarchy, whereas we know that *-tel´* does. Lexically specifying suffixes should therefore be reserved for unproductive suffixation only.

(8.3)

```
Stranstvovat´:
   <> == VERB_I_OV
   <stem 1> = stranstvova
   <transitivity> == intrans
   <gloss> == wander
   ...
```

(8.4)

```
Stranstvovatel´:
   <> == LEXEME
   <base> == "Stranstvovat´:<>"
   <deriv sem feature> == person
   <deriv suffix> == tel´
   <gloss> == wanderer
   ...
```

The second, and preferred, approach is to allow conditions on *-tel´* suffixation to be overridden by 'missing them out', and inheriting directly from the path that is paired with the suffix, in a sense short-circuiting the system. The *-tel´* WFR with the secondary syntactic condition of transitivity in place is represented in (8.5) and (8.6). The `<deriv suffix>` path at the lexical entry (8.7) is specified as inheriting directly from the path `<trans>`, which is picked up at DE_VERB_PERSON in (8.6), and circumventing the evaluable path that expresses the condition in (8.5).

(8.5)

```
DERIV_DE_VERB:
   <deriv noun person> == DE_VERB_PERSON:<"<base transitivity>">
   ...
```

(8.6)

```
DE_VERB_PERSON:
   <trans> == tel´
   <> == .
```

(8.7)

```
Stranstvovatel´:
   <> == LEXEME
   <base> == "Stranstvovat´:<>"
   <deriv suffix> == DE_VERB_PERSON:<trans>
   ...
```

The exceptionality is restricted to the conditions a WFR imposes, rather than the WFR in its entirety. Thus the difference between the *rvač* example and the *stranstvovatel´* example is the representation of the fact about suffixation. With *rvač* both path and value are lexically specified, but with *stranstvovatel´* only the path is lexically specified. The value, on the other hand, is inherited from the Derivational hierarchy. This expresses the exceptionality: it is not what is inherited that is exceptional, but how it is inherited. For completeness, we look at the treatment of structural description exceptions at all four levels.

8.3. Exceptions at the (primary) syntactic level

Recall that the *-n´ik* WFR contains the primary syntactic condition for Bases to be nouns. This was represented with full explanation in **7.3**, and represented again as in (8.8) to (8.12). Note that to avoid complication this does not take into account the encoding of semantic conditions in **7.4**. A derived lexeme's suffix depends on its Base's syntactic category (8.8). If this is `noun`, the suffix will ultimately be found at the node `DERIV_DE_NOUN`, a node where denominal suffixes are lodged (8.9), (8.10), (8.11), (8.12). This, for example, is the case with derivation of nouns denoting persons (8.11), (8.12).

(8.8)

```
DERIV_LEXEME:
   <deriv suffix> == SYNCAT_INTERDEPENDENCY:<"<base syn cat>">
   ...
```

(8.9)

```
SYNCAT_INTERDEPENDENCY:
   <noun> == NOUN:<deriv suffix>
   ...
```

(8.10)

```
NOUN:
   <deriv> == DERIV_NOUN
   ....
```

(8.11)

```
DERIV_NOUN:
   <deriv suffix> == DERIV_DE_NOUN:<"<deriv syn cat>"
                                   "<deriv sem>">
   ...
```

(8.12)

```
DERIV_DE_NOUN:
   <deriv noun person> == n´ik
   ...
```

In chapter six we listed exceptions to the *-n´ik* WFR where the Base was a verb and not a noun (**6.5.1**). Examples are listed again in Table 8.3. Recall that for these examples it was noted that derivation takes place on the verb's Stem 0, i.e. /balov/, /prestup/, etc.

balova(t´)	spoil	balovn´ik	spoilt child
prestup´i(t´)	transgress	prestupn´ik	criminal
svod´i(t´)	procure	svodn´ik	procurer
koč´ova(t´)	wander	koč´ovn´ik	nomad

TABLE 8.3. Nouns in-*n´ik* with verb Bases

The lexical entry for *balovn´ik* 'spoilt child' is represented in (8.14), and its verb Base in (8.13). The path `<deriv suffix>` is lexically specified as inheriting directly from NOUN (8.14e), and in this way the Derivative acts as though its Base is a noun, which ultimately allows for the inheritance of `n´ik` (8.12). Note that the stem on which the derivation is based is interestingly Stem 0 (8.14c), which was noted to be the default stem for derivation (see **7.2.1**). (Note also that the node VERB_I_OV delivers the value for `<stem 0>` (**7.2.2**).)

(8.13)

```
Balovat´:
   <> == VERB_I_OV
   <root> == bal
   <stem 0> = balov
     ...
```

(8.14)

```
Balovn´ik:
   a. <> == LEXEME
   b. <base> == "Balovat´:<>"
   c. <base stem> == "Balovat´:<stem 0>"
   d. <deriv sem feature> == person
   e. <deriv suffix> == NOUN
   ...
```

8.4. Exceptions at the morphological level

As an example of exceptionality at the morphological level, we can consider exceptions to the *-ec* WFR. Recall that this WFR states the conditions negatively: legitimate Bases are those not derived in the suffixes *-n*, *-ov*, or *-´an*. This was represented in **7.5.2** and here in (8.15) and (8.16), where the empty path in (8.16) expresses any suffix other than those specified.

(8.15)

```
DERIV_DE_ADJ:
   <noun person> == DE_ADJ_PERSON:<"<base deriv suffix>">
   ...
```

(8.16)

```
DE_ADJ_PERSON:
   <n> == ´ik
   <ov> == <n>
   <´an> == <n>
   <> == ec
   ...
```

Examples were given in **6.8.1** of *-ec* Derivatives whose Bases were in *-n*, thereby representing morphological exception to the WFR. These included *poslann(ij)* 'sent' > *poslanec* 'envoy', *oborvann(ij)* 'torn' > *oborvanec* 'ragamuffin'. We account for these by specifying in the `Poslanec` lexical entry that its Base's derived suffix is undefined. In other words, for the purposes of person formation, this is specified as behaving as if its Base is underived. Since `undefined` is not stated at (8.16), inheritance will be via the empty path in (8.16).

8.5. Exceptions at the semantic level

The *-´ist* WFR represented the only person WFR whose structural description contained a semantic condition, namely that Bases have the feature +foreign. Exceptions were those *-´ist* Derivatives whose Bases were +native. One such was *očerk* 'essay' > *očerkist* 'essayist'. The semantic condition is 'overridden' (or circumvented) to allow for the inheritance of the suffix. This is represented in (8.17) to (8.20).

(8.17)

```
DERIV_DE_NOUN:
   <noun person> == DE_NOUN_PERSON:<"<base sem feature>">
   ...
```

(8.18)

```
DE_NOUN_PERSON
   <foreign> == ´ist
   ...
```

(8.19)

```
Očerk
   <> == NOUN
   <sem feature> == native
   ...
```

(8.20)

```
Očerkist
   <> == LEXEME
   <base> == "Očerk:<>"
   <deriv suffix> == DE_NOUN_PERSON:<foreign>
   ...
```

8.6. Exceptions at the phonological level

Phonological conditions have been viewed as conditions on the Base's stem type. For *-tel´* derivation the stem selected is the Base's Stem 1. The selection rule was represented in **7.2.1** as in (8.21) and (8.22). Exceptions are those items where derivation has taken place on the 'wrong' stem. Examples were given in **6.2.2**, one of which was *smotre(t´)* 'watch' > *smotr´itel´* 'supervisor', rather than predicted **smotretel´*. To account for phonological exceptions, all we need do is override the stem selection rule encoded in the hierarchy, and lexically specify it as shown in (8.23), (8.24). Since for all the exceptions the stem used is a stem in /i/, we can add a 'Stem i' to the Base's inventory of indexed stems[4]. Note that Stem i is defined as the formative /i/ added to Stem 0.

(8.21).

```
LEXEME:
   <index> == STEM_SELECTION:<"<base syn cat>"
                                  "<deriv sem feature>">
     ...
```

(8.22)

```
STEM_SELECTION:
   <verb person> == 1
   <> == 0
     ...
```

(8.23)

```
Smotret´:
   <> == VERB
   <root> == smotr
   <stem 0> = smotr
   <stem 1> == <stem 0> e
   <stem i> == <stem 0> i
   ...
```

(8.24)

```
Smotr´itel´:
   <> == LEXEME
   <base> == "Smotret´:<>"
   <base stem> == "Smotret´:<stem i>
   <deriv sem feature> == person
   ...
```

8.7. Concluding remarks

WFRs in our account express generalizations about the derivational system. Since WFRs are generalizers of derivational information, our account not only accommodates exceptionality naturally as an overriding of default statements, but is able to pinpoint the exact nature of the exception in terms of what generalization is being overridden. This may be in the way an item fails to inherit productive suffixation despite meeting all the necessary conditions; or it may be in the way an item succeeds in inheriting a suffix despite failing to meet the conditions required for its attachment.

Notes to chapter eight

1 Andrews (1996: 248-9) contains a list of some forty five words in *-ač*.

2 i.e. 'person removing himself from work or situation in the manner most profitable for himself' (Andrews 1996: 248).

3 Note, though, that adjective Bases are particularly unproductive according to Vinogradov (1960: 210). Andrews (1996: 112) cites Dementjev (1960) as claiming that there are only two examples (the two we have we included in Table 9.2). Nonetheless, the fact that-*ač* attaches to both verb and noun Bases is clear indication of its unproductivity since a suffix with this combination of syntactic category restrictions fails to comply even with Scalise's (1986: 138-9) Modified Unitary Base Hypothesis: 'Only suffixes which attach to both Nouns and Verbs would violate the M[odified] U[nitary] B[ase] H[ypothesis]...' (1986: 139).

4 Further development of the fragment would of course involve the incorporation of the other verb classes besides I-*ov*, including the class that *smotre(t')* belongs to. This would provide for the full stem inventory, but for present purposes we shall be content with lexically specifying the stems apart from Stem 0, as is done in (8.22).

Chapter 9:
Summary and Conclusions

The aim of this study has been to present a declarative approach to derivational morphology, investigating for this purpose the derivation of nouns denoting persons in Russian. Our declarative account is represented by the DATR theory in the appendices, together with its computationally verified theorems which demonstrate that the analysis makes correct predictions about the data. In this final chapter we summarise the main points of our model (**9.1**), and assess the key areas of our theory (**9.2**). Finally, possible future developments to our model are briefly discussed in **9.3**.

9.1. Summary

Declarative derivation is a lexeme-based approach to word formation where generalizations that can be made about types of derivation are identified and declaratively stated in a network of nodes. These generalizations are then inherited by underspecified Derivative lexical entries, represented by leaf nodes, by default. The account has been based within the framework of Network Morphology, a declarative framework where lexical information is expressed as path:value pairings representing facts. The facts are distributed across nodes in hierarchies of nodes, and the hierarchies themselves are connected, to various degrees of complexity, to one another within a single network. The main hierarchies are the Lexemic hierarchy, where generalizations about the major lexical categories are stored, and whose leaf nodes are the lexemes themselves, and the Inflectional hierarchy. Our Network Morphology account of word formation assumes a third hierarchy, the Derivational hierarchy, and it is from here that Derivative lexical entries inherit generalizations about their form.

All Network Morphology accounts are expressed in the lexical knowledge representation language DATR. The full representation of our account is given in Appendix I, and a number of sample lexical entries in Appendix II. An extremely important aspect of DATR is that it is computable, and we have therefore been in a position to verify computationally the theory's claims. There is no discrepancy between the theory and its set of theorems, which are listed in Appendix III.

A crucial assumption that is made in Network Morphology is that the lexeme, and not the morpheme, is the minimal linguistic sign. We saw in **5.4** that for inflection this means that inflections are not lexical entries, but differences in shape of a lexeme's stem, where the various shapes encode the various sets of morphosyntactic features. A lexeme therefore contains a paradigm of morphosyntactic words, whose realisations are the various inflections of the lexeme's stem. The realisational rules are 'within-lexeme' rules that relate a set of morphosyntactic features to a form that can be analysed as the lexeme's stem plus morphological material. In chapter three we showed how Network Morphology encodes within-lexeme rules by path:value pairings. The path represents a morphosyntactic feature set using one or more attributes, and the value consists of a reference to the lexeme's stem plus an atomic value representing a suffix. For example, the within-lexeme rule for the nominative singular of class II nouns is represented as `<mor sg nom> == "<stem>" a`. Such facts are distributed across nodes in the Inflectional hierarchy, identified by the leading sub-path `<mor>`, the 'hierarchy identifier' of the Inflectional hierarchy, from where they are inherited by default by lexical entries. To account for inflectional homonymy, facts are shared by being inherited through the hierarchy of nodes. Further homonymy is captured by allowing for referrals to be made across nodes. To ensure only systematic homonymy is captured, a number of constraints are imposed on the referrals, and these are formulated in the Referrals Principle, and its sub-principles.

Whereas for inflection the rules are within-lexeme, or 'intra-lexemic', derivational rules, or WFRs, are 'inter-lexemic'. The input of a WFR is a Base lexeme and its output is a Derivative lexeme. In a derivation the change in meaning and syntax is recorded by the change that has occurred in the Derivative lexeme's stem. The lexeme is an assembly of an item's form, meaning and syntax and prototypical derivation is accounted for by rules that bring about changes at all levels of the lexeme. For example the derivation of the person noun *tolkovatel´* 'interpreter', from the verb *tolkova(t´)* 'interpret', involves change at the phonological level in the suffixation of *-tel´* to the stem, at the syntactic level in the shift in class from verb to noun, and at the semantic level with the introduction of the semantics 'person who Xes'. Other types such as transpositions, zero affixation and (syntactic) category preserving derivation are merely a matter of preservation at one (or more) of these levels.

In our declarative account we express the change in syntacticosemantic information corresponding to a change in form as an evaluation of the suffix based on derived syntactic and semantic information. This is shown in (9.1) for the suffix *-tel´*.

(9.1)

```
NODE_1:
   <deriv suffix> == NODE_2:<"<deriv syn cat>"
                                 "<deriv sem feature>">
   ...
```

```
NODE_2:
    <noun person> == tel´
    ...
```

Apart from the semantics of the derivation which is specified in the lexical entry as path:value pairings of the type `<deriv sem feature> == x`, the structural change of a WFR is recorded in the Derivational hierarchy and inherited by underspecified Derivative lexical entries by default. The syntactic category that is introduced by a WFR is inherited via a system of interdependent defaults expressing the inferences that can be made from the derivational semantics stated at the lexical entry. For example, 'noun' is inferred from `<deriv sem feature> == person` at the lexical entry. The form that a WFR introduces is inherited from nodes such as in (9.1) in the Declarative hierarchy. In lexeme-based derivation the stem of a Derivative is analysed as its Base's stem plus the suffix introduced in the derivation. To capture this a Derivative lexical entry is unspecified for stem, and its stem is multiply inherited from the Derivational hierarchy (via the Lexemic hierarchy) for the suffix element and the lexical entry's Base for the root.

Because the input as well as the output of a WFR is a lexeme, WFRs are complex in the same way as lexemes are complex. As well as specifying the change that takes place at each level of the lexeme, WFRs have a set of conditions on the input (the structural description). The kinds of conditions match the levels of the input lexeme, so that a WFR may have semantic, syntactic and phonological conditions. The combination of structural change and structural description makes for unique WFRs, according to the Unitary Base Hypothesis. In chapter six we proposed unique WFRs for productive person formation in Russian. For each suffix we examined the conditions placed on the Base. All were found to have conditions on syntactic category, for example *-´ik* attaches only to stems belonging to adjective Base. An additional condition was introduced to account for suffixation in *-´ik* and *-ec*. The *-´ik* and *-ec* WFRs were specified with 'morphological' conditions, i.e. conditions on the morphological structure of the Base's stem.

Our account provides for a WFR's structural description specification by allowing the relevant features belonging to a Base, i.e. syntactic information including syntactic class, stem, and semantic features, to be inherited by its Derivative by default. Syntactic conditions are incorporated by a system of network relations emanating from the Derivational hierarchy to the nodes in the Lexemic hierarchy that serve Base lexical entries belonging to the various syntactic classes (**7.3**). These nodes are then linked to parallel nodes in the Derivational hierarchy which serve as collections of suffixes that are reserved for derivation from a noun, adjective or verb Base. (9.2) illustrates derivation based on a noun.

(9.2)

```
NOUN:
   <deriv> == DERIV_NOUN
   ...

DERIV_NOUN:
   <deriv suffix> == DERIV_DE_NOUN:<"<deriv syn cat>"
                                  "<deriv sem feature>">
   ...

DERIV_DE_NOUN:
   <noun person> == n´ik
   ...
```

Semantic conditions were used to account for the derivation of relational adjectives in *-sk* and *-ov*, and person nouns in *-´ist*. The suffix *-sk* productively attaches to Base nouns that denote persons (or places); for other types of Base the suffix *-ov* is normally used. The suffix *-´ist* is restricted to noun Bases of foreign origin, which we viewed as the semantic feature +foreign. Other noun Bases attach *-n´ik*. To capture this the path `<base sem feature>`, expressing semantic features of the Base lexical entry, is used in the evaluation of the suffix. (9.3) illustrates evaluation based on semantic features.

(9.3)

```
DERIV_DE_NOUN:
   <noun person> == DE_NOUN_PERSON:<"<base sem feature>">
   ...

DE_NOUN_PERSON
   <foreign> == ´ist
   <> == n´ik
   ...
```

Finally, in chapter 8 our declarative account was shown to naturally accommodate exceptionality. Since WFRs are represented as generalizers of derivational information which is inherited by lexical items by default, any exceptions can be expressed in terms of overriding a default statement. In this way we were able to separate out and characterize the different kinds of exception. We identified two broad groups, one where the item is exceptional in its choice of person forming suffix, and the other where an item inherits a productive suffix despite not meeting the default conditions on its inheritance. Exceptions belonging to the second group can be further classified according to the condition that has not been met.

9.2. Assessment of key areas of the theory

Having briefly summarised the main points of our account, we may assess how far it has succeeded in addressing key issues that fall within the domain of derivational morphology, and lexeme-based derivation in particular. In **9.2.1** we assess the extent to which WFR rivalry is accounted for. We then consider the question of the lexicon as a component for words structure and a storehouse of lexical entries in **9.2.2**. In **9.2.3** we see how our account provides for access to an item's internal morphological structure, and in **9.2.4** we summarise our approach to stem indexing.

9.2.1. Rivalry between WFRs

In chapter six we separated out the productive affixes from the host of affixes used to derive person nouns in Russian. Seven out of a possible fifty or so were identified as fully productive, which we listed as in Table 9.1.

-tel´	grab´i(t´)	steal	grab´itel´	thief
-´ist	traktor	tractor	traktor´ist	tractor driver
-´ik	frontov(ój)	front-line	frontov´ik	front-line soldier
-n´ik	vest´	news	vestn´ik	herald
-šč´ik	baraban	drum	barabanšč´ik	drummer
-(l´)šč´ik	r´isova(t´)	draw	r´isoval´šč´ik	draughtsman
-ec	skup(ój)	stingy	skupec	skinflint

TABLE 9.1. The productive person formation suffixes

WFRs for only these six suffixes were devised, and were therefore assumed to account for productive derivational patterns in Corbin's 'available' sense (see **1.1.2.2**, **6.1**). In our account, productive WFRs are given a declarative interpretation as generalizers of derivational information, which is inherited by default. Where for a given item the productive pattern has been blocked, and a less productive affix used instead, this is expressed by overriding default generalizations by specifying alternative information locally at the lexical entry, as we showed in some detail in chapter eight. This is possible because one of the key characteristics of Network Morphology is that it uses default inheritance to express information sharing between nodes (**3.3**). As Briscoe, Copestake and Lascarides (1995: 273) note:

"A major motivation for the introduction of default inheritance mechanisms into theories of lexical organization has been to account for the prevalence of the family of phenomena variously described as blocking...the elsewhere condition...or pre-emption by synonymy..."

Furthermore, default inheritance has been used in our account for the rivalry between the productive affixes themselves. In lexeme-based derivation, productive WFRs are assumed to be unique in terms of their structural description and structural change, i.e. their set of conditions on the one hand, and the change they introduce at the syntactic, semantic and phonological levels on the other. Thus the apparent rivalry in Table 9.2 collapses if we carefully take into account the fact that the set of conditions specified for each affix is slightly different. In our declarative account, WFR conditions are expressed by sets of interdependent defaults, a mechanism that Network Morphology supports as shown in its account of gender assignment in **3.5**. To summarise, our declarative account takes care of affix rivalry by straightforward defaults where the rivalry is between an identified productive affix and a non-productive affix, and by interdependent defaults where the rival affixes are productive but differ in the conditions they place on the Base.

9.2.1.1. 'True' affix rivalry

There are a number of cases, however, which appear to be problematic for our account. First, we are unable to handle 'true' rivalry where the conditions and function of two WFRs seem to match exactly. This is the case for the *-n´ik* WFR and the *-šč´ik* WFR which are both restricted to noun Bases, and which both derive nouns with the meaning 'person related in some way to X'. To cope with this we have simply chosen to incorporate only one WFR, the *-n´ik* WFR, and ignore the *-šč´ik* WFR altogether. Similarly, the *-tel´* and *-l´šč´ik* WFRs represent true rivals since their conditions and the syntax and meaning they introduce match almost exactly, and we have only incorporated *-tel´*. These two WFRs are given again in (9.4).

(9.4)

-tel′ WFR

structural description	⇒	structural change
syntax:		syntax:
c (primary) verb; (secondary) imperf, trans		verb → noun
semantics:		semantics:
c		X → 'person who Xes'
phonology:		phonology:
c stem 1		stem 1 → stem 1 - tel′

-(l′)šč′ik WFR

structural description	⇒	structural change
syntax:		syntax:
c (primary) verb; (secondary) imperf, trans		verb → noun
semantics:		semantics:
c		X → 'person who Xes'
phonology:		phonology:
c stem 4		stem 4 → stem 4 - šč′ik

A possible solution to these true rivalry cases lies in finding differences somewhere in their structural description, or somewhere in their structural change at the semantic level. For the *-n′ik* / *-šč′ik* rivalry we could see a distinction in structural change at the semantic level. The suffix *-šč′ik* derives nouns denoting 'person with trade' more productively than its *-n′ik* counterpart (see Vinogradov and Švedova 1964: 47-8). For example *tramvajšč′ik* denotes 'person related in some way to trams', and more specifically 'person related professionally to trams', i.e. 'tram worker'. The difference between the WFRs could therefore be seen in their semantic specificity, and would be represented in our account simply by having in addition to the path `<person>`, a second expanded path `<person trade>` for the *-šč′ik* suffix.

For the *-tel′* / *(l′)šč′ik* case a difference can be found not in the structural change, but in the structural description, particularly at the phonological level. From (9.4) we see that *-tel′* attaches to Stem 1 of verb Bases, whereas *-(l′)šč′ik* attaches to a more complex Stem 4. Recall that Stem 4 is formed by adding /l/ to Stem 1. In the same way as seeing 'person with trade' as more specific than 'person', we could think of Stem 4 as more 'specific' than Stem 1, and in this sense see the *-(l´)šč´ik* as having a more specific phonological condition than the *-tel´* WFR. For this to work, we would have to assume that though all verb lexemes are represented with stem inventories containing Stem 1, only some will have Stem 4 a well as Stem 1, namely the set whose members serve as input to the *-(l´)šč´ik* WFR. Apart from being ad hoc in the extreme, it would mean that no identity could be established between Stem 4 and the past tense form in /l/. Clearly an alternative solution would have to be found.

9.2.1.2. Coexistence of rival items

Briscoe et al. note that blocking is not an 'absolute property of lexical organization' (1995: 274) since there are numerous cases of two morphologically related forms happily coexisting despite occupying the same functional slot. The inflectional example they give is *dreamed* and *dreamt*. We find the same phenomenon in Russian person formation where two rival WFRs apply to the same Base. Vinogradov (1971: 94) gives examples of person nouns in the rival suffixes *-tel´* and *-(l´)šč´ik* which are derived from a common Base, and Andrews (1996: 56) lists *-n´ik* and *-šč´ik* Derivatives from the same Base. These are given in Table 9.2.

Base	Gloss	Derivative in *-tel´*	Derivative in *-(l´)šč´ik*	Gloss
gran´i(t´)	cut	gran´itel´	gran´il´šč´ik	cutter
seja(t´)	sow	sejatel´	sejal´šč´ik	sower
korm´i(t´)	feed	korm´itel´	korm´il´šč´ik	bread-winner
		Derivative in *-n´ik*	**Derivative in *-šč´ik***	
izmen(a)	betrayal	izmenn´ik	izmenšč´ik	traitor
atom	atom	atomn´ik	atomšč´ik	atomic scientist

Table 9.2. Derivatives in *-tel´* and *-(l´)šč´ik* from the same Base

As Briscoe et al. rightly point out, accounts represented in DATR cannot naturally handle coexisting rival forms (1995: 279-80). This is because of the functionality of DATR descriptions, since nodes denote partial functions from paths to values. Evans and Gazdar (1996: 201-2) note that due to the default path extension mechanism in DATR, descriptions preserve functionality and "ultimately the consistency of the set of (extensional) value statements is assured" (1996: 202). The question we must address is why these 'lexical pairs', to use Andrews' term, occur. It would appear that several WFRs are jostling for the same productive slot. A newer WFR challenges an older one, and where the conflict has not yet been resolved in the language we find 'true' affix rivalry, with instances of lexical pairs as in Table 9.2.

In Vinogradov and Švedova's brief history of the suffix *-tel´* (1964: 20-36) they state that the origins of *-tel´* go back to Common Slavonic (1964: 20). The height of its productivity is during the 18th century and part of the 19th century, after which time its productivity begins to drop. Evidence of this is partly found in measuring its productivity in the 'profitable' sense of Corbin. The 1847 Academy dictionary is compared to Ušakov (1935-1940) for *-tel´* words, and it is found that the older dictionary lists two to two and a half times more examples (1964: 36). Furthermore, many of the *-tel´* words in the newer dictionary have been marked as obsolete, or for specialist use only. On the other hand, *-l šč´ik* enters the language at the beginning of the 18th century (1964: 38), and according to Panov (1968: 183) is the youngest deverbal person suffix. A slightly different situation holds for the *-n´ik* / *-šč´ik* rivalry. The suffix *-šč´ik* enters the language in the 13th century[1] but in the 16th to 17th centuries *-šč´ik* becomes increasingly productive for forming person nouns with the specific meaning 'person with trade, professional occupation' [2]. Words in *-n´ik* are more general, covering this meaning amongst others, and therefore the conflict is over the more specific meaning. Examples can be found where the conflict has been decided, for example the Russian for 'stone mason' is now *kamenšč´ik* whereas previously the alternative *kamenn´ik* was possible[3]. Given this analysis, of the lexical pairs in Table 9.3 we would expect *izmenn´ik* to ultimately win out, since there is no sense of 'person with trade', and by the same token for *atomn´ik* to fall out of use because there is.

Our account is unable to capture unresolved conflicts of this kind which are based on diachronic factors. By specifying only one possible value it makes predictions about new outputs of WFRs that are operating synchronically. Further investigation into what WFRs truly are in synchronic use would have to be carried out, perhaps along the lines of Baayen (1989) who uses large corpora and the identification of hapaxlegomena to determine productivity in the available sense. His technique has been used for a fragment of English (Baayen and Lieber 1991), and to a limited extent for the Dutch derivational suffix *-heid* (whose English equivalent is *-ness*) (Baayen and Neijt 1997). Our only way of capturing true rivalry is to have a number of hierarchies that reflect the different stages of the language's development.

9.2.1.3. 'Function' rivalry

In the previous sections we have looked at rivalry between forms realising the same function. We may also consider the possibility of rivalry of functions corresponding to the same form. Examples of this type were given when we were discussing many-meaning-to-one form asymmetries in chapter one (**1.1.2.1**). A good example in Russian is the suffix *-k(a)* which can be used to realize nominalizations as in *belk(a)* 'bleaching', nouns denoting things or place as in *otkritk(a)* 'postcard', female person nouns as in *studentk(a)* 'student', and diminutives as in *komnatk(a)* 'room (dim)'. An obvious way of capturing this would be to set up referrals between the various nodes representing WFRs in the hierarchy. These would be analogous to the referrals that Network Morphology makes use of to capture inflectional homonymy, as we showed in chapter four (**4.4**). It will be recalled, however, that in order to capture only systematic homonymy Network Morphology constrains the nature of referrals by the Referrals Principle (**4.4.2**). This was given as in (9.5).

(9.5)

> *Referrals Principle*
> A referral is a fact in which a path beginning with a particular hierarchy identifier refers to another path beginning with the same identifier (Brown forthcoming a)

Recall that the effect of the Referrals Principle is to limit the range of a referral to its own hierarchy, so that derivation does not spread across to inflection. There is a sub-principle of the Referrals Principle which ensures even greater systematicity, namely Feature Preservation.

(9.6)

> *Feature Preservation*[4]
> Inter-node referrals require that the referring path and the referred path contain exactly the same features in the same order (Brown forthcoming a)

Feature Preservation prevents, for example, generalization over the affix *-u* for the singular dative of class I and IV nouns, e.g. *zakon-u* 'law', and the singular accusative of class II nouns, e.g. *komnat-u* 'room' since the case feature would be different in the referring and referred-to paths. Though Feature Preservation was formulated with primarily inflection in mind, it can be used in the Derivational hierarchy to avoid 'accidental' homonymy. The representation of the different *-k(a)* WFRs will differ in the 'features' not only of their semantics, but also their conditions, for example the *-k(a)* WFR for female derivation is restricted to nouns, but the *-k(a)* WFR for nominalization will have a condition on verb Bases.

However, there is an example where a referral would capture systematic homonymy. The history of *-tel´* formation is complicated by the fact that as its productivity in forming person nouns has waned, it has become a productive suffix for nouns denoting things (Vinogradov and Švedova 1964: 36). Moreover, the set of conditions for the person *-tel´* WFR and the 'thing' *-tel´* WFR is identical: for both the Base must be a verb, and more specifically imperfective and transitive, and the stem selected is Stem 1. This is illustrated in Table 9.3 which lists *-tel´* words denoting things, together with their Bases.

vikl´uč´a(t´)	switch off	vikl´uč´atel´	switch
opriskiva(t´)	sprinkle	opriskivatel´	sprinkler
obogreva(t´)	heat	obogrevatel´	heater
nagneta(t´)	supercharge	nagnetatel´	super-charger
dv´iga(t´)	move	dv´igatel´	motor
č´isl´i(t´)	count	či´sl´itel´	numerator

TABLE 9.3. Nouns in *-tel´* denoting things.

Note that the examples in the table exclusively denote things, pointing to the fact that synchronically there are two separate *-tel´* WFRs. Historically, however, it is clear that the *-tel´* WFR denoting things emerged from the *-tel´* WFR denoting persons, as lexical pairs such as *preobrazovatel´* 'reformer' and 'transformer', *iskatel´* 'seeker' and 'view-finder' illustrate. For example in Panov's count of *-tel´* Derivatives in Bielefeldt (1958), of five hundred entries three hundred and nineteen denote exclusively Person, sixty eight exclusively Object, but seventy six both (1968: 173, f.n.5). Any future development of our account would have to incorporate a referral between representations of these two WFRs to capture the systematicity of the homonymy.

9.2.2. Lexicon and lexical entries

In chapter two we looked at the role of morphology in structuralist and early generative models, and saw that the lexicon has developed to accommodate morphology more satisfactorily. Network Morphology aims at a sophisticated treatment of morphology, and in this regard should be seen as a contribution towards the development of the lexicon. As we have shown, its three 'sub-components' are the Lexemic hierarchy, the Inflectional hierarchy and the Derivational hierarchy, all of which are interconnected but in a constrained fashion. If this is the picture of the lexicon as a component to account for word structure, the lexicon as a list of lexical items was seen to be the collection of leaf nodes attached at the bottom of the Lexemic hierarchy representing lexemes. It is important to note that these lexical entries are underspecified and 'filled out' by inheritance from the hierarchies. In this way Aronoff's two senses of 'lexicon' are merged in Network Morphology. Due to the inheritance being non-monotonic, the lexicon can be viewed as both a storehouse of idiosyncrasies and a region where generalizations about words (or lexemes) can be made.

As well as actual lexical entries, we discussed the status of ghost lexical entries in our account. When discussing the construction of the *-´ist* WFR in chapter six we noted that there is a productive relationship between person words in *-´ist* and abstract nouns in *-´izm*, for example *social´ist* and *social´izm* (**6.3.2**). To account for this relationship we proposed ghost lexemes, such as *SOCIAL. A number of constraints were put on such items. First, they must be unspecified for syntactic category, but at the same time be read as noun Bases by WFRs; second, they can serve only as the first link in a derivational chain; and third, they must be of foreign origin. The first constraint is expressed by the empty path at the node SYNCAT_INTERDEPENDENCY (9.7d), which it will be recalled from **7.3** relates the syntactic category of the Base to the appropriate node in the Lexemic hierarchy, which is used to evaluate the suffix of the Derivative.

(9.7)

```
SYNCAT_INTERDEPENDENCY:
   a. <verb> == VERB:<deriv suffix>
   b. <noun> == NOUN:<deriv suffix>
   c. <adj> == ADJ:<deriv suffix>
   d. <> == <noun>.
```

The second constraint is expressed less directly. The default at (9.7d) will only apply if the item does not itself have a Base; if it does, its Base's syntactic category will be used for the evaluation. In other words, the item must represent a Base appearing as the first link in a derivational chain for (9.7d) to apply[5].

The third constraint is problematic to represent. To express the fact that only borrowings are abstract lexical entries we might state a default at LEXEME that the value for <sem feature> is foreign. However, as well as *-´izm* and *-´ist* Derivatives, ghost lexical items can be used to account for some relational adjectives in *-sk*, such as *makedonsk(ij)* 'Macedonian'. Yet as we showed in **5.2.1** and **7.4.2** the *-sk* WFR has a semantic condition that the Base denotes a person or place. Hence *MAKEDON must be listed with the semantic feature 'place', and not 'foreign'. A solution to this would be to view lexemes as having an additional 'stylistic' level of description where features such as 'foreign' and 'native' are stated. At the syntactic category nodes in the

Lexemic hierarchy the feature 'native' is stated as the default, but at LEXEME, from which ghost lexical items directly inherit, 'foreign' is stated as the default. And since ghost items are constrained from inheriting features from a Base, this default will not be overridden.

9.2.3. Morphological structure

As well as syntactic, semantic and phonological conditions we proposed the specification of morphological conditions in the structural description of certain WFRs, namely the *-´ik* and *-ec* WFRs (**6.4.1**, **6.8.1**). Morphological conditions were shown to require access to the internal morphological structure of the Base, in contravention to the Bracket Erasure Convention. Yet the contravention is limited by the Adjacency Constraint, which states that a morphological condition must only be on material that has been introduced by the preceding WFR.

Morphological conditions were incorporated by using the path `<base deriv suffix>`, expressing the Base lexical entry's suffix, to determine what suffix the Derivative will inherit. Note that the Base's suffix is itself inherited from the Derivational hierarchy, as indicated by the leading sub-path `<deriv>` which identifies the path with the Derivational hierarchy. Evaluation based on morphological information of the suffixes *-´ik* and *-ec* was represented as in (9.8).

(9.8)

```
DERIV_ADJ:
    <deriv suffix> == DERIV_DE_ADJ:<"<deriv syn cat>"
                                    "<deriv sem feature>">
    ...

DERIV_DE_ADJ:
    <noun person> == DE_ADJ_PERSON:<"<base deriv suffix>">
    ...

DE_ADJ_PERSON:
    <n> == ´ik
    <ov> == <n>
    <´an> == <n>
    <> == ec.
```

Morphological structure is also accessed to account for truncation, where the truncated stem is analysed as the stem of the Base minus the suffix (**7.5.3**). This was represented as in (9.9) where the truncated stem `<stem -1>` is defined as the Base's stem, without the Base's suffix.

(9.9)

```
LEXEME:
   <stem> == "<base stem "<index>">" "<deriv suffix>"
   <stem -1> == "<base stem 0>"
   ...
```

9.2.4. Indexed stems

In chapter five we showed that lexemes may contain more than one stem on which morphological rules operate. For example, in Latin verbs the 'third' stem is used for the past passive participle, the future active participle and the supine, as well as a number of derivational categories. The truncated stem, or Stem -1, would be included in the inventory, for example. Following Sadler et al. (1997) we identify four stem types for verbs. For the verb lexeme TOLKOVAT´ 'interpret' the indexed stem inventory was given as in Table 9.4.

Stem 0	Stem 1	Stem 2	Stem 3
tolkov-	tolkova-	tolkuj-	tolkovan-

TABLE 9.4. Indexed stem inventory of TOLKOVAT´.

A WFR's phonological condition may be viewed as the selection of one stem over other stems in the inventory. The *-tel´* WFR was specified with the phonological condition on Stem 1 of the verb Base's set of stems. To incorporate phonological conditions as stem selection we revised the definition of stem as a particular indexed stem of the Base plus suffix, as represented in (9.10). The indexed stem chosen then depends on the value for `<index>`. This is evaluated on the basis of the type of derivation: with deverbal person derivation the index is 1, and with any other type the index is 0. Recall that selection may also be lexically specified, as in the case of *los´* 'elk' > *los´atn´ik* 'elk hunter'.

(9.10)

```
LEXEME:
   <stem> == "<base stem "<index>">" "<deriv suffix>"
   <index> == STEM_SELECTION:<"<base syn cat>"
                                  "<deriv sem feature>">
     ...

STEM_SELECTION:
   <verb person> == 1
   <> == 0
     ...
```

The similarity of stems in an inventory was captured in terms of referrals, where the basic referral is to the root. This was either lexically specified, or expressed as generalizations in the hierarchy, though the basic stem, Stem 0, was stated at the syntactic nodes in the Lexemic hierarchy as coinciding with the root by default, as shown in (9.11).

(9.11)

```
NOMINAL:
    <> == LEXEME
    <stem 0> == "<root>"
    ...

VERB:
    <> == LEXEME
    <stem 0> == "<root>"
    ...
```

9.3. Future developments

The declarative account of Russian derivation that has been presented addresses many of the basic issues associated with word formation as lexeme formation, to a greater or lesser extent. Significant areas of word formation have not been touched, and would have to be the goal of future developments to the theory. Some of these we may briefly consider.

One important area of development would be the interaction of derivation with inflection. This would be accounted for by network relations between the Derivational and Inflectional hierarchies. The ordering of inflection after derivation would naturally fall out from the fact that the stem is partially evaluated in the Declarative hierarchy, and then used as the value for a path expressing a morphosyntactic complex in the Inflectional hierarchy. To avoid redundancy, a way would also have to be found of including inflectional class information in the structural description of a WFR. Animacy and gender would also be provided by inference from the semantic features of the derivation, for example, person would imply male, which would imply masculine gender and Class I; for female derivation, we would extend the path `<person>` to `<person female>` for the correct inferences.

Our account handles only suffixation, and on the more formal side any future development would need to incorporate the range of morphological operations possible in Russian derivation outlined in chapter one.

Allomorphy is another important area that needs to be looked at, since in Russian derivation consonantal, vocalic and stress alternations (see **1.2.3**) are possible. This would be accounted for by special alternation hierarchies that are parasitic on the Derivational hierarchy, much in the same way as stress alternations in inflection are accounted for in Network Morphology.

Still another area is the whole subject of lexical semantics, and the semantics of derivation. We already account for the inheritance of the Base's semantics, but the folksy semantics we use would need to be refined, possibly following Szymanek's Derivational Categories (1988), or Beard's Lexical Categories (1995).

The aim of the thesis, however, has not been to give an exhaustive account of Russian derivation. It has rather been to lay in place the key foundation stones on which something approaching an exhaustive account may be built, perhaps along the lines of what is suggested above.

Notes to chapter 9

[1] Vinogradov and Švedova (1964: 51).

[2] Vinogradov and Švedova (1964: 47).

[3] See Vinogradov and Švedova (1964: 52) for more examples of this kind.

[4] See Brown (forthcoming b) for Feature Preservation in its original form, which was developed with exclusively inflectional homonymy in mind.

[5] Obviously there will be no effect if the item's Base's syntactic category is a noun.

References

Anderson, S. 1982. Where's Morphology? *Linguistic Inquiry* 13, 4. 571-612.

Anderson, S. 1992. *A-Morphous Morphology*. Cambridge: Cambridge University Press.

Andrews, E. 1996. *The Semantics of Suffixation: Agentive Substantival Suffixes in Contemporary Standard Russian*. Newcastle: Lincom Europa.

Aronoff, M. 1976. *Word Formation in Generative Grammar*. Cambridge, Mass: MIT Press.

Aronoff, M. 1983. A decade of morphology and word formation. *Annual Review of Anthropology* 12.355-75.

Aronoff, M. 1992a. Noun classes in Arapesh. In: Booij, G and van Marle, J. (eds), *Yearbook of Morphology 1991*. Dordrecht: Kluwer.21-32

Aronoff, M. 1992b. Stems in Latin verbal morphology. In: Aronoff, M. (ed.) *Morphology Now*. New York: State University of New York Press. 5-32.

Aronoff, M. 1994. *Morphology by itself: Stems and Inflectional Classes*. Cambridge, Massachusetts: MIT Press.

Azarx, Ju. S. 1984. *Slovoobrazovanie i formoobrazovanie suščestvitel´nyx v istorii russkogo jazyka*. Moskva: Nauka.

Baayen, H. 1989. *A Corpus-Based Approach to Morphological Productivity: Statistical Analysis and Psycholinguistic Interpretation*. Dissertation, Free University, Amsterdam.

Baayen, H. and Lieber, R. 1991. Productivity and English derivation: a corpus-based study. *Linguistics* 29. 801-43.

Baayen, H. and Neijt, A. 1997. Productivity in context: a case study of a Dutch suffix. *Linguistics* 35.569-587.

Bauer, L. 1983. *English Word-Formation*. Cambridge: Cambridge University Press.

Bauer, L. 1988. *Introducing Linguistic Morphology*. Edinburgh: Edinburgh University Press.

Beard, R. 1976. A semantically based model of a generative lexical word-formation rule for Russian adjectives. *Language* 52.108-120.

Beard, R. 1995. *Lexeme-Morpheme Base Morphology: A General Theory of Inflection and Word Formation.* Albany: State University of New York Press.

Bielfeldt, H. 1958. *Rückläufiges Wörterbuch der russischen Sprache der Gegenwart.* Berlin.

Bloomfield, L. 1933. *Language*. New York: Holt.

Booij, G. 1994. Against split morphology. In: Booij, G. & van Marle, J. (eds) *Yearbook of Morphology 1993*. Dordrecht: Kluwer.27-49.

Booij, G. 1996. Inherent versus contextual inflection and the split morphology hypothesis. In: Booij, G. and van Marle, J. (eds) *Yearbook of Morphology 1995.* Dordrecht : Kluwer. 1-16.

Briscoe, T., Copestake, A., Lascarides, A. 1995. Blocking. In: St. Dizier, P. and Viegas, E (eds), *Computational Lexical Semantics.* Cambridge: Cambridge University Press. 273-302.

Brown, D. 1995. "Setevaja Morfologija" i russkaja glagol´naja sistema. *Vestnik moskovskogo universiteta. Ser. 9. Filologija*, 6.91-108.

Brown, D. 1996a. Polish nominal morphology and gender assignment: a Network Morphology based comparison with Russian. Paper presented at the *18th annual meeting of the Deutsche Gesellschaft für Sprachwissenschaft*, Freiburg, February 28 - March 1.

Brown, D. 1996b. Facts that influence the shape of inheritance hierarchies: a Bulgarian example. Paper presented at the *Linguistics Association of Great Britain Autumn Meeting*, University of Wales Institute, Cardiff, September 7-9, 1996.

Brown, D. 1996c. (Some) Hua verbal morphology. Paper presented at the *Frontiers of Research in Morphology ESRC seminar series*, Sussex, April 26.

Brown, D. 1997. Yup´ik verbal morphology and the animacy hierarchy. Paper presented at the *Linguistics Association of Great Britain Spring Meeting*, University of Edinburgh, April 7-9, 1997.

Brown, D. Forthcoming a. Stem Indexing and Morphonological Selection in the Russian Verb. In: Fabri, R., Ortmann, A. and Parodi, T. (eds) *Models of Inflection*. Niemeyer.

Brown, D. Forthcoming b. The general and the exceptional in Russian nominal morphology, University of Surrey PhD thesis, in draft.

Brown, D and Hippisley, A. 1994. Conflict in Russian Genitive Plural Assignment: A Solution Represented in DATR. *Journal of Slavic Linguistics* 2. 48-76.

Brown, D, Corbett, G., Fraser, N., Hippisley, A. and Timberlake, A. 1996. Russian noun stress and network morphology. *Linguistics* 34. 53-107.

Bybee, J. 1985. *Morphology: a Study of the Relation Between Meaning and Form*. Amsterdam: Benjamins.

Cahill, L. 1991. *Syllable-based Morphology for Natural Language Processing*. Doctoral Thesis, University of Sussex.

Cahill, L. and Gazdar, G. 1997. The inflectional phonology of German adjectives, determiners and pronouns. *Linguistics* 35 (2).211-245.

Carstairs, A. 1987. *Allomorphy in Inflexion*. London: Croom Helm.

Carstairs-McCarthy, A. 1992. *Current Morphology*. London: Routledge.

Chapin, P. 1967. *The Syntax of Word-Derivation in English*. Bedford MA: MITRE Corporation Information System Language Studies No. 16.

Chomsky, N. 1957. *Syntactic Structures*. The Hague: Mouton.

Chomsky, N. 1965. *Aspects of the Theory of Syntax*. Cambridge MA: MIT Press.

Chomsky, N. 1970. Remarks on nominalization. In: Jacobs, R. and Rosenbaum, P. (eds) *Readings in English Transformational Grammar*. Waltham MA: Blaisdell.184-221.

Chomsky, N. and Halle, M. 1968. *The Sound Pattern of English*. New York: Harper & Row.

Comrie, B. 1987. Russian. In: Comrie, B. (ed.) *The World's Major Languages*. London: Croom Helm.329-47.

Comrie, B., Stone, G. and Polinsky, M. 1996. *The Russian Language in the Twentieth Century*. Oxford: Clarendon.

Corbett, G. 1982. Gender in Russian. An account of gender specification and its relationship to declension. *Russian Linguistics* 6, (2). 197-232.

Corbett, G. 1987. The morphology/syntax interface: evidence from possessive adjectives in Slavonic. *Language* 63.299-345.

Corbett, G. 1989. The study of Russian stress patterns with advanced students. In: Falchikov, M, Pike, C and Russell, R (eds) *Words and Images: Essays in Honour of Professor (Emeritus) Dennis Ward*. Nottingham: Astra Press. 53-65.

Corbett, G. 1991. *Gender.* Cambridge: Cambridge University Press.

Corbett, G. and Fraser, N. 1993. Network Morphology: A DATR account of Russian nominal inflection. *Journal of Linguistics* 29. 113-42.

Corbett, G and Fraser, N. 1995. A typology of syncretism. Paper presented at the *Conference on Lexical Structures (SFB 282 Theory of the Lexicon),* Wuppertal, 28-31 August, 1995.

Corbett, G. and Fraser, N. Forthcoming a. Default Genders. To appear in: Unterbeck, B. (ed.) *Approaches to Gender*. Mouton.

Corbett, G. and Fraser, N. Forthcoming b. Gender assignment: a typology and a model. To appear in: Senft, G. (ed.) *Back to Basic Issues in Nominal Classification.*

Corbin, D. 1987. *Morphologie dérivationelle et structuration du lexique* (2 vols). Tübingen: Niemeyer.

Cubberley, P. 1994. *Handbook of Russian Affixes*. Columbus: Slavica.

Čurganova, V. G. 1973. *Očerk russkoj morfonologii*. Moskva: Nauka.

Daelemans, W., De Smedt, K. and Gazdar, G. 1992. Inheritance in Natural Language Processing. *Computational Linguistics* 18.205-18.

Darden, B. 1988. Truncation and/or Transderivational Constraints in Russian Word-formation. In: MacLeod, L., Larson, G. and Brentari, D. (eds) *Papers from the 24th Annual Regional Meeting of the Chicago Linguistic Society*. 88-99.

Dementjev, A.A. 1960. Suffiksy *-ak*, *-jak*...v russkom jazyke. *Učenye zapiski Kujbyševskogo gosudarstvennogo pedagogičeskogo instituta*. 51-65.

Dressler, W. U. 1989. Prototypical Differences Between Inflection and Derivation. *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung*, 42.3-10.

Evans, R. 1990. An introduction to the Sussex Prolog DATR system. In: Evans, R. and Gazdar, G. (eds) *The DATR Papers vol I*. (Cognitive Science Research Paper CSRP 139). University of Sussex. 63-71.

Evans, R. and Gazdar, G. 1989a. Inference in DATR. *Proceedings of the 4th Conference of the European Chapter of the Association for Computational Linguistics*. Manchester, England.66-71.

Evans, R. and Gazdar, G. 1989b. The semantics of DATR. In: Cohn, A. G. (ed.) *Proceedings of the Seventh Conference of the Society for the Study of Artificial Intelligence and Simulation of Behavio*ur. London: Pitman/Morgan Kaufmann.79-87.

Evans, R. and Gazdar, G. 1995. *DATR: a Language for Lexical Knowledge Representation.* (Cognitive Science Research Papers CSRP 382). University of Sussex.

Evans, R. and Gazdar, G. 1996. DATR: a Language for Lexical Knowledge Representation. *Computational Linguistics* 22, (2). 167-216.

Evans, R., Gazdar, G. and Moser, L. 1993. Prioritised multiple inheritance in DATR. In: Briscoe, T., Copestake, A. and De Paiva, V. (eds) *Inheritance, Defaults and the lexicon*. Cambridge: Cambridge University Press.

Evans, R., Gazdar, G. and Keller, B. Index to the DATR archive [online]. Available: http://www.cogs.sussex.ac.uk/lab/nlp/datr/node37.html# [February 1997].

Fabb, N. 1988. English suffixation is constrained only by selectional restrictions. *Natural Language and Linguistic Theory* 6.527-39.

Fedjanina, N. A. 1976. *Udarenie v sovremennom russkom jazyke*. Moskva: Russkij jazyk.

Flickinger, D. 1987. *Lexical rules in the hierarchical lexicon*. Unpublished doctoral dissertation, Stanford University.

Fraser, N. and Corbett, G. 1995. Gender, animacy and declensional class assignment: a unified account for Russian. In: Booij, G. and van Marle, J (eds) *Yearbook of Morphology 1994*. Dordrecht: Kluwer.123-50.

Fraser, N. and Corbett, G. Forthcoming. Gender Assignment in Arapesh: a Network Morphology analysis. To appear in *Lingua*, 103 (1997).

Galkina-Fëdoruk, E. M., Gorškova, K. V., Šanskij, N. M. (eds). 1957. *Sovremennij russkij jazyk*. Moskva: Prosveščenie.

Gazdar, G. 1987. Linguistic Applications of Default Inheritance Mechanisms. In: Whitelock, P., Wood, M., Somers, H., Johnson, R. and Bennett, P. (eds) *Linguistic Theory and Computer Applications*. London: Academic Press.37-67.

Gazdar, G. 1990. An Introduction to DATR. In: Evans, R. and Gazdar, G. (eds) *The DATR Papers vol I*. (Cognitive Science Research Paper CSRP 139). University of Sussex. 1-14.

Gazdar, G. 1992. Paradigm Function Morphology in DATR. In: Cahill, L. and Coates, R. (eds) *Sussex Papers in General and Computational Linguistics*. (Cognitive Science Research Paper CSRP 239). University of Sussex.43-53.

Gazdar, G. Forthcoming. Ceteris paribus. To appear in: Kamp, J. and Rohrer, C. (eds) *Aspects of computational linguistics*. Berlin: Springer.2-35.

Gibbon, D and Bleiching, D. 1991. An ILEX model for German compound stress in DATR. In: *FORWISS-ASL Workshop: "Prosodie in der Mensch-Maschine-Kommunikation", Erlangen, December 2-3, 1991* Erlangen.

Gibbon, Dafydd. 1992. ILEX: a linguistic approach to computational lexica. In: Klenk, U. (ed.) *Aufsätze zur algorithmischen und quantitativen Analyse der Sprache*. Stuttgart: Franz Steiner Verlag.32-53.

Gussmann, E. 1988. Review of Mohanan 1986 'The Theory of Lexical Phonology'. *Journal of Linguistics* 24 (1).232-9.

Gvozdev, A. N. 1961. *Sovremennyj russkij literaturnyj jazyk*. Moskva: Prosveščenie.

Halle, M. 1959. *The Sound Pattern of Russian*. The Hague: Mouton.

Halle, M. 1973. Prolegomena to a theory of word-formation. *Linguistic Inquiry* 4. 3-16.

Hippisley, A. 1994a. Network Relations in Expressive Derivation. Paper presented at the *Frontiers of Research in Morphology ESRC seminar series*, University of Surrey, December 1994.

Hippisley, A. 1994b. Default Inheritance and Word-Formation: DATR Approaches to English and Russian Derivational Morphology. Paper presented at the *Linguistics Association of Great Britain Spring Meeting*, University of Salford, April 7, 1994.

Hippisley, A. 1996. Russian Expressive Derivation: a Network Morphology Account. *The Slavonic and East European Review* 74(2).201-222.

Hockett, C. 1958. *A Course in Modern Linguistics.* New York: Macmillan.

Hudson, R. 1984. *Word Grammar.* Oxford: Blackwell.

Hudson, R. 1990. *English Word Grammar.* Oxford: Blackwell.

Illingworth, V. (ed.). 1990. *Dictionary of Computing.* Oxford: Oxford University Press. [third edition]

Ilola, E and Mustajoki, A. 1989. *Report on Russian Morphology as it appears in Zaliznyak's Grammatical Dictionary.* Helsinki: Helsinki University Press.

Isačenko, A. V. 1960. *Grammatičeskij stroj russkogo jazyka v sopostavlenii c slovackim. Morfologija (2).* Bratislava: Slovackaja AN.

Isačenko, A. V. 1968. *Die russische Sprache der Gegenwart vol. I.* Halle: Max Niemeyer Verlag.

Isačenko, A. V. 1969. Morpheme classes, deep structure and Russian indeclinables. *International Journal of Slavic Linguistics and Poetics*, XII.48-72.

Isačenko, A. V. 1972. Rol′ usečenija v russkom slovoobrazovanii. *International Journal of Slavic Linguistics and Poetics*, XV.95-125.

Jackendoff, R. 1972. *Semantic Interpretation in Generative Grammar.* Cambridge MA: MIT Press.

Jakobson, R. 1948. Russian Conjugation. *Word* 4. 155-167.

Janssen, T. 1994. Derivation. In: Asher, R. (ed.) *Encyclopedia of Language and Linguistics*, vol 2. Oxford: Pergamon Press.872-874.

Jenkins, E. 1990. Enhancements to the Sussex Prolog DATR implementation. In: Evans, R. and Gazdar, G. (eds) *The DATR Papers vol I*. (Cognitive Science Research Paper CSRP 139). University of Sussex. 41-61.

Katamba, F. 1993. *Morphology*. London: Macmillan.

Katlinskaja, L. P. 1983. Nekotorye nabljudenija nad slovoobrazovaniem v sovremennoj russkoj terminologii. *Izvestija Akademii nauk SSSR, Serija literatury i jazyka,* 42, 6 (Nov-Dec). 540-48.

Kempgen, S. 1989. *Grammatik der russischen Verben*. Wiesbaden: Otto Harrosowitz.

Kilbury, J. 1992. Paradigm-Based Derivational Morphology. In: Görz, G. (ed.) *KONVENS 92*. Berlin: Springer Verlag. 159-68.

Kilgarriff, A. 1995. Inheriting polysemy. In: Saint-Dizier, P. and Viegas, E. (eds) *Computational Lexical Semantics*. Cambridge: Cambridge University Press.

Kiparsky, P. 1982. Lexical morphology and phonology. In: Yang, I. S. (ed.) *Linguistics in the Morning Calm. Selected papers from SICOL-1981*. Seoul: Hanshin Publishing Company.3-91.

Kiparsky, P. 1983. Word formation and the lexicon. In: Ingemann, F. (ed.) *Proceedings of the 1982 Mid-America Linguistics Conference*. University of Kansas. 3-29.

Krieger, H. and Nerbonne, J. 1993. Feature-based inheritance networks for computational lexicons. In: Briscoe, T., Copestake, A. and De Paiva, V. (eds) *Inheritance, Defaults, and the Lexicon*. Cambridge: Cambridge University Press.90-136

Lazova, M. V. 1974. *Obratnij slovar´ russkogo jazyka*. Moskva: Sovetskaja ènciklopedija.

Lees, R. 1960. *The Grammar of English Nominalizations*. The Hague: Mouton.

Lieber, R. 1980. *The Organization of the Lexicon*. PhD dissertation, MIT. [Distributed by Indiana University Linguistics Club]

Likova, A. G. 1959. *Obrazovanie imen suščestvitel´nyx so značeniem lica v sovremennom russkom jazyke*. Moscow State University dissertation.

Marchand, H. 1969. *The Categories and Types of Present-Day English Word-Formation*. München: Beck. [Second edition]

Matthews, P. 1972. *Inflectional Morphology*. Cambridge: Cambridge University Press.

Matthews, P. 1991. *Morphology*. Cambridge: Cambridge University Press [second edition].

Newmeyer, F. 1980. *Linguistic Theory in America*. Chicago: University of Chicago Press.

Nida, E. 1949. *Morphology: the Descriptive Analysis of Words*. Ann Arbor: University of Michigan Press.

North, M. and Hillard, A. 1930. *Latin Prose Composition*. London: Rivingtons.

Panov, M. V. 1968. *Russkij jazyk i sovetskoe obščestvo: slovoobrazovanie sovremennogo russkogo literaturnogo jazyka*. Moskva: Nauka.

Pirogova, L. 1969. O klassifikacii russkix glagolov. *Russkij jazyk v nacional´noj škole* 4.26-33.

Plank, F. 1994. Inflection and derivation. In: Asher, R. *Encyclopedia of Language and Linguistics, vol. 3*. Oxford: Pergamon Press.1671-1678.

Red´kin, V. A. 1971. *Akcentologija sovremennogo russkogo literaturnogo jazyka: posobie dlja učitelej*. Moskva: Prosveščenie.

Reformatskij, A. A. 1967. *Vvedenie v jazykovedenie*. Moskva.

Robins, R. 1980. *General Linguistics: an Introductory Survey*. New York: Longmans.

Sadler, L, Spencer, A. and Zaretskaya, M. 1994. The 'Third Stem' in Russian. *Working Papers in Language 44*, University of Essex.

Sadler, L, Spencer, A. and Zaretskaya, M. 1997. A morphomic account of a syncretism in Russian deverbal nominalizations. In: Booij, G. and van Marle, J. (eds) *Yearbook of Morphology 1996*. Dordrecht: Kluwer.181-215.

Šanskij, N. M. 1975. *Russkij jazyk. Leksika. Slovoobrazovanie*. Moskva: Prosveščenie.

Scalise, S. 1986. *Generative Morphology*. Dordrecht: Foris [second edition].

Scalise, S. 1988. Inflection and derivation. *Linguistic Inquiry*, 26.561-581.

Shapiro, M. 1967. Laws, Latitudes, and Limitations of Stress: Russian Derived Substantives. *Acta Linguistica Hafniensia*, 10 (2).187-200.

Shieber, S. 1987. Separating Linguistic Analyses from Linguistic Theories. In: Whitelock, P., Wood, M., Somers, H., Johnson, R. and Bennett, P. (eds) *Linguistic Theory and Computer Applications*. London: Academic Press.1-36.

Siegel, D. 1977. The Adjacency Constraint and the Theory of Morphology. *Proceedings of the Eighth Annual Meeting of the North Eastern Linguistics Society*. 189-97.

Siegel, D. 1979. *Topics in English Morphology*. New York: Garland.

Spencer, A. 1991. *Morphological Theory*. Oxford: Blackwell.

Stankiewicz, E. 1962. The Interdependence of Paradigmatic and Derivational Patterns. *Word* 18.1-22.

Stankiewicz, E. 1968. *Declension & Gradation of Russian Substantives*. The Hague: Mouton.

Stump, G. 1990. Breton Inflection and the Split Morphology Hypothesis. In: Hendrick, R. (ed.). *The Syntax of the Modern Celtic Languages* (Syntax and Semantics no. 23). San Diego: Academic Press. 97-119.

Stump, G. 1991. A paradigm-based theory of morphosemantic mismatches. *Language* 67, 675-725.

Švedova, N. Ju (ed.). 1970. *Grammatika sovremennogo russkogo jazyka*. Moskva: Nauka.

Švedova, N. Ju. (ed.). 1980. *Russkaja grammatika, tom I*. Moskva: AN SSSR.

Szymanek, B. 1988. *Categories and Categorization in Morphology*. Lublin: Catholic University Press.

Timberlake, A. 1993. Russian. In: Comrie, B. and Corbett, G (eds) *The Slavonic Languages*. Routledge: London/New York. 827-86.

Tixonov, A. N. 1985. *Slovoobrazovatel'nyj slovar' russkogo jazyka*. Moskva: Russkij jazyk.

Touretzky, D. 1986. *The Mathematics of Inheritance Systems*. London: Pitman.

Townsend, C. 1975. *Russian word-formation*. Columbus: Slavica.

Uluxanov, I. C. 1979. Slovoobrazovatel'nye otnošenija meždu častjami reči. *Voprosy jazykoznanija*, 28 (4), 101-110.

Unbegaun, B. O. 1957. *Russian Grammar*. Oxford: Clarendon.

Ušakov, D. N. 1935-40. *Tolkovyj slovar' russkogo jazyka* (4 vols.). Moskva.

Vinogradov, V. V. 1960. *Grammatika russkogo jazyka, tom 1: fonetika i morfologija*. Moskva: Nauka.

Vinogradov, V.V. 1971. *Russkij jazyk (grammatičeskoe učenie o slove)*. Moscow: Academic International.

Vinogradov, V. V. and Švedova, N. Ju. (eds). 1964. *Izmenenija v slovoobrazovanii i formax suščestvitel'nogo i prilagatel'nogo v russkom literaturnom jazyke XIX veka*. Moskva: Nauka

Vinogradov, V.V., Istrina, E. S., & Barxudarov, S. G. (eds) 1953. *Grammatika russkogo jazyka, tom* I. *Fonetika i morfologija*. Moskva: AN SSSR.

Walker, J. 1924. *The Rhyming Dictionary*, revised by L. Dawson. London: Routledge.

Worth, D. S. 1967. The Notion of 'Stem' in Russian Flexion and Derivation. In: *To honor Roman Jakobson: essays on the occasion of his seventieth birthday, vol. III*. Mouton: The Hague.2269-2288.

Zaliznjak, A. A. 1977. *Grammatčeskij slovar' russkogo jazyka*. Moskva: Russkij jazyk.

Zemskaja, E. A. 1973. *Sovremennij russkij jazyk: slovoobrazovanie*. Moskva: Prosveščenie.

Zwicky, A. 1985. How to describe inflection. *Berkeley Linguistic Society* 11.372-86.

Zwicky, A. 1987. Morphological rules, operations and operation types. In: Miller, A. and Powers, J. (eds) *Eastern States Conference on Linguistics, 4*. Ohio State University.318-334.

Zwicky, A. 1992. Some Choices in the Theory of Morphology. In: Levine, R. D. (ed.) *Formal grammar: theory and implementation*. Oxford: Oxford University Press. 327-71.

Zwicky, A. 1996. The Architecture of Morphology. Paper read at *Frontiers of Research in Morphology ESRC Research Seminar*, University of Sussex, April 1996.

1847 slovar´ cerkovnoslavjanskogo i russkogo jazyka, 4 vols. Sankt Peterburg: AN.

Dictionaries consulted (semasiological)

Alford, M. & Alford, V. 1970. *Russian-English Scientific and Technical Dictionary* (2 vols). Oxford: Pergamon.

Černyšev, V. E. (main ed.). 1950 - 65. *Slovar´ sovremennogo russkogo literaturnogo jazyka*, 17 vols. Moskva: AN SSSR.

Evgenjeva, A. P. (main ed.). 1981. *Slovar´ russkogo jazyka v 4 tomax*. Moskva: Russkij jazyk.

Macura, J. and Macura, A. 1982. *Russian-English Botanical Dictionary*. Columbus: Slavica.

Ožegov, S. I. 1973. *Slovar´ russkogo jazyka*. Moskva: Sovetskaja ènciklopedija.

Ušakov, D. N. 1935-40. *Tolkovyj slovar´ russkogo jazyka* (4 vols.). Moskva.

Wheeler, M. 1984. *The Oxford Russian-English Dictionary*. Oxford: Clarendon. [second edition]

APPENDICES

The Appendices contain the DATR representation of the declarative theory of Russian person derivation outlined in the previous chapters, together with the theorems, demonstrating that the theory makes the correct predictions about the data it claims to account for. The fragment representing the theory appears in Appendix 1, and its lexical entries are contained in Appendix 2. The computer-generated theorems appear in Appendix 3.

Appendix 1:
'derivperson1.dtr'

The DATR representation of our declarative account of Russian person noun derivation is given as the file' derivperson1.dtr'. Included in the file is a representation of the derivational hierarchy and partial representation of the Lexemic hierarchy. Note that numbers in square brackets denote reference to the relevant chapter and section in the thesis. Example lexical entries are given in Appendix II.

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%    File:           derivperson1.dtr                                  %
%    Purpose:        Russian person derivation                         %
%    Author:         Andrew Hippisley 31 07, 1997                      %
%    Email:          lislah@surrey.ac.uk                               %
%    Address:        LIS, University of Surrey, Guildford GU2 5XH      %
%    Documentation:  Declarative Derivation: chapters 7, 8 and 9       %
%    Related Files:  show_person_noun1.dec, lexicon1.dtr               %
%    Version:        1.01                                              %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%    1.1. CHOOSE LEXICON AND SHOW DECLARATIONS                         %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

 #load 'show_person_noun1.dec.'
 #load 'lexicon1.dtr'.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%    1.2. LEXEMIC HIERARCHY                                            %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.2.1. The node LEXEME.
% Paths express that:
% a) the stem is the Base's stem plus the derivational suffix [7.1.1];
% the stem the derivation is based on is one of a range of indexed
% stems [7.2.1]
% b) truncation is defined as the stem minus its suffix [7.5.2]
% c) a stem's index corresponds to the derivational function (e.g. 'deverbal
% person derivation' corresponds to stem index 1) [7.2.1]
% d) by default, a Derivative's Base is itself underived.
% e) by default, a Derivative's syntactic category is provided by the deriv-
% ation.
% f) a lexeme's semantics is undefined unless specified
% g) derivational information is addressed to the node DERIV_LEXEME in the
% Derivational hierarchy, using the leading sub-path <deriv> which serves
% as the hierarchy identifier of the Derivational hierarchy [7.1.2]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

LEXEME:
   a. <stem> == "<base stem "<index>">" "<deriv suffix>"
   b. <stem -1> == "<base stem 0>"
   c. <index> == STEM_SELECTION:<"<base syn cat>" "<deriv sem feature>">
   d. <base deriv suffix> == undefined
   e. <syn cat> == "<deriv syn cat>"
   f. <sem feature> == undefined
   g. <deriv> == DERIV_LEXEME.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.2.2. The node NOMINAL
% This node generalises over nouns and adjectives. In Network Morphology
% accounts of Russian inflection, it states that stems by default end in
% non-palatalised consonants, for example. In our account, it stores the
% generalisation that the default stem in an item's stem inventory is
% Stem 0, and that Stem 0 by default coincides with the root [7.2.2]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

NOMINAL:
   <> == LEXEME
   <stem 0> == "<root>"
   <stem> == "<stem 0>.
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.2.3. The nodes NOUN and ADJ
% a,d) both nodes inherit generalisations about the stem from NOMINAL
% b,e) for derivational information, items are referred to equivalent
% nodes in the Derivational hierarchy (DERIV_NOUN, DERIV_ADJ) [7.1.2], [7.1.3]
% c,f) lexical entries representing underived lexemes inherit from these nodes
% for their syntactic category [7.1.1]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

NOUN:
   a. <> == NOMINAL
   b. <deriv> == DERIV_NOUN
   c. <syn cat> == noun.

ADJ:
   d. <> == NOMINAL
   e. <deriv> == DERIV_ADJ
   f. <syn cat> == adj.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.2.4. The node VERB
% This node carries information similar to NOUN and ADJ. Thus it
% expresses that a verb's basic stem (Stem 0) by default coincides with
% its root [7.2.2]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

VERB:
   a. <> == LEXEME
   b. <deriv> == DERIV_VERB
   c. <syn cat> == verb
   d. <stem 0> == "<root>".

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.2.5. The node VERB_I_OV
% This node express stem formation generalisations over the class of
% verbs belonging to the '/ov/' group of the first conjugation. As a
% sub-class of the class of verbs, it inherits from VERB (a). But note that it
% overrides the default at verb that the basic stem coincides with the
% root (b) [7.2.2]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
```

```
VERB_I_OV:
    a. <> == VERB
    b. <stem 0> == "<root>" ov
    c. <stem 1> == "<stem 0>" a
    d. <stem 2> == "<stem 0>" uj
    e. <stem 3> == "<stem 1>" n.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%    1.3. DERIVATIONAL HIERARCHY                                       %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.1. The DERIV_* nodes                                             %
% These represent the first 'level' of derivational information, and  %
% are referred to by the nodes in the lexemic hierarchy [7.1.2], [7.3]%
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.1.1. The node DERIV_LEXEME
% This is the node referred to by LEXEME for derivational information
% about lexemes.
% a) states that the suffix depends first and foremost on the lexical
% entry's Base's syntactic category. Evaluation is carried out at an
% interdependency node (see 1.4.1). This is how syntactic conditions are
% expressed [7.3]
% b) states that by default the semantics introduced in a derivation are
% undefined. This provides for transpositions, i.e. asemantic derivations.
% c) states that the syntactic category introduced in a derivation can be
% inferred by the semantics introduced in the derivation. The inferences
% themselves are stated as a set of interdependent defaults at the node
% SEM_SYNCAT (1.4.2) [7.1.1]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DERIV_LEXEME:
    a. <deriv suffix> == SYNCAT_INTERDEPENDENCY:<"<base syn cat>">
    b. <deriv sem feature> == undefined
    c. <deriv syn cat> == SEM_SYNCAT:<"<deriv sem feature>">.
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.1.2. The nodes DERIV_NOUN, DERIV_ADJ, DERIV_VERB
% These nodes are addressed by the equivalent nodes in the Lexemic hierarchy
% for derivational information for nouns, adjectives and verbs. They inherit
% the generalisations stated above at DERIV_LEXEME. Importantly, they express
% the relationship between the suffix and the semantics and syntax introduced
% in a derivation, in other words, the WFR's structural change.
% At the same time they express that suffix selection is dependent on the
% lexical entry's Base's syntactic category. This is done by referring
% evaluations to separate nodes which collect suffixes for derivation
% from nouns, adjectives and verbs, i.e. the DERIV_DE* nodes [7.1.3], [7.3]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DERIV_NOUN:
   <> == DERIV_LEXEME
   <deriv suffix> == DERIV_DE_NOUN:<"<deriv syn cat>" "<deriv sem feature>">.

DERIV_ADJ:
   <> == DERIV_LEXEME
   <deriv suffix> == DERIV_DE_ADJ:<"<deriv syn cat>" "<deriv sem feature>">.

DERIV_VERB:
   <> == DERIV_LEXEME
   <deriv suffix> == DERIV_DE_VERB:<"<deriv syn cat>" "<deriv sem feature>">.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.2 The DERIV_DE* NODES
% These nodes directly express the interdependence of the lexical
% entry's Base's syntactic category and the suffix that is selected, and
% in this way contribute to the encoding of syntactic conditions in WFRs.
% Suffixes, or further evaluations relating to suffixes, are collected
% at these nodes. Hence suffixes stored at DERIV_DE_NOUN are suffixes that
% are inherited by lexemes derived from nouns, etc. [7.3]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.2.1. DERIV_DE_LEXEME
% This node is used to store the default that where the syntactic category
% and semantics introduced by a WFR cannot be retrieved, the suffix delivered
```

```
% is undefined. In other words, only derivation that adds information will
% be realised formally. The other DERIVE_DE* nodes inherit from here.
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DERIV_DE_LEXEME:
   <> == undefined.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.2.2. DERIV_DE_NOUN
% This node serves as a collection point for suffixes that are selected
% by lexical entries whose Base is a noun.
% a) expresses inheritance from DERIV_DE_LEXEME, and the default about empty
% derivation
% b) states that derivation introducing the syntactic category 'noun', and
% the semantics 'person' is realized by -n´ik (later modified as (c))
% c) expresses a modification of (b), that the suffix selected to realize
% this derivation depends on the semantics of the lexical entry's Base. In
% this way a semantic condition is being expressed [7.4.1]
% d) expresses another semantic condition, this time the selection of a suffix
% for relational adjective derivation [7.4.2]
% e) states that derivation of adjectives, where it is unspecified whether the
% adjective is qualitative or relational, is realized by the suffix -n
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DERIV_DE_NOUN:
   a. <> == DERIV_DE_LEXEME
   b. %% <noun person> == n´ik %modified as the next line ->
   c. <noun person> == DE_NOUN_PERSON:<"<base sem feature>">
   d. <adj rel> == DE_NOUN_REL:<"<base sem feature>">
   e. <adj undefined> == n.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.2.3. DERIV_DE_ADJ
% This node serves as a collection point for suffixes selected where
% the lexical entry's Base is an adjective.
% b) expresses a morphological condition, where the suffix used to
% realise derivation of a person noun depends on the suffix that is present
% in the stem of the lexical entry's Base [7.5.1] [7.5.2]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
```

```
DERIV_DE_ADJ:
   a. <> == DERIV_DE_LEXEME
   b. <noun person> == DE_ADJ_PERSON:<"<base deriv suffix>">.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.2.4. DERIV_DE_VERB
% This node functions similarly to DERIV_DE_NOUN and DERIV_DE_ADJ, and
% collects suffixes used to for derivation based on verbs, for example
% -tel´ which derives person nouns [7.1.3] [7.3]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DERIV_DE_VERB:
   <> == DERIV_DE_LEXEME
   <noun person> == tel´.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.3 Semantic and morphological interdependency nodes
% At these nodes suffix selection that is conditional on
% the morphological structure or semantics of an item's Base is
% expressed as a set of interdependent defaults
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.3.1. The node DE_NOUN_REL
% This node states semantically based generalisations regarding relational
% adjectives derived from nouns.
% a) states that if the Base denotes a person, the suffix inherited by the
% Derivative lexical entry will be -sk [7.4.2]
% b) states that the same happens for Bases that denote places
% c) states that for any other type of Base, the suffix -ov will be inherited
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DE_NOUN_REL:
    a. <person> == sk
    b. <place> == <person>
    c. <> == ov.
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.3.2. The node DE_NOUN_PERSON
% This node lists default statements regarding persons derived from nouns.
% The suffix selected is determined by semantic information in the Base.
% If the Base is marked 'foreign', the suffix inherited by the Derivative
% lexical entry will be -´ist (a); otherwise it will be -n´ik (b). [7.4.1]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DE_NOUN_PERSON:
    a. <foreign> == ´ist
    b. <> == n´ik.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.3.3.3 The node DE_ADJ_PERSON
% For person nouns derived from adjectives, the suffix selected is determined
% by the Base's morphological structure. This node expresses that if the Base
% is derived in the suffixes -n, -ov or -´an, the suffix inherited by the
% Derivative lexical entry will be -´ik. If it is derived in any other suffix,
% including no suffix at all, then -ec will be inherited [7.5.1] [7.5.2]
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

DE_ADJ_PERSON:
    <n> == ´ik
    <ov> == <n>
    <´an> == <n>
    <> == ec.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%    1.4. OTHER INTERDEPENDENCY NODES                                  %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.4.1. The node SYNCAT_INTERDEPENDENCY
% This node functions to relate syntactic category information of a
% Derivative's Base to the syntactic category node in the Lexemic hierarchy.
% It therefore contributes to the encoding of syntactic conditions [7.3]
% It is addressed by path (a) at DERIV_LEXEME (1.3.1.1).
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
```

```
SYNCAT_INTERDEPENDENCY:
   <verb> == VERB:<deriv suffix>
   <noun> == NOUN:<deriv suffix>
   <adj> ==  ADJ:<deriv suffix>
   <> == <noun>.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.4.2. The node SEM_SYNCAT
% This node states the inference of the syntactic class in a derivation
% from the semantics in a derivation. [7.1.1]
% It is addressed by path (b) at DERIV_LEXEME (1.3.1.1).
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

SEM_SYNCAT:
   <> ==
   <person> == noun
   <rel> == adj
   <thing> == noun.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
% 1.4.3. The node STEM_SELECTION
% This node relates the derivational function with the index of the stem,
% thereby expressing the 'morphomic' level. For verbs, person derivation
% corresponds to index 1, i.e. Stem 1; any other type of derivation
% corresponds to the basic stem, i.e. Stem 0 [7.2.1]
% It is addressed by the path (c) at LEXEME (1.2.1).
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

 STEM_SELECTION:
   <verb person> == 1
   <> == 0.
```

Appendix II:
'lexicon1.dtr'

Example lexical entries are given below. They are contained in the file 'lexicon1.dtr', which is loaded by 'derivperson1.dtr' (see Appendix I).

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%    File:            lexicon1.dtr                                      %
%    Purpose:         Russian person derivation: lexical entries        %
%    Author:          Andrew Hippisley 31 07, 1997                      %
%    Email:           lis1ah@surrey.ac.uk                               %
%    Address:         LIS, University of Surrey, Guildford GU2 5XH      %
%    Documentation:   Declarative Derivation: chapters 7,8 and 9        %
%    Related Files:   derivperson1.dtr, show_person_noun1.dec           %
%    Version:         1.01                                              %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%
% 1) This file
%
% This file contains nodes representing Derivative lexical entries along
% with their Bases. Examples have been chosen to illustrate the following
% points of the theory, as outlined in chapters 7 and 8:
%
% 1.1. Syntactic conditions [7.3]
%
% 1.2. Phonological conditions [7.2]
%
% 1.3. Semantic conditions [7.4]
%
% 1.4. Morphological conditions [7.5]
%
% 1.5. Truncation [7.5.2]
%
% 1.6. Exceptions [chapter 8]
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.1. LEXICAL ENTRIES ILLUSTRATING SYNTACTIC CONDITIONS [7.3]        %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Atom:
   <> == NOUN
   <root> == atom
   <gloss> == atom.

Atomn´ik:
   <> == LEXEME
   <base> == "Atom:<>"
   <deriv sem feature> == person
   <gloss> == atomic_scientist.

Kleveta:
   <> == NOUN
   <root> == klevet
   <gloss> == slander.

Klevetn´ik:
   <> == LEXEME
   <base> == "Kleveta:<>"
   <deriv sem feature> == person
   <gloss> == slanderer.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.2. LEXICAL ENTRIES ILLUSTRATING PHONOLOGICAL CONDITIONS [7.2]     %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Tolkovat´:
   <> == VERB_I_OV
   <root> == tolk
   <gloss> == interpret.
```

```
Tolkovatel´:
    <> == LEXEME
    <base> == "Tolkovat´:<>"
    <deriv sem feature> == person
    <gloss> == interpreter.

Los´:
    <> == NOUN
    <root> == los´
    <stem 1> == <stem 0> ´at
    <gloss> == elk.

Los´atn´ik:
    <> == LEXEME
    <base> == "Los´:<>"
    <base stem> == "Los´:<stem 1>"
    <deriv sem feature> == person
    <gloss> == elk_hunter.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.3. LEXICAL ENTRIES ILLUSTRATING SEMANTIC CONDITIONS [7.3]       %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Abbat:
    <> == NOUN
    <root> == abbat
    <sem feature> == person
    <gloss> == abbot.

Abbatskij:
    <> == LEXEME
    <base> == "Abbat:<>"
    <deriv sem feature> == rel
    <gloss> == abbot_adj.
```

```
Šum:
   <> == NOUN
   <root> == šum
   <gloss> == noise.

Šumovoj:
   <> == LEXEME
   <base> == "Šum:<>"
   <deriv sem feature> == rel
   <gloss> ==  noise_adj.

Mašina:
   <> == NOUN
   <root> == mašin
   <sem feature> == foreign
   <gloss> == machine.

Mašin´ist:
   <> == LEXEME
   <base> == "Mašina:<>"
   <deriv sem feature> == person
   <gloss> == machine_worker.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.4. LEXICAL ENTRIES ILLUSTRATING MORPHOLOGICAL CONDITIONS [7.5]  %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Krov´:
   <> == NOUN
   <root> == krov´
   <gloss> == blood.

Krovnij:
    <> == LEXEME
    <base> == "Krov´:<>"
    <deriv sem feature> == undefined
    <deriv syn cat> == adj
    <gloss> == blood_adj.
```

```
Krovn´ik:
    <> == LEXEME
    <base> == "Krovnij:<>"
    <deriv sem feature> == person.
    <gloss> == relative.

Pravo:
    <> == NOUN
    <root> == prav
    <gloss> == law.

Pravovoj:
    <> == LEXEME
    <base> == "Pravo:<>"
    <deriv sem feature> == rel
    <gloss> == legal.

Pravov´ik:
    <> == LEXEME
    <base> == "Pravovoj:<>"
    <deriv sem feature> == person
    <gloss> == jurist.

Skupoj:
    <> == ADJ
    <root> == skup
    <gloss> == stingy.

Skupec:
    <> == LEXEME
    <base> == "Skupoj:<>"
    <deriv sem feature> == person
    <gloss> == stingy_person.

č´ornij:
    <> == ADJ
    <root> == č´orn
    <gloss> == black.
```

```
Č´ornec:
   <> == LEXEME
   <base> == "Č´ornij:<>"
   <deriv sem feature> == person
   <gloss> == monk.


% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.5. LEXICAL ENTRIES ILLUSTRATING TRUNCATION [7.5.2]              %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Kanada:
   <> == NOUN
   <root> == kanad
   <sem feature> == place
   <gloss> == canada.

Kanadskij:
   <> == LEXEME
   <base> == "Kanada:<>"
   <deriv sem feature> == rel
   <gloss> == canadian.

Kanadec:
   <> == LEXEME
   <base> == "Kanadskij:<>"
   <base stem> == "Kanadskij:<stem -1>"
   <deriv sem feature> == person
   <gloss> == canadian_person.
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.6. LEXICAL ENTRIES ILLUSTRATING TYPES OF EXCEPTION           %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.6.1. UNPRODUCTIVE SUFFIXES [8.1]                             %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Truba:
   <> == NOUN
   <root> == trub
   <gloss> == trumpet.

Trubač:
   <> == LEXEME
   <base> == "Truba:<>"
   <deriv sem feature> == person
   <deriv suffix> == ač
   <gloss> == trumpeter.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.6.2. SYNTACTIC EXCEPTIONS [8.3]                              %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Balovat´:
   <> == VERB_I_OV
   <root> == bal
   <gloss> == spoil.

Balovn´ik:
   <> == LEXEME
   <base> == "Balovat´:<>"
   <base stem> == "Balovat´:<stem 0>"
   <deriv sem feature> == person
   <deriv suffix> == NOUN
   <gloss> == spoilt_child.
```

```
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.6.3. SEMANTIC EXCEPTIONS [8.5]                                  %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Očerk:
   <> == NOUN
   <root> == očerk
   <gloss> == essay.

Očerkist:
   <> == LEXEME
   <base> == "Očerk:<>"
   <deriv sem feature> == person
   <deriv suffix> == DE_NOUN_PERSON:<foreign>
   <gloss> == essayist.

% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %
%   1.6.4. PHONOLOGICAL EXCEPTIONS [8.6]                              %
% % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % % %

Smotret´:
   <> == VERB
   <root> == smotr
   <stem 1> == "<root>" e
   <stem i> == <stem 0> ´i
   <gloss> == watch.

Smotr´itel´:
   <> == LEXEME
   <base> == "Smotret´:<>"
   <base stem> == "Smotret´:<stem i>"
   <deriv sem feature> == person
   <gloss> == supervisor.
```

Appendix III:
Theorems

The theorems of the lexical entries listed in Appendix II are given below.

```
Atomn´ik:<deriv sem feature> = person.
Atomn´ik:<deriv syn cat> = noun.
Atomn´ik:<deriv suffix> = n´ik.
Atomn´ik:<base stem> = atom.
Atomn´ik:<stem> = atom n´ik.
Atomn´ik:<gloss> = atomic_scientist.

Klevetn´ik:<deriv sem feature> = person.
Klevetn´ik:<deriv syn cat> = noun.
Klevetn´ik:<deriv suffix> = n´ik.
Klevetn´ik:<base stem> = klevet.
Klevetn´ik:<stem> = klevet n´ik.
Klevetn´ik:<gloss> = slanderer.

Tolkovatel´:<deriv sem feature> = person.
Tolkovatel´:<deriv syn cat> = noun.
Tolkovatel´:<deriv suffix> = tel´.
Tolkovatel´:<stem> = tolk ov a tel´.
Tolkovatel´:<gloss> = interpreter.

Los´atn´ik:<deriv sem feature> = person.
Los´atn´ik:<deriv syn cat> = noun.
Los´atn´ik:<deriv suffix> = n´ik.
Los´atn´ik:<base stem> = los´ ´at.
Los´atn´ik:<stem> = los´ ´at n´ik.
Los´atn´ik:<gloss> = elk_hunter.

Abbatskij:<deriv sem feature> = rel.
Abbatskij:<deriv syn cat> = adj.
Abbatskij:<deriv suffix> = sk.
Abbatskij:<base stem> = abbat.
Abbatskij:<stem> = abbat sk.
Abbatskij:<gloss> = abbot_adj.
```

```
Šumovoj:<deriv sem feature> = rel.
Šumovoj:<deriv syn cat> = adj.
Šumovoj:<deriv suffix> = ov.
Šumovoj:<base stem> = šum.
Šumovoj:<stem> = šum ov.
Šumovoj:<gloss> = noise_adj.

Mašin´ist:<deriv sem feature> = person.
Mašin´ist:<deriv syn cat> = noun.
Mašin´ist:<deriv suffix> = ´ist.
Mašin´ist:<base stem> = mašin.
Mašin´ist:<stem> = mašin ´ist.

Krovnij:<deriv sem feature> = undefined.
Krovnij:<deriv syn cat> = adj.
Krovnij:<deriv suffix> = n.
Krovnij:<base stem> = krov´.
Krovnij:<stem> = krov´ n.
Krovnij:<gloss> = blood_adj.

Krovn´ik:<deriv sem feature> = person.
Krovn´ik:<deriv syn cat> = noun.
Krovn´ik:<deriv suffix> = ´ik.
Krovn´ik:<base stem> = krov´ n. %depalatalisation not accounted for!
Krovn´ik:<stem> = krov´ n ´ik.
Krovn´ik:<gloss> = relative.

Pravovoj:<deriv sem feature> = rel.
Pravovoj:<deriv syn cat> = adj.
Pravovoj:<deriv suffix> = ov.
Pravovoj:<base stem> = prav.
Pravovoj:<stem> = prav ov.
Pravovoj:<gloss> = legal.
```

```
Pravov´ik:<deriv sem feature> = person.
Pravov´ik:<deriv syn cat> = noun.
Pravov´ik:<deriv suffix> = ´ik.
Pravov´ik:<base stem> = prav ov.
Pravov´ik:<stem> = prav ov ´ik.
Pravov´ik:<gloss> = jurist.

Skupec:<deriv sem feature> = person.
Skupec:<deriv syn cat> = noun.
Skupec:<deriv suffix> = ec.
Skupec:<base stem> = skup.
Skupec:<stem> = skup ec.
Skupec:<gloss> = stingy_person.

Č´ornec:<deriv sem feature> = person.
Č´ornec:<deriv syn cat> = noun.
Č´ornec:<deriv suffix> = ec.
Č´ornec:<base stem> = č´orn.
Č´ornec:<stem> = č´orn ec.
Č´ornec:<gloss> = monk.

Kanadskij:<deriv sem feature> = rel.
Kanadskij:<deriv syn cat> = adj.
Kanadskij:<deriv suffix> = sk.
Kanadskij:<base stem> = kanad.
Kanadskij:<stem> = kanad sk.
Kanadskij:<gloss> = canadian.

Kanadec:<deriv sem feature> = person.
Kanadec:<deriv syn cat> = noun.
Kanadec:<deriv suffix> = ec.
Kanadec:<base stem> = kanad.
Kanadec:<stem> = kanad ec.
Kanadec:<gloss> = canadian_person.
```

```
Trubač:<deriv sem feature> = person.
Trubač:<deriv syn cat> = noun.
Trubač:<deriv suffix> = ač.
Trubač:<base stem> = trub.
Trubač:<stem> = trub ač.
Trubač:<gloss> = trumpeter.

Balovn´ik:<deriv sem feature> = person.
Balovn´ik:<deriv syn cat> = noun.
Balovn´ik:<deriv suffix> = n´ik.
Balovn´ik:<base stem> = bal ov.
Balovn´ik:<stem> = bal ov n´ik.
Balovn´ik:<gloss> = spoilt_child.

Očerkist:<deriv sem feature> = person.
Očerkist:<deriv syn cat> = noun.
Očerkist:<deriv suffix> = ´ist.
Očerkist:<base stem> = očerk.
Očerkist:<stem> = očerk ´ist.
Očerkist:<gloss> = essayist.

Smotr´itel´:<deriv sem feature> = person.
Smotr´itel´:<deriv syn cat> = noun.
Smotr´itel´:<deriv suffix> = tel´.
Smotr´itel´:<base stem> = smotr ´i.
Smotr´itel´:<stem> = smotr ´i tel´.
Smotr´itel´:<gloss> = supervisor.
```