

# **Testing the Semantic Homogeneity Constraint: Analogical change and Russian verbs**

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## *Abstract*

*Although it has been widely assumed in historical linguistics that semantics plays a crucial role in analogical change, it is difficult to pinpoint the contribution of the semantic factor, since meaning and form work closely together in bringing about language change. The purpose of the present article is to shed light on the issue by means of two case studies from Russian, which enable us to isolate the role of semantics. The hypothesis we test is that analogical change is restricted to semantically homogeneous domains. We call this the “Semantic Homogeneity Constraint”. Two phenomena from Russian conjugation are explored: “suffix shift” and “NU-drop”. Although they seem parallel, analogical change occurs in the former, but not in the latter. It is argued that this is because the verbs involved in suffix shift constitute a semantically homogeneous domain, within which analogical change can take place. By contrast, NU-verbs are semantically diverse, and these semantic differences create boundaries which block analogical change. The findings have implications both for Russian and general linguistics. While suffix shift and NU-drop are well-known phenomena in Russian conjugation, they have not been juxtaposed and compared before. Our comparison provides new insights about the differences and similarities of the two phenomena. From the perspective of historical linguistics, the present article contributes to the theory of analogy, insofar as we provide empirical evidence for the Semantic Homogeneity Constraint, which places restrictions on semantic domains where analogical change can take place.*

## **1. Analogy in historical linguistics and beyond**

Few, if any, linguistic concepts have a longer history than analogy, which has been important since Ancient Greek grammar.<sup>1</sup> In our time, analogy plays a key role in both cognitive science and historical linguistics. As pointed out by Blevins & Blevins (2009: 1), there is considerable evidence from cognitive psychology that analogy represents a domain-independent cognitive process at the core of human cognition (see also Hofstadter 1995 and 2001).<sup>2</sup> As an early example of a definition of analogy in cognitive science, consider the following:

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<sup>1</sup> It has often been claimed that analogy was pivotal in the Ancient Greek “controversy as to whether language was controlled by regularity or analogy, as against irregularity or anomaly” (Anttila 1989: 88, see also Anttila 1977: 25). Although it appears uncontroversial that analogy was important in Ancient Greek grammar and philosophy, it is unclear whether in actual reality there was a controversy between “analogs” and “anomalists”. This controversy is only documented in one rather late text (Varro’s grammar), and it is possible that the controversy was invented by Varro (see Matthews 1994: 61-65, Hock 2003: 457).

<sup>2</sup> In his discussion of the cognitive differences between humans and other species, Deacon (1997) argues that the major cognitive ability unique to humans is that of symbolic reference. Apart

[A]nalogy is a mapping of knowledge from one domain (the base) into another (the target), which conveys that a system of relations that holds among the base objects also holds among the target objects. (Gentner 1989: 201)

Emphasizing the key role of analogy, Hofstadter (2001: 499) argues that “analogy is anything but a bitty blip – rather, it’s the very blue that fills the whole sky of cognition”. While the nature of analogy in human cognition has been debated intensely in cognitive science and artificial intelligence (cf. Turner 2001: 119-136), the central idea in the quoted sentence above appears uncontroversial, namely that analogy involves relations between relations (cf. Itkonen 2005: 3). This idea is illustrated in Figure 1, which contains two domains, each of which comprises two elements. A relation (represented as a dashed line) holds between the two elements in domain X, A and B, and the two elements C and D in domain Y are also connected by a relation. Furthermore, a relation holds across the domains, indicating that the two relations inside the domains are somehow parallel and similar.

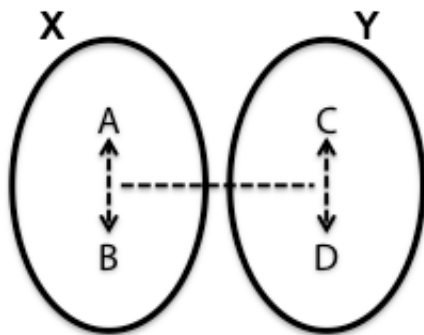


Figure 1: Analogy as relations between relations

Since language is a central facet of human cognition, it comes as no surprise that the idea of relations between relations is relevant for analogy in linguistics as well. In historical linguistics, analogy is used about language change based on “resemblance between the relationship of things rather than between the things themselves” (Anttila 1989: 105). By way of example, consider the change of normative *brought* in English to *brang*, where we are dealing with two classes of verbs, one containing strong verbs such as *ring* and another comprising irregular verbs like *bring* (cf. e.g. Joseph 2012: 227). We can think of these verb classes as domains like X and Y in Figure 1. There are relations between infinitive/present tense forms and past tense forms in each domain. Language users may perceive these relations as analogous, since in both cases we are dealing with a relationship between infinitive/present tense and past tense forms, and since verbs like *ring* and *bring* rhyme in the infinitive/present tense. Thus, in the same way as in Figure 1, there is a cross-domain relation of analogy holding between the two verb classes. This analogy sparks a change in the language of some speakers, where the past tense form *brought* is replaced by *brang*. As a result of

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from being able to perceive iconic and indexical relationships, humans are able to see symbolic relationships between entities. Although Deacon does not mention analogy, symbolic reference clearly presupposes analogy.

this, the relationship between the two domains changes. While the relationship between *ring-rang* and *bring-brought* is one of similarity (i.e. analogy), the relationship after the change is one of full identity, in the sense that now the situation in the two domains are entirely parallel.

Traditionally, analogical change of the *brought* to *brang* type is represented in terms of proportions (cf. e.g. Paul 1880/1975: 106-120, Anttila 1989: 88, Hock 1991: 171, Anttila 2003: 426, Hock 2003: 441, Itkonen 2005: 105-113, Blevins & Blevins 2009: 2f.). Indeed, as Anttila (1977: 17) points out, “‘proportion’ is the Latin translation of Greek ‘analogy’”:

(1) *ring : rang = bring : X, X = brang*

A shortcoming of the format in (1) is the fact that it does not explicate the semantic relationships between the terms in the proportion (cf. Andersen 2009: 23). The format in (1), furthermore, does not clarify whether the analogy is motivated by the single example mentioned in the left part of the proportion or a whole class of examples, for which this example stands metonymically (cf. Anttila 1989: 89, see also Albright 2009: 187 for discussion). We will not discuss this problem in the following, since it is tangential to our line of argument. Although this format is insightful as far as it goes, a more accurate format is this, since it accommodates the situations before and after language change has taken place:

(2) Before: *ring : rang ≈ bring : brought*  
After: *ring : rang = bring : brang*

In (2), we represent the situation before and after analogical change has taken place and show that the relation between the two classes of verb changes. Before change takes place, the relationship between the two verb pairs is one of analogy (represented as  $\approx$ ), because the formal relationship between *bring* and *brought* is similar, but not identical to the formal relationship between *ring* and *rang*. After all, *brought* and *rang* express past tense by means of different morphological markers. However, after language change takes place, and *brang* has replaced *brought*, the formal relationships become identical (hence represented as  $=$ ); the relationships between the word pairs *bring-brang* and *ring-rang* are entirely parallel, since *brang* and *rang* express past tense in the same way, i.e. by means of the same type of ablaut.

At this point, a note on terminology is in order. We use the term “analogy” in two closely related senses. As pointed out above, “analogy” is the name of the static relationship we observe before language change takes place in (2). However, in keeping with traditional terminology we will also use “analogy” in a dynamic sense to denote the transition from the “before” to the “after” state, i.e. as the name of a particular type of language change. When it is necessary to distinguish between the two senses, we will refer to the type of language change as “analogical change”.

The difference between relationships of analogy and identity goes beyond linguistic examples of the type cited in (2). As pointed out by Fauconnier and

Turner (2002: 116, see also Hofstadter 2001) the human mind has the capacity to compress analogies into identities. Compressions of this kind enable humans to think and speak about complex abstract problems in concrete terms. We argue that analogical change in historical linguistics is an example of such compression, insofar as analogical relations turn into identities through language change, as shown in (2). We suggest the following definition of analogical change:

- (3) Analogical change is the compression of a relationship of analogy of form into identity.

Notice that (3) refers to “analogy of form” since in examples like *brought* to *brang* we are interested in changes in form, rather than in content. The definition in (3) enables us to situate the theory of analogical change in the broader context of cognitive science, or as Anttila (2003: 426) puts it we “secure metatheoretical glory for analogy”.<sup>3</sup> However, in the following we will limit ourselves to discussion of linguistic examples. Our argument is structured as follows, in Section 2 we discuss the Semantic Homogeneity Constraint, which we then relate to two case studies presented in Sections 3 and 4. The two case studies are compared in Section 5 and a systematic exception is explored in Section 6. Section 7 concludes the article.

## **2. Constraining analogy: asymmetry, proximity and the Semantic Homogeneity Constraint**

If humans are so good at detecting analogies and compressing them into identities, why do all differences simply not disappear? Why does not analogical change happen all the time? Clearly, a theory of analogy needs constraints in order to explain why language users implement only a small subset of all the theoretically possible analogical changes. Indeed, placing principled constraints on analogical change has been a primary concern in theorizing on analogy in historical linguistics. In the *brought-brang* example the analogy relation turns into identity by changing the morphology in the *bring* class. In other words, there is an asymmetry between two domains (the *ring* and the *bring* classes), whereby the *ring* class exerts influence on the *bring* class, which undergoes change. Why does analogical change not go the other way so as to produce unattested past tense forms such as *\*rought* from *ring*? Furthermore, there is an asymmetry inside the two domains; in the case of *brought-brang* the infinitive/present tense forms exert their influence on past tense forms, so as to bring about change in the past tense morphology. Why does the past tense not instead make the infinitive/present tense change its morphology? If we let X and Y represent any two domains or elements in domains, what we may call the “asymmetry question” (or “directionality question”) can be phrased as follows:

- (4) The asymmetry question: why does X make Y change, and not the other way around?

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<sup>3</sup> Note that we apply the notion of “analogical change” to processes both within and across paradigms.

A full-fledged theory of analogical change must have principled answers to the asymmetry question, and a number of constraints have been proposed over the years (cf. discussions in e.g. Anttila 1989, Hock 1991, Wanner 2006: 122, Bybee 2007a, Albright 2008, Garrett 2008). Classical examples are Kuryłowicz's (1995 [1949]) "laws" and Mańczak's (1958a, 1958b) tendencies, while more recent approaches include Bybee's (1985, 1995, 2001, 2007a, 2007b, 2010) work on frequency, Albright's (2008, 2009) work on analogy and informativity and Barðdal's (2006, 2008, 2011) work on analogy and productivity. For present purposes, detailed surveys of individual proposals are not necessary, and we will also not discuss the more general question concerning the asymmetrical relationships among forms in an inflectional paradigm (but see Finkel & Stump 2009, Ackerman et al. 2009 for recent proposals). Suffice it to say that influential answers to the asymmetry question include:

- (5) Analogical change is based on
- a. the shortest or least suffixed form (e.g. Mańczak's 1958a: 298 and 312 tendencies no. 1 and 3, see Mańczak 1980: 284 and Hock 1991: 229-231 for discussion).
  - b. the least marked form (e.g. Kuryłowicz 1995 [1949], see Andersen 2001 and Bybee 2007a: 960 for critical discussion).<sup>4</sup>
  - c. the most frequent form (e.g. Paul 1975 [1880]: 109, Mańczak 1980: 284f., Bybee 1985: 51, Bybee 2001, 2007a, 2007b, Lieberman et al. 2007).
  - d. the most informative form, i.e. a form in a paradigm where an opposition is not neutralized (Albright 2008, 2009: 208-212).

Since the differences between these approaches are not of direct relevance for the case studies explored in the present article, we will not discuss these approaches in the following.<sup>5</sup> Instead, we turn to another question that is also important, although it has received less attention in the scholarly literature on analogy:

- (6) The proximity question: How close must X and Y be in order for analogical change to take place?

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<sup>4</sup> Markedness is a concept that linguists love or love to hate. A discussion of the various uses of this concept in theoretical linguistics is beyond the scope of the present paper, but see Andersen (1989, 2001) for insightful discussions.

<sup>5</sup> As pointed out by an anonymous referee, an additional challenge for the theory of analogy is to account for the fact that analogy can proceed in different directions in different languages. While in the case of *bring-brang*, the infinitive/present tense exerts its influence on the past tense, in some cases the opposite development takes place. In German, for instance, the infinitive/present tense *verlieren* 'lose' has adopted the /r/ from the past tense forms (*verlor* etc.). Although the situation in German appears to have a close parallel in Dutch, the relevant analogical change has not taken place in Dutch, as shown by the infinitive *verliezen* with no /r/. Even within the same language, analogical change in opposite directions may occur. While in English and other Germanic languages strong verbs tend to become weak, some verbs have gone in the opposite direction. Examples include *dive*, which has developed the past tense form *dove* in addition to *dived*, presumably under the influence of strong verbs like *drive*. Further discussion of these issues is beyond the scope of the present study.

The idea here is that in order for one form or class to exert its influence on another, the two forms or classes must somehow be related. A similar idea is discussed in recent work by Joseph:

[S]peakers in the process of using – and thus of changing – their language often act as if they are in a fog, by which is meant not that they are befuddled but that they see clearly only immediately around them [...] they thus generalize only ‘locally’. (Joseph 2011: 405)

Joseph’s fog metaphor suggests that language change takes place in local domains, i.e. among closely related forms. Using a related metaphor, De Smet (2012: 630) refers to the generalizations of speakers as “shortsighted”. In a large empirical study of verbs in Icelandic, Barðdal (2008: 89-96) convincingly shows the relevance of semantic closeness for analogical change. Bybee summarizes the interplay between asymmetry and proximity as follows:

Thus, leveling occurs within subparadigms of closely related forms where the more frequent form serves as the basis for the creation of a new form that replaces the less frequent form. (Bybee 2007a: 961)

But what exactly does it mean that forms are “closely related”? What are the constraints on the domains where analogical change can (and cannot) take place? Bybee (1985: 15 and 58-65) proposes an account of the degree of relatedness of forms in terms of how relevant morphosyntactic categories are to the verb stem (see also Croft 2000: 154 for discussion). For instance, mood is higher in relevance than agreement categories such as number and person, since mood affects the meaning of the verb stem itself, while agreement concerns the arguments of the verb. Since mood is high on the relevance scale, it changes the meaning of the stem considerably, and as a consequence of this, for instance indicative and imperative forms are less closely related than the 1 person indicative and the 2 person indicative. Bybee’s theory predicts that analogy is more likely to take place across different persons rather than across different moods, since different persons are more closely related than different moods.

In Section 6, we will see that Bybee’s (1985) theory of relevance facilitates a principled account of one of the case studies under scrutiny in the present article. However, insofar as Bybee (1985) concerns grammatical categories, it does not have much to say about the relationship between classes of words, such as regular and irregular verbs.<sup>6</sup> In a study of English verbs, Bauer (1997, see also Enger 2007: 59 for discussion) asks: “how does the native speaker (or, a fortiori, the linguist) know what the relevant phonological class of verbs is?” Bauer’s question is well put and important not only for classes defined in phonological

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<sup>6</sup>There is a long and strong tradition for investigating the relations among the forms of an inflectional paradigm (cf. e.g. Wurzel 1984, 1989, see also Itkonen 2005: 78-86), while relations across paradigms often receive less attention from students of morphology. A recent example is Finkel & Stump (2009) who develop a theory of “paradigmatic transparency” (“the ease with which some cells in a paradigm can be deduced from other cells in that paradigm”, Finkel & Stump 2009: 13), but leave the corresponding cross-paradigmatic concept of “transparadigmatic transparency” open for future research.

terms. As a response to the proximity question we propose the following general constraint on analogical change (see Barðdal 2008):<sup>7</sup>

- (7) The Semantic Homogeneity Constraint: Analogical change takes place within semantically homogeneous domains.

This constraint captures the idea that analogy takes place “locally” (Joseph 2011) and between “closely related forms” (Bybee 2007a: 961, see also Kraska-Szlenk 2007: 14). The Semantic Homogeneity Constraint is formulated as a hypothesis; while this hypothesis emerges from the scholarly literature, our contribution is to bring together insights from different traditions and scholars and state the hypothesis explicitly, so as to facilitate empirical testing.

While empirical testing is as crucial for the theory of analogy as for other scientific theories, testing the role of semantics in analogy is far from straightforward, since semantic and phonological factors tend to work together in bringing about analogical change. The interaction of semantic and phonological factors is insightfully analyzed in a recent study of pragmatic “downtoners” such as *far from* and *all but* in English (De Smet 2012: 619-620). De Smet observes that *far from* has been much less successful as a downtoner than *all but*, and speculates that this may be due to semantic factors. We argue that in order to go beyond speculation, one would ideally need a situation where two phenomena are completely parallel except for a semantic difference. Such a situation would enable the researcher to isolate the role of semantics, while other factors are kept constant. Although we are not aware of such a situation for downtoners in English, we argue that Russian conjugation provides suitable data that facilitate empirical testing of the Semantic Homogeneity Constraint. For this purpose, we invite the reader to consider two case studies, which will be presented in Sections 3 and 4 and compared in Section 5. The two case studies shed light on the Semantic Homogeneity Constraint; although both cases involve closely parallel phenomena, in the first we are dealing with a semantically homogeneous domain, while in the second we are not. Our main focus is on relationships between classes of words, but we turn to relationships among forms within inflectional paradigms in Section 6, where we discuss the relationship between Bybee’s notion of relevance and the Semantic Homogeneity Constraint.

### **3. Case study 1: Suffix shift in Russian verbs**

Suffix shift is a process in Russian conjugation whereby a group of verbs show vacillation between the suffixes /a/ and /aj/ in the present tense and imperative. For instance, as shown in (8) and (9), the verb *bryzgat’* ‘splash, spatter’ has alternative present tense forms such as *bryzžet* (3 sg, with truncated suffix /a/)

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<sup>7</sup> Notice that “homogeneity” here is not used in the same way as in the computational theory of Analogical Modeling (Skousen 2002: 12, 2009: 165-166).



and *bryzgaet* (3 sg, with /aj/ suffix). In both examples, the verb is used to describe rain:<sup>8</sup>

(8) *Neb-o vs-e zakry-l-o-s', bryž-et*  
 sky-NOM.SG all-N.NOM.SG cover-PST-N.SG-REFL spatter-PRS.3SG  
*ponemnogu i sobira-et-sja sil'n-ee pojti dožd'.*  
 a.bit and plan-PRS.3SG-REFL strong-CMPR go.INF rain[NOM.SG]  
 'The sky has gotten all clouded over, it is spattering a bit and getting ready to become a strong rain.' (M.M Prišvin 1926)

(9) *Skvoz' tuman inogda bryzgaet na koleni*  
 through fog[ACC.SG] sometimes spatter-aj-PRS.3SG on knee-ACC.PL  
*melkij, xolodnyj dožd'.*  
 small-M.NOM.SG cold-M.NOM.SG rain[N.SG]  
 'A fine, cold rain sometimes spatters through the clouds onto his knees.' (M. Gorky 1928-1935)

Table 1 gives the alternative forms of *bryzgat'* compared to the paradigm of *delat'* 'do', for which the /aj/ suffix is obligatory in all the present tense and imperative forms. Since (transliterated) orthography obscures relevant morpheme boundaries, the verbs are given in phonemic transcription. Notice that some speakers have /z/ instead of /zʲ/ in verbs like *bryzgat'*; the phonemic status of /zʲ/ is controversial in Russian (Timberlake 2004: 65-67), but this issue is beyond the scope of the present study.

The variation we observe in Contemporary Standard Russian reflects ongoing language change; as pointed out by Andersen (1980: 297) the synchronic situation of the relevant verbs "has all the earmarks of a change in progress". It is not hard to see the motivation for this change, since the relationship between the two classes of verbs is asymmetrical in the sense discussed in Section 2 above. The verbs with the /aj/ suffix represent a highly productive verb class in Russian (cf. e.g. Švedova, ed. 1980: 648, Dressler & Gagarina 1999), while the class of verbs with the /a/ suffix is unproductive. In other words, we are dealing with a situation where verbs from an unproductive class are regularized due to the influence of a productive class – much in the same way as many strong verbs have become weak in Germanic languages (cf. e.g. Bybee & Slobin 1982, Lieberman et al. 2007 for discussion). Notice that for our purposes it is not necessary to go into detail about the relative type frequencies of the verb classes we compare; for the case studies discussed in this and the following two sections it is sufficient to observe that we are dealing with a contrast between an unproductive and a productive class. However, in section 6 we will return to frequency data in our discussion of gerunds and participles of Russian NU-verbs.

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<sup>8</sup> Numbered examples in this article are culled from the Russian National Corpus available at [www.ruscorpora.ru](http://www.ruscorpora.ru). In the tradition of Jakobson (1948), the absence of the /a/ suffix on the surface in the present tense and imperative is accounted for in terms of a (morpho)phonological truncation rule that deletes a vowel before a vowel-initial inflectional ending. The relative merits of the Jakobsonian "one-stem system" and the traditional "two-stem system" are not relevant for the present study, but see Andersen (1980) and Nessel (2008: 77-110) for critical discussion.

For an interesting analysis of the relationship between productivity and frequency, see Barðdal (2008).

Furthermore, the two classes are formally closely related insofar as the opposition between the /aj/ and /a/ suffixes is neutralized in the past tense and infinitive forms of the verbs in question. As shown in Table 1, both suffixes are realized as /a/ in this subparadigm. The neutralization of the /a/ and /aj/ suffixes in the past tense and infinitive can be accounted for in terms of a (morpho)phonological rule whereby a suffix-final consonant (in our case /j/) is deleted before a consonant-initial inflectional ending (Jakobson 1948).

To sum up, there is considerable “proximity” in the sense discussed in Section 2. As a consequence of the asymmetry and proximity, analogical change is expected. This prediction is borne out by the facts; based on the identity of the two classes in the past tense and infinitive, speakers are inclined to select the productive instead of the unproductive suffix in the present tense and imperative.<sup>9</sup> This is an example of abductive change in the sense of Andersen (1973, see also Anttila 1977: 13-16 and 80-85 for discussion), insofar as speakers make the “wrong” inference based on the homophony in the past tense and infinitive and select the productive /aj/ suffix instead of the unproductive /a/.

**Table 1: Paradigms of verbs with /a/ and /aj/ (phonemic transcription)**

	<i>bryzgat'</i> (with /a/)	<i>bryzgat'</i> (with /aj/)	<i>delat'</i> (with /aj/)
1 sg present	brýzj-u	brýzg-aj-u	dʲél-aj-u
2 sg present	brýzj-oʂ	brýzg-aj-oʂ	dʲél-aj-oʂ
3 sg present	brýzj-ot	brýzg-aj-ot	dʲél-aj-ot
1 pl present	brýzj-om	brýzg-aj-om	dʲél-aj-om
2 pl present	brýzj-otʲe	brýzg-aj-otʲe	dʲél-aj-otʲe
3 pl present	brýzj-ut	brýzg-aj-ut	dʲél-aj-ut
Present active participle	brýzj-uʃj-ij	brýzg-aj-uʃj-ij	dʲél-aj-uʃj-ij
Imperfective gerund	brýzj-a	brýzg-aj-a	dʲél-aj-a
Imperative	brýzj-i(-tʲe)	brýzg-aj(-tʲe)	dʲél-aj(-tʲe)
Past masculine sg	brýzg-a-l	brýzg-a-l	dʲél-a-l
Past feminine sg	brýzg-a-l-a	brýzg-a-l-a	dʲél-a-l-a
Past neuter sg	brýzg-a-l-o	brýzg-a-l-o	dʲél-a-l-o
Past pl	brýzg-a-l-i	brýzg-a-l-i	dʲél-a-l-i
Past active participle	brýzg-a-vʂ-ij	brýzg-a-vʂ-ij	dʲél-a-vʂ-ij
Past passive participle	za-brýzg-a-n	za-brýzg-a-n	s-dʲél-a-n
Infinitive	brýzg-a-tʲ	brýzg-a-tʲ	dʲél-a-tʲ

<sup>9</sup> The use of “prediction” in the context of historical linguistics calls for comment, since historical linguistics deals with the past and not the future. Arguably, “retrodiction” would be a better term. However, for the purposes of the present study we use “prediction” in a standard way in scientific methodology to denote an assertion that follows from a hypothesis and that can be tested against data (in our case large databases extracted from electronic corpora).

Although suffix shift is a well-known and well-attested phenomenon in Russian linguistics (cf. e.g. Krysin, ed. 1974, Gorbačevič 1978, Andersen 1980, Švedova, ed. 1980: 649, Comrie et al. 1996, Kiebzak-Mandera et al. 1997, Graudina et al. 2001, Gagarina 2003, Gor & Chernigovskaya 2004, 2005, Gor 2007, Nessel 2008b, Svistunova 2008, Janda et al. 2010, Nessel 2010a, 2010b, Nessel & Janda 2010, Tkachenko & Chernigovskaya 2010 and references therein), it was only with the advent of large electronic corpora that large-scale studies of the diachronic development became possible. In a recent study based on 66,507 examples excerpted from the Russian National Corpus ([www.ruscorpora.ru](http://www.ruscorpora.ru)), Nessel & Kuznetsova (2011) demonstrate that suffix shift is indeed an ongoing process in Contemporary Standard Russian. As shown in Table 2, the proportion of innovative forms with /aj/ has increased from 18% in the beginning of the 19th century to 24% in the period after year 2000. This change is statistically highly significant. Although the effect size is relatively small, it is still within the range of what is considered reportable (King & Minium 2008: 327-329).<sup>10</sup> In other words, we have witnessed a slight increase over the last two centuries, and suffix shift has now reached a level where roughly every fourth verb form has replaced the unproductive /a/ suffix by the productive /aj/.

**Table 2: Development of suffix shift (based on Nessel & Kuznetsova 2011). The numbers refer to the present tense and imperative subparadigms only, since these subparadigms contain all the inflected forms that can be affected by suffix shift.**

<b>Period</b>	<b># /a/</b>	<b># /aj/</b>	<b># Total</b>	<b>% /aj/</b>
1800-1849	2164	464	2628	18
1850-1899	7418	2087	9505	22
1900-1949	15799	3875	19674	20
1950-1999	16757	3481	20238	17
After 1999	10036	3177	13213	24
Total all periods	52174	13084	65258	20

<sup>10</sup> For the purposes of the present paper, we use the statistical software package R (2011). Pearson's Chi-squared test enables us to calculate a p-value, which indicates the likelihood that the observed distributions are due to chance. We follow standard practice and consider p-value < 0.05 an indication of statistical significance, since this means that there is less than 5% likelihood that the distribution is due to chance. We also calculate Cramer's V-value, which measures effect size. Theoretically, Cramer's V-value can vary from 0 to 1, but 0.5 is considered high, while 0.3 represents a moderate value and 0.1 a low value (cf. King and Minium 2008: 327-329). It is important to notice that p-value and Cramer's V-value measure different things. Even if it is unlikely that something is due to chance (statistical significance as measured by the p-value), this does not necessarily imply that the relevant factors have a strong impact (as measured by Cramer's V-value). The development of suffix shift over time (cf. Table 2) illustrates the importance of both p-value and Cramer's V-value in large data samples. We compared the numbers from the first half of the 19<sup>th</sup> century with the numbers from the beginning of the 21<sup>st</sup> century. Pearson's Chi-squared test with Yates' continuity correction (X-squared = 50.1786, d(egree of) f(reedom) = 1) gave p-value = 1.404e-12 (i.e. 0. ... 404 with fifteen zeros before 404). This shows that for practical purposes the likelihood that the changes over time are due to chance is zero. However, Cramer's V-value = 0.1 indicates a small effect size.

In order to see the difference between statistical significance and effect size, consider the everyday example of a diet. A chi-square test of a large sample of subjects provides a low p-value, demonstrating that the weight differences before and after undergoing the diet cannot be due to chance. In other words, the diet really makes you slimmer. However, before you are willing to subject yourself to a long and potentially unpleasant diet, you want to know whether the diet makes you *much* slimmer or only *slightly* slimmer. This is the effect size. Especially for large data sets it is important to calculate the effect size, because in large samples even very small differences will prove statistically significant. In other words, the more data, the more important it is to calculate effect sizes. In this article, we investigate large sets of data. This enables us to draw a very precise picture of language change in Russian verbs, but at the same time it is necessary to pay attention to effect size in addition to statistical significance.

There is ample psycholinguistic evidence that the process of suffix shift is alive and kicking in present day Russian. In a number of studies reporting on psycholinguistic experiments, Chernigovskaya, Gor and co-authors (Gor & Chernigovskaya 2004, 2005, Gor 2007, Tkachenko & Chernigovskaya 2010, see also Svistunova 2008) have documented a strong tendency for speakers to use the productive /aj/ suffix instead of the unproductive /a/. This conclusion holds for native speakers of Russian with and without language impairment, as well as L2 learners of Russian.

Given the strong impetus to regularize /a/-verbs through suffix shift, one may ask why there have not been more dramatic changes over the last two centuries. In part, the reasons may be socio-linguistic; characteristic of the Russian language community is a strong awareness of normative correctness, which represents a counterforce to analogical change. The normative pressure was arguably particularly strong in Soviet times; possibly, the fact that suffix shift did not increase during the 20<sup>th</sup> century, as shown in Table 2, may be related to the socio-linguistic situation in the Soviet Union. At the same time, there are some language-internal factors that inhibit suffix shift. As pointed out by Nessel and Kuznetsova (2011, see also Nessel 2008b, 2010a, 2010b) there are lexical differences; suffix shift is not attested for all verbs with the /a/ suffix, and different verbs show different proportions of the /a/ and /aj/ suffixes. Furthermore, factors such as the root-final consonant and morphophonological alternations in the root affect the likelihood for suffix shift to take place. As shown in Nessel & Janda (2010) and Janda et al. (2010), it is also the case that some inflected forms are more likely to undergo suffix shift than others – a fact we return to in Section 6.

However, despite these provisos, the psycholinguistic and corpus studies cited above indicate that suffix shift is an example of analogical change that is still unfolding in Contemporary Standard Russian. This comes as no surprise, since we are dealing with an asymmetrical relationship between two classes of verbs that are in close proximity, in the sense discussed in Section 2. With this in mind, we turn to the second case study under scrutiny in the present paper.

#### 4. Case study 2: NU-drop in Russian verbs

On the face of it, our second case study resembles suffix shift closely; in both cases, we are dealing with a relationship between an unproductive and a productive class, where the opposition between the two classes is neutralized in part of the paradigm. Despite these similarities, however, the two cases behave differently with regard to analogical change. The phenomenon we will explore in this section is “NU-drop”, which concerns verbs like *gasnut* ‘go out (about light)’. Such verbs may drop the suffix /nu/ in the past tense as in (10) or keep it as in (11):

(10) *Svet*                    *to*    *voznikal*,                    *to*    ***gas***.  
 Light[NOM.SG] PTCL appear-PST[M.SG] PTCL fade[PST.M.SG]  
 ‘By turns the light came on and went out.’ (Mamleev 1975-1999)

(11) *Svet*                    *to*    *zažigalsja*,                    *to*    ***gasnul***.  
 Light[NOM.SG] PTCL turn.on-PST[M.SG]-REFL PTCL fade-nu-PST[M.SG]  
 ‘By turns the light came on and went out.’ (Okudžava 1989-1993)

NU-drop resembles suffix shift both in terms of asymmetry and proximity; we turn to asymmetry first. As shown in Table 3, modern Russian has two classes of NU-verbs, one productive class which always keeps the nasal suffix throughout the paradigm (cf. *maxnut* ‘wave once’), and an unproductive class where vacillation between /nu/ and Ø (“zero”) is attested in the past tense forms (cf. *gasnut* in 10-11). Admittedly, the productive NU-class is somewhat weaker in productivity than the /aj/ class discussed in the previous section (Dressler & Gagarina 1999), but the NU-class also attracts new members as demonstrated by recent loans like *snikersnut* ‘eat a Snickers chocolate bar’ and *faksanut* ‘send a fax’, which are attested in the Russian National Corpus (see Kuznetsova & Makarova 2012 for discussion of a number of such examples).

**Table 3: Paradigms of unproductive and productive NU-verbs (phonemic transcription)**

	<i>gasnut</i> (with Ø)	<i>gasnut</i> (with /nu/)	<i>maxnut</i> (with /nu/)
1 sg present	gas-n-u	gas-n-u	max-n-u
2 sg present	gas-nʲ-oʂ	gas-nʲ-oʂ	max-nʲ-oʂ
3 sg present	gas-nʲ-ot	gas-nʲ-ot	max -nʲ-ot
1 pl present	gas-nʲ-om	gas-nʲ-om	max -nʲ-om
2 pl present	gas-nʲ-otʲe	gas-nʲ-otʲe	max-nʲ-otʲe
3 pl present	gas-n-ut	gas-n-ut	max-n-ut
Present active participle	gas-n-ufʲ-ij	gas-n-ufʲ-ij	max-n-ufʲ-ij
Imperative	gas-nʲ-i(-tʲe)	gas-nʲ-i(-tʲe)	max-nʲ-i(-tʲe)
Past masculine sg	gas-Ø	gas-nu-l	max-nu-l
Past feminine sg	gas-Ø-l-a	gas-nu-l-a	max-nu-l-a
Past neuter sg	gas-Ø-l-o	gas-nu-l-o	max-nu-l-o
Past pl	gas-Ø-lʲ-i	gas-nu-lʲ-i	max-nu-lʲ-i
Past active participle	gas-Ø-ʂ-ij	gas-nu-vʂ-ij	max-nu-vʂ-ij

Perfective gerund	u-gas-Ø-ŝ-i	u-gas-nu-v	max-nu-v
Infinitive	gas-nu-tʃ	gas-nu-tʃ	max-nu-tʃ

In terms of proximity, the situation with NU-verbs also appears similar to suffix shift, since both the unproductive and productive types display the nasal suffix in the present tense, imperative and infinitive. In other words, the opposition between the two classes of NU-verbs is neutralized in parts of the inflectional paradigm in a way that resembles the neutralization of the opposition between the /a/ and /aj/ suffixes discussed in the previous section.<sup>11</sup>

In the same way as suffix shift, NU-drop has been studied from both synchronic and diachronic perspectives (cf. e.g. Černyšev 1915, Bulaxovskij 1950, 1954, Vinogradov & Švedova, eds. 1964, Gorbačevič 1971, Graudina et al. 1976, Rozental' 1977, Gorbačevič 1978, Nessel 1998, Plungian 2000, Dickey 2001, Graudina et al. 2001, 2007). In a recent corpus study of 34,026 examples from the Russian National Corpus, Nessel & Makarova (2011) analyze all 74 verbs that according to authoritative sources (Švedova, ed. 1980 and Zaliznjak 1980) may display /nu/-Ø variation in the past tense. On the basis of Nessel & Makarova's data, which is summarized in Table 4, it is possible to carry out a detailed comparison of NU-drop and suffix shift.

For the convenience of the reader, Table 4 is organized in the same way as Table 2 in Section 3 and shows the development from the 19<sup>th</sup> to the 21<sup>st</sup> century. Of particular interest is the rightmost column which gives the percentage of examples with the /nu/ suffix. This is the proportion of examples that adopt the suffix of the productive class for each period, so these percentages are comparable to the percentages in Table 2 which also indicate the proportion of examples that adopt the suffix of the productive class (in the case of suffix shift: /aj/).

**Table 4: Development of NU-drop (based on Nessel & Makarova 2011). The numbers concern the infinitive and past tense subparadigms, which contain the forms that can be affected by NU-drop.**

Period	# Ø	# NU	# Total	% NU
1800-1849	1072	239	1311	18
1850-1899	3281	348	3629	10
1900-1949	7993	552	8545	6
1950-1999	10795	606	11401	5
After 1999	8597	543	9140	6
Total all periods	31738	2288	34026	7

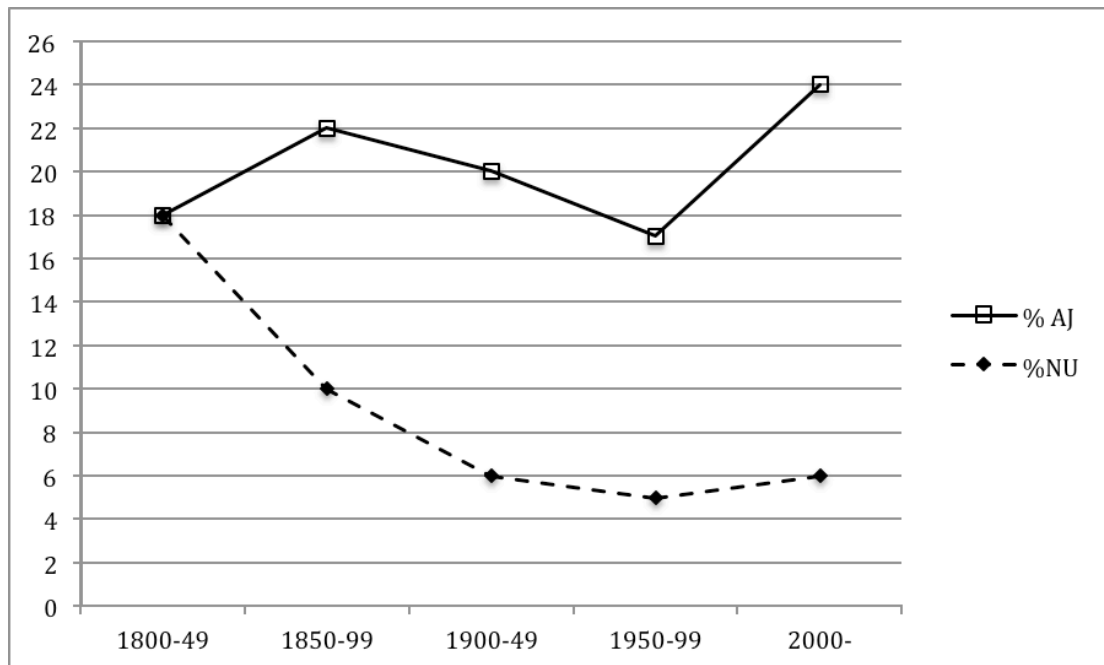
<sup>11</sup> Notice that *gásnut'* and *maxnúť'* have different stress patterns. However, there are numerous verbs in the productive NU-class that have immobile stem stress in the same way as *gásnut'*, e.g. *stúknut'* 'knock once'. For detailed discussion, see Nessel (1998: 131-132).

The similarities of NU-drop and suffix shift with regard to asymmetry and proximity are summarized in Table 5. Both cases involve a productive and an unproductive class where the opposition between the classes is neutralized in part of the inflectional paradigm.

**Table 5: Comparison of suffix shift and NU-drop with regard to asymmetry and proximity**

	Suffix shift:	NU-drop:
Asymmetry:		
i) Productive class:	/aj/-verbs	Productive NU-class
ii) Unproductive class:	/a/-verbs	Unproductive NU-class
Proximity:		
Identical subparadigms:	Past tense & infinitive	Present tense, imperative & infinitive

Since NU-drop resembles suffix shift with regard to both asymmetry and proximity, we would expect the two phenomena to display parallel development over time. However, Figure 1, which is based on Tables 2 and 4, show that this is not the case. Although the two phenomena start out at the same level in the first half of the 19<sup>th</sup> century (with 18% of the attested examples having the suffix from the productive class), the two phenomena develop in opposite directions. While suffix shift shows a slight increase and ends up at 24% at the beginning of the 21<sup>st</sup> century, NU-drop displays a relatively steep decrease in the 19<sup>th</sup> century and then stabilizes at 5-6% in the 20<sup>th</sup> and 21<sup>st</sup> centuries. Closer inspection of Nessel & Makarova's data indicates that the difference between suffix shift and NU-drop is even more dramatic; for finite past tense forms the proportion of forms that adopt the suffix of the productive class is as low as 1% in the 20<sup>th</sup> and 21<sup>st</sup> centuries, a fact we return to in Section 6.



**Figure 2: Comparison of suffix shift and NU-drop (percentages from Tables 2 and 4)**

We have carried out two statistical analyses that corroborate our argument. First, we compared the numbers for NU-drop in the first half of the 19<sup>th</sup> century with the corresponding numbers at the beginning of the 21<sup>st</sup> century. Is the observed decrease statistically significant? Pearson's Chi-squared test with Yates' continuity correction ( $X^2 = 248.3676$ ,  $df = 1$ ) enables us to answer this question in the affirmative. This test gave  $p$ -value  $< 2.2e-16$ , which is the smallest number the software package R operates with. For all practical purposes, therefore, the likelihood that the observed change over time is due to chance is zero. We also calculated Cramer's  $V$ -value = 0.2, which indicates that the change over time has a small to moderate effect size. The second statistical analysis we carried out is a comparison of suffix shift and NU-drop. Are the differences illustrated in Figure 1 statistically significant? Again, Pearson's Chi-squared test with Yates' continuity correction provides a positive answer. Comparison of the total numbers in the bottom row of Tables 2 and 4 gave a  $p$ -value  $< 2.2e-16$ , which indicates that the observed differences cannot be due to chance ( $X^2 = 3033.772$ ,  $df = 1$ ). Cramer's  $V$ -value = 0.2, so again we are dealing with a small to moderate effect size.

To summarize, we have seen that NU-drop resembles suffix shift with regard to asymmetry and proximity. In both cases we are dealing with an asymmetrical relationship between two classes of verbs, and in both cases there is formal proximity in the sense that the opposition between the unproductive and the productive suffixes is neutralized in parts of the inflectional paradigm. Nevertheless, NU-drop and suffix shift show diametrically opposed diachronic behavior with regard to analogical change. While for suffix shift there is an increasing tendency to adopt the suffix from the productive class, in the case of NU-drop the suffix of the productive class is in the process of being marginalized. The question is why. In the next section, we propose a principled account in terms of the Semantic Homogeneity Constraint.



## 5. Local domains: the Semantic Homogeneity Constraint

Although the two case studies discussed in the previous sections appear parallel, there are interesting semantic differences between them. In Section 2 we formulated the Semantic Homogeneity Constraint, according to which analogical change is restricted to semantically homogeneous domains. The data explored in the two previous sections facilitate empirical testing of the proposed constraint. In the following we will see that the constraint correctly predicts that analogical change takes place for suffix shift, but is blocked in the case of NU-drop.

Let us first consider the meaning of the suffixes /a/ and /aj/ that are involved in suffix shift. These suffixes are added to a root and turn the root into a verbal stem, to which inflectional endings can be added. For instance, the root /bryzg/ can be extended by the suffix /a/, which in turn is followed by inflectional endings, e.g. the masculine sg past tense marker /l/, as in /bryzg+a+l/ '(he) splashed, spattered'. Insofar as /a/ does not occur in words of other parts of speech with the same root (e.g. the *plurale tantum* noun /bryzg+i/ 'splashes'), the /a/ suffix signals that we are dealing with a verb. However, beyond being a marker of verbhood, the /a/ suffix does not have any discernable meaning in Contemporary Standard Russian. Likewise, the /aj/ suffix is added to roots such as /diel/ in order to form verbal stems that combine with inflectional endings like the 1 sg present tense marker /u/: /diel+aj+u/ '(I) do'. The /aj/ suffix signals that we are dealing with a verb, since it is absent in words of other parts of speech with the same root, e.g. /diel+o/ 'thing'. However, while /aj/ is a marker of verbhood, it seems impossible to assign a more precise meaning to the suffix. The upshot of this is that /a/ and /aj/ are on a par semantically. To the extent that they have a meaning at all, they have the same meaning.

For NU-verbs the situation is different. In the productive class, /nu/ is associated with semelfactive aktionsart (cf. e.g. Isačenko 1960, Smith 1997: 246, Plungian 2000, Zaliznjak & Šmelev 2000: 118-120, Dickey 2001, Dickey & Janda 2009, Makarova & Janda 2009, Nessel 2013). By way of example, consider *maxat'* 'wave' and *maxnut'* 'wave once'. *Maxat'* denotes an activity in the sense of Vendler (1957); it has a duration, but unlike achievements and accomplishments it does not culminate in a change of state. While *maxat'* denotes an activity consisting of a series of repeated hand or arm movements, the corresponding NU-verb *maxnut'* picks out one such repetition, i.e. one single movement whereby the hand or arm is moved and then resumes its initial position. Semelfactive verbs are punctual in the sense that they denote one single instance and they are non-resultative in the sense that the event goes back to the original state, rather than culminating in a change of state (cf. Smith 1997: 29 and 246).

The unproductive class of NU-verbs is semantically different from the productive class, insofar as the unproductive NU-verbs are not semelfactive.<sup>12</sup> The majority of the unproductive class consists of unaccusative verbs such as *soxnut'* 'become

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<sup>12</sup> The etymological relationship between the two NU suffixes is complicated and controversial. Since this question is beyond the scope of the present paper, we will not discuss it in the following. See, however, Gorbachov (2007) and references therein.

dry' that signal that the subject is in the process of undergoing a gradual change.<sup>13</sup> In addition to these “dynamic unaccusatives”, there is also a small group of “stative unaccusatives”, such as *merznut* ‘be cold’ and *paxnut* ‘smell’. Nessel & Makarova’s (2011) database of 74 verbs counts eight stative verbs. Apart from unaccusatives, there is a small group of unergative verbs in the unproductive class, e.g. *dvignut* ‘move (transitive)’. In the aforementioned database there are six such verbs, none of which are semelfactive. Since all three semantic types of unproductive NU-verbs (dynamic unaccusatives, stative unaccusatives and unergatives) are clearly different from the semelfactive verbs, there is a clear semantic contrast between the unproductive and productive verbs with /nu/.

In addition there is also a contrast with regard to imperfective and perfective aspect. Unprefixed verbs in the unproductive class of NU-verbs (e.g. *gasnut*) are imperfective, while unprefixed semelfactive verbs in the productive class display perfective aspect (e.g. *maxnut*). There is no such contrast for the /a/ and /aj/-verbs; both unprefixed /a/-verbs like *pisat* ‘write’ and unprefixed /aj/-verbs like *delat* ‘do’ are imperfective.

How can the semantic differences discussed above help us to account for the different behavior of suffix shift and NU-drop with regard to analogical change? The Semantic Homogeneity Constraint predicts that analogical change is possible if two classes of verbs form a semantically homogeneous domain. On the other hand, if two classes of verbs have different meanings, and thus do not constitute a semantically homogeneous domain, we expect analogical change to be blocked. With regard to the case studies under scrutiny in the present article, these predictions are borne out by the facts. We have seen that the /a/ and /aj/ suffixes that are relevant for suffix shift, are not semantically distinct, and we therefore predict analogical change. This is confirmed; although as pointed out in Section 3 analogical change does not target all verbs with the /a/ suffix, the process of replacing /a/ by the productive /aj/ is alive in Contemporary Standard Russian. In the case of NU-verbs, on the other hand, we have seen that the unproductive and productive classes are semantically distinct. In other words, the unproductive and productive classes of NU-verbs do not form a semantically homogeneous domain, and we therefore expect analogical change to be blocked. Once again, this prediction is borne out by the facts; as shown in Section 4, in general the unproductive NU-verbs do not adopt the productive pattern, whereby the nasal suffix is kept throughout the paradigm.<sup>14</sup>

The Semantic Homogeneity Constraint relates to the proximity question discussed in Section 2. The idea is that semantic differences create barriers between domains and therefore block analogical change. Although there is an

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<sup>13</sup> In Slavic linguistics, the term “inchoative” is sometimes used about the unproductive class of NU-verbs (cf. e.g. Schuyt 1990). However, this is imprecise, since verbs like *soxnut* ‘become dry’ strictly speaking do not denote the beginning of a process. An alternative term is Padučeva’s (1996: 117) “gradative” (Russian: *gradativ*).

<sup>14</sup> Note that this discussion is compatible with the framework of Barðdal (2008). Barðdal uses the terms “productivity domain”, “open schemas” and “restricted schemas”.

asymmetrical relationship between an unproductive and a productive class both for suffix shift and NU-drop, in the case of NU-verbs the unproductive class is semantically too far removed from the productive class. This lack of semantic proximity prevents the productive class of NU-verbs from exerting its influence on the corresponding unproductive class. As a result, analogical change is blocked.

## **6. Systematic exceptions: a local domain within the paradigm of unproductive NU-verbs**

If we accept the Semantic Homogeneity Constraint in (7), the unproductive NU-verbs are “cut off” from the influence of the productive class. This enables us to explain why in general unproductive NU-verbs do not adopt the productive pattern. However, as we will see in this section, there is one systematic exception to the generalization that unproductive NU-verbs do not display the /nu/ suffix in the past tense: for gerunds and unprefixed participles /nu/ is nearly obligatory. Although this may look like a counterexample to the Semantic Homogeneity Constraint, upon closer inspection it turns out to lend additional support to the constraint. We propose a “paradigm internal approach” to the unproductive NU-verbs, whereby the dominance of /nu/ in gerunds and unprefixed participles is argued to be due to the influence of another form of the same paradigm, viz. the infinitive. Our analysis clarifies the relationship between the Semantic Homogeneity Constraint and Bybee’s (1985) notion of relevance. Simply put, Bybee’s relevance shows how analogy seeks semantically homogeneous domains inside inflectional paradigms.

Let us take a closer look at the unproductive class of NU-verbs. Table 6 and Figure 3 show the historical development for prefixed and unprefixed past tense forms.<sup>15</sup> Although in the majority of forms the development has reached a level where /nu/ is nearly or completely ousted by the Ø suffix, gerunds and unprefixed participles display the opposite tendency; for these forms /nu/ is close to obligatory in present day Russian. However, since gerunds and unprefixed participles are low frequency forms, their behavior does not have an impact on the overall picture described in Section 4. We may refer to the polarized situation reported in Table 6 and Figure 3 as a “split picture”, since /nu/ is either virtually obligatory or nearly unattested, while there are no past tense forms with, say, a fifty–fifty distribution of /nu/ and Ø. Moreover, the tendency towards polarization has become stronger over time; as shown in Table 6 and Figure 4 the percentage of /nu/ for the forms that favor Ø has gone down in the 20<sup>th</sup> century.

**Table 6: Development of /nu/ in past tense forms of unprefixed and prefixed verbs (based on Nessel & Makarova 2011)**

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<sup>15</sup> Gerunds are always prefixed. Since for non-masculine finite forms the Ø-suffix has been obligatory at least since 1900, we do not differentiate between prefixed and unprefixed verbs for these forms.

		Non- masc finite	Unpref. masc finite	Pref. masc finite	Unpref. participle	Pref. participle	Gerund
1800-49	#tot	671	20	333	5	169	113
	%/nu/	6	15	22	80	15	84
1850-99	#tot	1902	54	889	16	597	171
	%/nu/	1	26	9	100	13	80
1900-49	#tot	4392	103	1939	62	1746	303
	%/nu/	0	21	2	94	8	85
1950-99	#tot	5669	161	2803	40	2305	423
	%/nu/	0	8	1	95	5	94
2000-	#tot	4748	87	1927	22	2009	347
	%/nu/	0	6	1	91	8	92

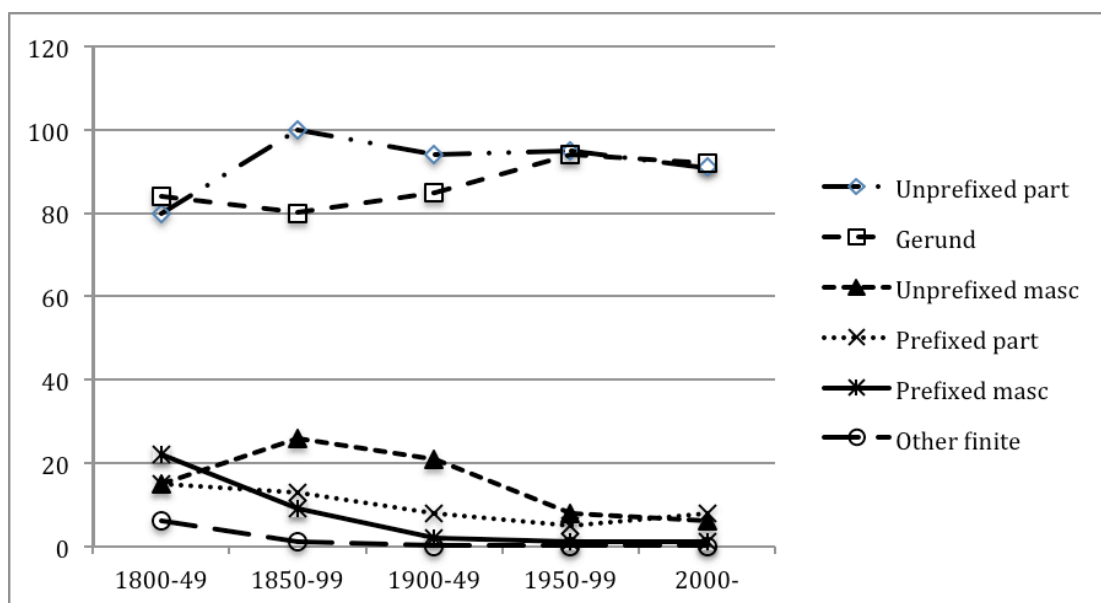


Figure 3: Development of /nu/ in past tense forms of unprefixing and prefixed verbs (based on Nessel & Makarova 2011)

The split picture we observe in Table 6 and Figure 3 indicates that there is a local domain within the past tense subparadigm of unproductive NU-verbs where /nu/ dominates strongly. On the face of it, this is at variance with the Semantic Homogeneity Constraint. Since /nu/ has different meanings in the productive and unproductive classes of NU-verbs, the Semantic Homogeneity Constraint predicts that the unproductive NU-verbs are “cut off” from the influence of the productive class. We therefore do not expect /nu/ in the unproductive class, gerunds and participles included. In spite of this, however, we propose that the occurrence of /nu/ in these forms can be reconciled with the Semantic Homogeneity Constraint. Instead of analyzing the dominance of /nu/ in gerunds and unprefixing participles as a result of the influence of the productive class of NU-verbs, we suggest that we are dealing with paradigm internal redistribution, whereby the unproductive class develops independently of the productive class

of NU-verbs. In particular, we submit that the dominance of /nu/ in the gerunds and unprefixed participles of the unproductive NU-verbs is due to the influence of another form in the same paradigm, namely the infinitive, which even in the unproductive class of NU-verbs always keeps /nu/ (cf. the paradigm of *gasnut* ‘go out (about light)’ in Table 3).<sup>16</sup>

In order to assess the merits of our “paradigm internal approach”, we must consider both asymmetry and proximity. Let us take asymmetry first. The paradigm internal approach implies that there is an asymmetrical relationship between the infinitive on the one hand and the gerunds and the unprefixed participles on the other. Frequency data from the Russian National Corpus demonstrates that this prediction is indeed correct. As can be seen from Table 7, the infinitive is by far more frequent than the gerunds and the unprefixed participles. The table reports on raw frequencies of the unproductive NU-verbs listed in Nessel & Makarova (2011). However, we omitted the verb *dostignut* ‘reach’ (and other prefixations based on this root), since this verb has alternative forms without /nu/ in the infinitive (cf. *dostič*). We also omitted verbs that are homonymous with semelfactive verbs, since semelfactive verbs are irrelevant for present purposes. Searches were performed in the Russian National Corpus in January 2012. In order to make the present study comparable to Nessel & Makarova (2011), we ignored examples from before 1800, which are of limited relevance for a study of modern Russian. Notice that we are dealing with statistically significant differences. We carried out a statistical analysis of the actual numbers in Table 7 compared to the expected numbers if the examples were distributed evenly among the relevant forms of the paradigm. Pearson's Chi-squared test (X-squared = 15611.87, df = 3) gave p-value < 2.2e-16. Since this is the smallest number the statistical software package R operates with, for all practical purposes the likelihood that the observed distribution is due to chance, is zero. Cramer's V-value = 0.5, which indicates a large effect size (cf. King & Minium 2008, 327-329). Since as shown in Table 6 and Figure 3 above /nu/ does not spread from the infinitive to *prefixed* participles, we expect the prefixed participles to be more frequent than the infinitive. Once again, this prediction is borne out by the facts, as shown in Table 7.

**Table 7: Raw frequencies of non-finite forms of unproductive NU-verbs (data from the Russian National Corpus)**

	<b># tokens</b>
Infinitive	12901
Gerund	3203
Prefixed participle	19279
Unprefixed participle	179
Total	35562

<sup>16</sup> Admittedly, there is one lexical exception to the generalization that /nu/ is intact in the infinitive. The verb *dostignut* ‘reach’ and other prefixed verbs with this root display parallel infinitives without /nu/ (e.g. *dostič*).

Before we turn to proximity consider another piece of evidence for analogical change based on the infinitive in Russian verbs. Although the vast majority of Russian verbs have identical stems throughout the past–infinitive subparadigm, a small class of verbs consisting of prefixations of *meret* ‘die’, *peret* ‘close’ and *teret* ‘wipe’ have different stems in the past tense and infinitive, insofar as the infinitive stem has the shape /CVr<sup>i</sup>e/, while the past tense stem lacks the final vowel and has a non-palatalized /r/: /CVr/. Interestingly, the gerund vacillates between forms with the infinitive stem and the past tense stem, e.g. *uterev* and *uterši* from *uteret* ‘wipe away’. Moreover, the gerund based on the infinitive has gained strength over time and is now by far the dominant gerund for the verbs in question, as shown by the corpus data reported in Table 7. Table 8 reports on data for the three verbs *meret* ‘die’, *peret* ‘close’ and *teret* ‘wipe’ as well as prefixations from these verbs. Data was collected from the Russian National Corpus in November 2011. In order to avoid biased data, we included only one example per document in our database. The examples were divided into 50-year time spans in order to illustrate the diachronic development from 1800 to 2000. Statistical analysis shows that the observed decrease in the use of gerunds based on the past tense stem is highly significant, insofar as Pearson's Chi-squared test (X-squared = 193.1469, df = 3) gave p-value < 2.2e-16. Cramer's V-value = 0.5, which represents a large effect size (cf. King & Minium 2008, 327-329). In other words, the infinitive exerts its influence on the gerund; this parallel lends additional support to the analysis of NU-verbs outlined above.

**Table 8: Morphological variation in gerunds of *meret* ‘die’, *peret* ‘close’ and *teret* ‘wipe’**

	# Gerund with infinitive stem	# Gerund with past tense stem	% Gerund with past tense stem
1800-49	7	29	80.5
1850-99	88	41	31.8
1900-49	270	42	13.5
1950-99	401	18	4.3

Since we have seen that there is strong evidence in favor of an asymmetrical relationship between the infinitive on the one hand and the gerunds and unprefixated participles on the other, we turn to the proximity question.

Do infinitives, gerunds and participles constitute a semantically homogeneous domain? We claim that they do. In order to see that, we must take a closer look at the structure of Russian verb paradigms. Such paradigms are divided in two subparadigms insofar as the stem has different shapes in the present–imperative forms and the past–infinitive forms. For instance, as shown in Table 3, *maxnut* has the stem /maxnu/ in the past–infinitive subparadigm, while there is no stem-final /u/ in the present–imperative subparadigm. We are interested in the past–infinitive subparadigm which is where the variation between /nu/ and  $\emptyset$  occurs.

The past–infinitive subparadigm comprises four finite forms (masculine sg, feminine sg, neuter sg and a plural form that does not distinguish between grammatical genders). In addition, we must consider three non-finite forms: the infinitive, the active participle and the gerund. For the purposes of the present study we ignore the past passive participle, which is not attested in unaccusative verbs and is therefore not relevant for the unproductive class of NU-verbs. The non-finite forms differ from finite forms in that non-finite forms are not specified for mood.

Recall from Section 2 that mood is highly relevant for the verbal stem in the sense of Bybee (1985), insofar as this category changes the meaning of the verb to a much higher degree than, say, agreement categories that concern the arguments of the verb, rather than the verb itself. We therefore predict that analogical change will target forms with the same specification for mood. As opposed to finite forms, non-finite forms share syntactic properties with other parts of speech. Infinitives resemble nouns insofar as they occur in argument positions, participles are used as modifiers in the same way as adjectives, while gerunds show adverb-like properties.

In short, as pointed out by Nessel & Janda (2010: 707), finiteness represents a major division line within the Russian verb paradigm, and the non-finite forms constitute a set of closely related forms that are a likely target for analogical change. Our discussion of finiteness might lead us to expect that /nu/ would spread from the infinitive to all the remaining non-finite forms, i.e. not only to gerunds and unprefixated participles, but also to *prefixated* participles. However, as shown above, the high frequency of the prefixated participles protects them from the influence of the less frequent infinitive. To summarize, the paradigm internal approach we propose for unproductive NU-verbs is a perfect illustration of Bybee's (2007a: 961) idea about leveling, which takes place within subparadigms of closely related forms. The less frequent form is replaced by a new form, which is created on the basis of a more frequent form.

We started this section by noting that the non-finite forms of unproductive NU-verbs seemed to present a challenge to the Semantic Homogeneity Constraint. If the unproductive NU-verbs are “cut off” from the influence of the productive class of NU-verbs, how come /nu/ dominates in the gerund and unprefixated participles of unproductive NU-verbs? We have shown that there is paradigm internal motivation for this state of affairs, and that we are dealing with a coherent domain that is semantically opposed to finite forms, namely non-finite forms. In other words, rather than being a counterexample to the Semantic Homogeneity Constraint, the non-finite forms of the unproductive NU-verbs obey the constraint, and therefore lend additional support to it.

At the same time, the discussion of the unproductive NU-verbs sharpens our understanding of semantic homogeneity and its relation to previous proposals concerning analogy. First of all, paradigm internal cases such as /nu/ in non-finite forms of unproductive NU-verbs suggest that semantic homogeneity is not an absolute. Since the cells of an inflectional paradigm (e.g. infinitive, gerund and participle) have different content, analogy between paradigm cells presupposes some differences in meaning. What we see, however, is that the meaning

differences are minimized in the sense that analogy tends to take place between closely related forms rather than between forms that have more different content. As Kraska-Szlenk (2007: 14) notes, “the greater the semantic distance, the smaller the pressure for analogy and vice versa”. This is in line with Bybee’s (1985) theory of the relevance of grammatical categories to the verb stem; analogy crosses smaller semantic barriers posed by less relevant categories (e.g. agreement) rather than larger barriers created by categories of higher relevance to the verb stem, such as mood.

Since the Semantic Homogeneity Constraint is closely related to Bybee’s theory of relevance, a critical reader may ask whether we need the Semantic Homogeneity Constraint at all. Not unexpectedly, we submit that we do need this constraint. Because Bybee’s (1985) theory about “relevance” concerns the relationship between a stem and grammatical categories it has little to say about the relationships between classes of verbs, such as Russian /a/-verbs and /aj/-verbs. However, as we have argued in this article, semantic homogeneity places constraints on analogy between classes of verbs, and in this article we have tested empirically the implications of the Semantic Homogeneity Constraint. We hasten to add that this does not mean that the notion of relevance is superfluous. While the Semantic Homogeneity Constraint is a general principle, the notion of relevance demonstrates how analogy seeks semantically homogeneous domains within inflectional paradigms. Stated differently, the notion of relevance shows how the Semantic Homogeneity Constraint works within inflectional paradigms. Furthermore, Bybee’s relevance has implications for areas outside the scope of the Semantic Homogeneity Constraint, such as the syntagmatic order of morphemes in inflected words (cf. Bybee 1985: 23f. for discussion).

## **7. Conclusion**

What are the constraints on analogical change? In this article, we have tested empirically the hypothesis that analogical change is restricted to semantically homogeneous domains. This hypothesis, which we refer to as the “Semantic Homogeneity Constraint”, is tested against data from Russian conjugation. Our contribution can be summarized as follows. In Sections 1 and 2 we argue that constraints on analogy must be formulated *both* in terms of asymmetry and proximity. We have focused on proximity, which has received less attention in the scholarly literature. In Sections 3 and 4 we show that Russian suffix shift and NU-drop can shed light on proximity, since these phenomena are parallel in terms of asymmetry, but nevertheless behave differently with regard to analogical change. In Section 5, we demonstrate that the Semantic Homogeneity Constraint provides a principled account for why analogical change is blocked in the case of NU-verbs, but not for suffix shift. Finally, Section 6 explores a systematic exception, which upon closer inspection lends additional support to the Semantic Homogeneity Constraint. It is shown that the constraint is closely related to Bybee’s (1985) concept of relevance; while the Semantic Homogeneity Constraint is a broad principle concerning analogy across and within paradigms, Bybee’s relevance shows how analogy seeks semantically homogeneous domains inside paradigms.



The present study has implications both for Russian and general linguistics. Our detailed comparison of suffix shift and NU-drop situates these phenomena in a new context, thereby sharpening our understanding of morphological variation in Russian conjugation. Although there is a considerable psycholinguistic literature on suffix shift, we are not aware of any experimental studies concerning the relationship between the two classes of NU-verbs. An experimental investigation of NU-verbs therefore represents an interesting alley for future research in Russian linguistics. From the perspective of general linguistics, our study has implications for the theory of analogical change, suggesting that further studies of seemingly parallel phenomena like suffix shift and NU-drop can lead to a better understanding of the interplay between asymmetry and proximity in analogical change. Although the importance of semantic proximity has been assumed in the literature, our study has facilitated empirical testing of the role of semantics, since we have investigated two cases that are parallel with the sole exception of semantics. Thus, keeping other factors constant, we have demonstrated the pivotal role of semantic proximity in analogical change. An important question arising from the present article is whether the constraint we have explored is relevant for cognition in general. In other words, is language change different from other aspects of human cognition, or is language subject to different constraints on analogy than other facets of cognition? Although this question is beyond the scope of the present article and must be left for future research, our empirical test of the Semantic Homogeneity Constraint represents an important step toward a more constrained theory of analogy in historical linguistics.

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