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The competitive nature of grammatical feature selection: A study of Russian speech errors

An analysis of Russian speech errors involving word inflections suggests that, in a highly inflected language, both the selection of grammatical features at the grammatical encoding level and the selection of bound morphemes at the morphophonological encoding level are competitive processes.

Key words: grammatical features; inflectional affixes; speech errors; language production; Russian.

1. Introduction

Over the past few years, there has been a debate about whether the grammatical features of words are selected by competition or through non-competitive processes. The experimental results appear to differ depending on language specific properties such as the degree of inflectionality and the interaction of a particular feature with other features like number and case.

Most experimental studies concerned with the processing of grammatical features have used picture-word naming tasks to investigate the role of the gender and number features in sentence production. Schriefers (1993) used the picture-word interference paradigm to explore the processes involved in the selection of grammatical gender in German and discovered that the gender feature of a dis-

tractor word influenced the selection of the gender feature of the target word (determiner and/or adjective plus noun). He concluded that the selection of the gender feature is a competitive process. A contrary view was taken by Schiller and Caramazza (2002), who investigated the effect of the number feature of a distractor word on the production of a target noun phrase (determiner-noun), i.e. the number congruency effect, in German. Their results seem to indicate that the selection of the number diacritic in naming is a noncompetitive process. This led the authors to the more general conclusion that grammatical features are not selected by competition. They proposed that the so-called gender congruency effect observed in German and Dutch is in fact the "determiner congruency effect" reflecting competition in the selection of gender determiner forms rather than in the selection of the gender feature. Consequently, Caramazza and colleagues explained the fact that the gender congruency effect was not observed in any of Romance languages studied (French, Italian, Catalan and Spanish) by referring to the language-specific properties affecting determiner selection in these languages (Caramazza et al. 2001). Unlike German and Dutch, where grammatical information is sufficient to select determiner forms, Romance languages are "late-selection" languages, in which the forms of determiners cannot be selected until the phonological context is available. The authors argued that even though the selection of the gender feature in these languages might be competitive, any competition may have been resolved by the time phonological encoding is completed. Thus, the studies of Germanic and Romance languages left unresolved the question as to whether the gender congruency effect is universal across languages of different families.

In inflected languages, the retrieval of inflectional affixes goes along with the selection of grammatical features. Assuming that grammatical features or determiners are selected by competition, is the selection of inflectional morphemes also competitive?

Caramazza and colleagues claim that the competition is restricted to free-standing morphemes such as gender determiners whereas the selection of bound morphemes such as inflectional affixes is a non-competitive process (Schiller & Caramazza 2002; Costa et al. 2003). Contrary to their conclusion, the experimental results for German obtained by Schriefers and colleagues suggest that freestanding and bound morphemes are basically processed in the same way, although competition is not as strong for bound morphemes as it is for free morphemes (Schriefers et al. 2005). Similarly, a study of noun phrase production in a pure picture-naming task in Dutch (Lemhöfer et al. 2006) reveals that the competition is not restricted to free-standing items and that both types of gender-marked morphemes (determiners and inflectional affixes) are selected via the same basic processing mechanisms.

To explore the Slavic language family of inflected languages which have no free-standing determiners, Costa et al. (2003) analyzed the gender congruency effect in Croatian, where the gender feature surfaces only as an inflectional affix. In a number of picture-word interference experiments, the gender congruency effect was observed only when the noun's gender value was required to select a free-standing morpheme. Thus, the study appeared to support the view that unlike freestanding lexical forms, their grammatical features and associated morphophonological transformations are selected automatically as a consequence of morphosyntactic processes. On the other hand, Bordag and Pechmann (2008), who recently made a similar study of Czech, another Slavic language, did observe gender congruency effect; since Czech has no articles and the gender value in Czech surfaces only as a bound morpheme, the authors concluded that bound morphemes, like free-standing items, compete for selection.

Another question open for debate is the locus of the gender congruency effect. Schriefers (1993) attributes the effect to a level in sentence production where grammatical features of lexical nodes compete for selection, i.e. the grammatical encoding level. Caramazza and colleagues conclude that the effect results from competition at the morphophonological encoding level (Schiller and Caramazza 2002; Costa et al. 2003). Similarly, Bordag and Pechmann (2008) propose that whereas bound morphemes seem to be selected by competition, it is the phonological forms, not the abstract gender features, that are involved in the competition.

There are thus two debatable points: whether grammatical features of lexical nodes are selected automatically or by competition and whether bound morphemes, like freestanding morphemes, compete for selection at the morphophonological encoding level. This paper approaches the issues through an analysis of Russian speech error data. Since Russian is a highly inflected language, a failure to retrieve a target grammatical feature such as gender, number, case, tense, and aspect or a target bound morpheme is likely to surface as an inappropriate grammatical form of a given word or an illegal inflectional affix, respectively. An important advantage is that, unlike picture-word naming tasks which focus on a limited number of categories such as gender and number, speech errors involve a variety of different grammatical features, thus making it possible to add a wider perspective to the study of the storage, selection, and control of grammatical features.

The paper reports a study of 396 naturally produced Russian speech errors (slips of the tongue) involving inflected word forms. The 396 examples relevant to the present study were selected from the corpus of approximately 6,000 Russian speech errors which were collected by tape-recording and digitally record-

ing everyday conversations, telephone conversations, and live TV and radio programs such as talk shows and interviews.

There are basically two different types of errors that involve inflected word forms. They seem to reflect two different level processes: the selection of an inappropriate inflected form of a target word, which supposedly occurs at the level of grammatical encoding, and the selection of an illegal inflectional affix of a target word, which occurs at the morphophonological encoding level.

2. An overview of Russian inflectional system

The following is a general description of the features of the Russian inflectional system that are relevant to the present study (for a detailed description, see Shvedova et al. 1982).

Russian is a morphologically complex language in which nouns do not require determiners expressing number, gender, and case information. Instead, grammatical features such as case, gender, number, person, tense, and aspect almost always surface as bound morphemes.

Nouns, personal pronouns and nominal adjectives are overtly marked for gender, number, and case, while verbs and predicate adjectives are marked for gender and number information. There are three grammatical genders (masculine, feminine, and neuter) and two kinds of number specification, singular and plural.

Russian has six grammatical cases: nominative, accusative, genitive, dative, instrumental, and locative, which are marked differently for singular and plural in three declension paradigms. For singular nouns, the exact form of the case marking depends on the gender of the noun. Most singular masculine and neuter nouns follow the first declension, the feminine nouns that end in *–a* or its allomorph in the nominative case and the masculine nouns that end in *–a* follow the second declension, and the feminine nouns that end in a palatalized consonant in the nominative case follow the third declension.

Plural nouns (regardless of gender) typically follow one of the three different declension paradigms depending on whether their stems end in a hard consonant, a soft consonant or sibilant, or in *[–j]*. The case markers for nominative, accusative, and genitive case forms differ depending on the declension type whereas the case markers for dative, instrumental and locative case forms are similar in all plural nouns regardless of their stem ending.

Russian case marking varies with respect to animacy, which affects the marking of the accusative case in masculine and plural nouns. In addition, allomorphy is fairly common, e.g. the phonological shape of the noun determines the specific variant of the preposition and case marker.

Similarly to nouns and adjectives, Russian verbs are inflected for gender and number. Besides, verbs express tense, aspect, person, voice, and mood information. There are three tenses: past, present, and future, and two aspects (perfective and imperfective). Typically, the verbs whose infinitive forms end in *–it'* follow the second conjugation paradigm and the rest of the verbs follow the first conjugation, although there are some exceptions to the former rule and some verbs that follow different conjugation paradigms depending on their number specification (singular or plural).

3. Competition at the grammatical encoding level

This section analyzes word form substitutions caused by the selection of an inappropriate inflected form of a word instead of the target form. The substitutions can be either dependent on or independent of the grammatical context in which the word appears. Errors of this kind suggest that grammatical features are subject to competition during sentence production.

3.1. *Context-free substitutions of a grammatical feature*

CONTEXT-FREE SUBSTITUTIONS OF A GRAMMATICAL FEATURE such as case, number, gender, tense, and aspect cause the selection of a wrong inflected form of a noun, verb, pronoun or adjective, as in (1a-h). 198 example errors of this type were analyzed in the present study. Below are some representative examples of substitutions of the different grammatical features (the target and error word forms are in bold).

In (1a), the genitive case form of the noun 'shops', *magazin-ov*, is selected instead of the target locative case form, *magazin-ax*:

(1a) Case feature substitution: LOC → GEN

On v **magazin-ax** *ne byvaet* → *...v* **magazin-ov**
he in shop-PL.**LOC** not go …v shop-PL.**GEN**
'He does not go shopping'

Similarly, dative is replaced by accusative/genitive as in (1b), where the accusative/genitive form of the pronoun 'she,' *ee*, is substituted for the target dative, *ej* (the exact substitute case feature cannot be identified due to the homonymy of the accusative and genitive case forms):

(1b) Case feature substitution: DAT → ACC/GEN

Ty **ej** *pozvonila?* → *Ty* **ee** *pozvonila?*
you 3SG.F.**DAT** call:F.PST you 3SG.F.**ACC/GEN** call:F.PST
'Have you called her?'

In (1c), the target genitive case form *deneg* of the word *dengi* 'money' is replaced by the nominative/accusative case feature (again, the exact substitute case feature cannot be identified because of the homonymy of the nominative and accusative case forms):

(1c) Case feature substitution: GEN → NOM/ACC

Ty voobšče znaeš' skol'ko tebe nado imet'
you generally know how much you need have

deneg → **den′g-i**
money[**GEN**] money-**NOM/GEN**
'Do you have any idea how much money you need to have?'

Apart from the case feature, other grammatical features also appear to be involved in context-free substitutions though their examples are not as numerous in the speech error corpus as those of case feature substitutions.

In (1d), the target plural number feature of the noun *zuby* 'teeth' is replaced by the singular *zub* 'tooth':

(1d) Number feature substitution: PL → SG

Da ja uže vzjala v **zub-y** *tu, kotoraja uronena*
but I already took in tooth-**PL**.ACC that which was dropped

→ ... *v* **zub**…
…in tooth:**SG**.ACC
'But I've already put the one [cigarette] that was dropped between my teeth [=into my mouth]'

In (1e), the speaker declines the neuter gender noun *bljudce* 'saucer' as a feminine gender noun; besides, in all its modifiers, the neuter gender feature is also replaced by the feminine gender feature:

(1e) Gender feature substitution: N → F

Ja	*voz'mu*	*vot*	**et-o**	**bljudc-e:**	**on-o**
I	will-take	here	this-SG.**N**.ACC	saucer-SG.**N**.ACC	3SG-**N**.NOM

sam-oe	**malen′k-oe**
most-SG.**N**.NOM	small-SG.**N**.NOM

→ **…**	**vot**	**et-u**	**bljudc-u:**	**on-a**
	here	this-SG.**F**.ACC	saucer-SG.**F**.ACC	3SG-**F**.NOM

sam-aja	**malen′k-aja**
most-SG.**F**.NOM	small-**F**.NOM

'I'll take this saucer: it's the smallest'

In (1f), the target future tense form of the verb 'be,' *budu*, is replaced by the past tense form, *byla*.

(1f) Tense feature substitution: FUT → PST

Ja dumaju	*ja vynuždena*	**budu**	*vyslušat' plamennuju*	*tiradu*
I think	I have to	be:3SG.**FUT**	listen to fiery	tirade

→ ...**byla**...
be:3.SG.**PST**
'I think I'll have to listen to a fiery tirade'

Generally, past and present tense forms occur much more frequently in spoken Russian (both with a frequency of 45 per cent) as opposed to future tense forms (whose frequency is only about 10 per cent) (Sandzhi-Garjaeva 2003).

In (1g), *skazat'* and *govorit'* are two suppletive forms (perfective and imperfective, respectively) of 'say:' the imperfective form is substituted for the target

perfective:

(1g) Aspect feature substitution: PFV → IPFV

Kak eto *po-anglijski* **skazat′** → ... **govorit′**
how it in English say:INF.**PFV** say:INF.**IPFV**
'How do you say it in English?'

However, errors involving tense and aspect feature substitutions are sometimes difficult to interpret because the two features closely interact and as a result the error verb form may differ from the target form both in tense and in aspect as in (1h), where the target present imperfective form of the verb 'leave,' *uxodiš′*, is replaced by the future perfective form, *ujdeš′*:

(1h) Tense + Aspect feature substitution:

A potom *opjat′* **uxod-iš′** *i* *gulja-eš′*
and then again leave-2SG.**PRS.IPFV** and walk-2SG.PRS.IPFV

→ … **ujd-eš′**...
leave-2SG.**FUT.PFV**
'And then you leave again and go for a walk?'

Errors like (1a-h) suggest that within the inflectional paradigm of a given word, some forms may be more likely to be selected—either because of their higher frequency or perhaps due to the individual characteristics of a given speaker's linguistic experience.

3.1.1. *Comparison with corpus data*

To find out whether the substitutions are affected by the frequencies of inflected word forms, the frequency of each substitute word form in the Russian National Corpus (*http://ruscorpora.ru*) was compared to that of the target word. The search was run in the subcorpus of spoken Russian (including formal and informal monologs and dialogs), which contains 7.8 million word tokens. In some cases, the search results had to be corrected manually to remove grammatical homonymy as only part of the corpus is annotated for grammar.

A comparison between the RAW FREQUENCIES of the target and error word forms seems to suggest that speakers tend to substitute higher frequency forms

for low frequency forms (overall, paired t-tests yield significant differences, with $t(198) = 2.35$, $p < .05$).

The difference between the RELATIVE FREQUENCIES of target and error word forms, i.e. their frequencies within the word's declension paradigm, was found to be statistically significant for noun/pronoun case feature substitutions, which make up 52.5 per cent of the total number of context-free grammatical feature substitutions analyzed. Paired t-tests performed to compare the relative frequencies of the target noun/pronoun case forms to those of the substitute case forms revealed that the case forms that have higher frequencies within a word's declension paradigm tend to substitute for lower-frequency case forms (overall, $t(104) = 3.39$, $p < .001$).

The numbers of the examples illustrating the substitutions of other grammatical features are still insufficient to estimate the statistical significance of the relative frequency differences. Besides, the interaction of grammatical features such as tense and aspect in some of the substitution errors, e.g. in (1h), complicate their analysis.

Sample results for noun/pronoun case feature substitutions are presented in Table 1, which shows the raw and relative frequencies of the target and substitute case forms as per the spoken part of the Russian National Corpus.

Due to the homonymy of some case forms, it is not always possible to identify the exact case feature of the substitute, e.g. in (1c), the substitute word form *den'gi* 'money' is either NOM or ACC and in (1b), the substitute form *ee* 'her' is either ACC or GEN. Since the accusative case forms of Russian nouns and pronouns are often homonymous with either their nominative (for singular masculine inanimate and plural inanimate nouns; masculine inanimate, neuter, and plural inanimate demonstrative pronouns, etc.) or their genitive (for singular masculine animate and plural animate nouns; singular and plural animate demonstrative pronouns, etc.) case forms, the frequency of a substitute inflected form in such examples is calculated as the combined frequency of NOM/ACC or ACC/GEN forms, respectively; consequently, the 'strength' of the substitute inflected form may be 'doubled', increasing the likelihood of a substitution error.

Table 1. Sample frequencies of target and error word forms in context-free case feature substitutions.

Noun or personal pronoun	Target form	Raw frequency	Relative frequency (per cent)	Error form	Raw frequency	Relative frequency (per cent)
den′gi *money*	GEN	2,252	28.76	NOM/ACC	5,158	65.82
belok *protein*	GEN	7	41.2	NOM/ACC	9	52.9
točki *points*	GEN	56	21.7	NOM/ACC	161	62.4
on *he*	GEN	20,294	21.63	NOM	48,856	52.08
turisty *tourists*	DAT	9	5.7	ACC/GEN	28	17.72
rodstvenniki *relatives*	DAT	122	11.11	ACC/GEN	158	14.39
ona *she*	DAT	3,241	7.93	ACC/GEN	9,396	22.98
my *we*	DAT	9,506	12.21	ACC/GEN	24,419	31.36
oni *they*	DAT	4,511	7.6	ACC/GEN	11,009	41.13
vy *you*	DAT.PL	14,833	16.27	ACC/GEN	18,305	20.08
papa *dad*	DAT	105	4.2	GEN	133	5.3
proekty *projects*	DAT	8	3.61	LOC	15	6.78
etap *stage*	INS	9	1.51	NOM/ACC	89	14.93
zdorov′e *health*	INS	39	5.4	GEN	181	25
holodil′nik *fridge*	LOC	48	15.1	NOM/ACC	82	25.78
procenty *interest*	LOC	26	1.05	GEN	1,087	44.77
literatura *literature*	LOC	146	21.95	GEN	211	31.73
kollektiv *staff*	GEN	62	19.13	LOC	54	16.66
stol *table*	LOC	330	13.68	DAT	212	8.79

The general frequency distribution of different case forms in spoken Russian is shown in Fig.1 (the frequency values were taken from Martynenko 2003).

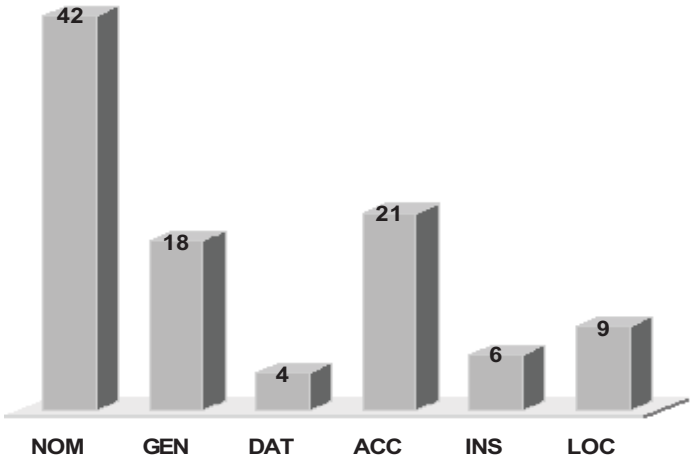

Fig.1. Distribution of different case forms in spoken Russian (per cent).

As it appears from the comparison of Table 1 with Fig. 1, the noun/pronoun case forms reported to occur most frequently in spoken Russian (nominative, genitive, and accusative) tend to substitute for the less frequent oblique case forms (dative, instrumental, and locative); at the same time, the more frequent nominative and accusative substitute for the less frequent genitive. Paired t-tests yield significant frequency differences for GEN→NOM/ACC substitutions (t (37) = 3.58, $p < .001$) and for DAT→ACC/GEN substitutions (t (39) = 3.08, $p < .01$).

3.2. *Contextual substitutions of a grammatical feature*

This section presents an analysis of CONTEXTUAL SUBSTITUTIONS OF A GRAMMATICAL FEATURE such as case, number, gender and person, resulting from the interference of a grammatical feature of an "interloper" (a distractor word from the same utterance, either preceding or following the target word). The total number of examples of this kind is 154. Some representative examples of the interference effects of the different grammatical features are considered below. (the target and error word forms are in bold, and the distractor word form, in bold italics).

In (2a), the genitive CASE form of the pronoun 'he' is substituted for the target dative CASE form due to the interference of the genitive case feature of the following noun *begemotika* 'hippo':

(2a) Case feature substitution: DAT → GEN

Eto	*potomu čto*	**emu**	***begemotik-a***	*podarili*
this	because	3SG.M.**DAT**	hippo-SG.M.**GEN**	was given

→ …	**ego**	***begemotik-a***	podarili
	3SG.M.**GEN**	hippo-SG.M.GEN	was given

'Is that because he was given a (toy) hippo?'

Similarly, in (2b), the target genitive CASE form of the pronoun 'I', *menja,* is replaced by the dative case form *mne* owing to the interference of the dative case form *im* of the pronoun 'they':

(2b) Case feature substitution: GEN → DAT

Im	*by*	**menja**	*v*	*pomošč*
3PL.**DAT**		1SG.**GEN**	in	help

→	***Im***	*by*	**mne**	*v*	*pomošč*
	3PL.**DAT**		1SG.**DAT**	in	help

'I wish I were there to help them'

In (2c), the preposition *na* prescribes the locative CASE form of the noun *klarnet* 'clarinet'. However, the dative case feature of the word *klarnet* 'clarinet' is substituted for the target locative case feature due to the interference of the dative case feature of the preceding word *igre* 'playing'. As can be seen from (2a-c), the attraction effect works both forward–from a preceding word and backward–from a following word.

(2c) Case feature substitution: LOC → DAT

Ja	*ne*	*javljajus'*	*specialistom*	***po***	***igr-e***	*na*
I	not	be	specialist	in	playing-SG.F.**DAT**	on

klarnet-e
clarinet-SG.M.**LOC**

→… ***po*** ***igr-e*** *na* **klarnet-u**
in playing-SG.F.**DAT** on clarinet-SG.M.**DAT**
'I am not a specialist in playing the clarinet'

In (2d), the attraction effect exerted by the plural NUMBER FEATURE of the noun *sferax* 'spheres' leads to the selection of the plural number feature of the premodifier adjective *nravstvennyx* 'moral' instead of the target singular feature:

(2d) Number feature substitution: SG → PL

...v *duxovn-oj* *i* **nravstvenn-oj** ***sfer-ax***
in spiritual-SG.F.LOC and moral-**SG**.F.LOC sphere-**PL**.LOC

→ *...v* *duxovn-oj* *i* **nravstvenn-yx** ***sfer-ax***
in spiritual-SG.F.LOC and moral-**PL**.LOC sphere-**PL**.LOC
'…in the spiritual and moral spheres'

In (2e), the attraction effect exerted by the 2SG pronoun *ty* 'you' causes the selection of a wrong PERSON FEATURE (2SG instead of 3SG) of the verb *znat'* 'know', which has to agree with the 3SG noun *čelovek* 'person:'

(2e) Person feature substitution: 3SG → 2SG

Eto ***ty*** *čelovek,* *kotoryj* *bolee ili menee* **zna-et**
this **2**SG person: 3SG that more or less know-**3**SG.PRS

jazyk?
language

→ *Eto* ***ty*** *čelovek,* *kotoryj* *bolee ili menee* **zna-eš'**
this **2**SG person: 3SG that more or less know-**2**SG.PRS

jazyk?
language
'Are you the person that more or less knows the language?'

In (2f), the future form of the verb 'tell', *skažu*, is substituted for the target past form *skazal* due to the interference of the future TENSE FEATURE of the following verbs *odenus'* 'will get dressed' and *pridu* 'will come:'

(2f) Tense feature substitution: PST → FUT

… ja tebe **skaz-al**, *čto ja seičas* ***oden-us'***
1SG 2SG.DAT tell-SG.**PST** that 1SG now get dressed-SG.**FUT**

i ***prid-u***
and come-1SG.**FUT**

→ *… ja tebe* **skaž-u**, *čto ja seičas*
1SG 2SG.DAT tell-SG.**FUT** that 1SG now

oden-us' *i* ***prid-u***
get dressed-SG.**FUT** and come-1SG.**FUT**
'I told you I'll get dressed and come right now'

Finally, consider (2g), which is an example of contextual substitution of the GENDER FEATURE. The gender feature of the adjectival pronoun pre-modifier, *v drugoj* 'in the other' has to agree with the feminine gender feature of the noun *ruke* 'hand'; however, due to the attraction effect exerted by the masculine gender feature of the preceding noun, *čemodan* 'case', the target feminine gender is replaced by masculine:

(2g) Gender feature substitution: F → M

… v odnoj ruke ***čemodan***, *v*
in one:**F**.SG.LOC hand:**F**.SG.LOC case:**M.**SG.NOM in

drug-oj *sumka*
other–**F.**SG.LOC bag:**F**.SG.NOM

→ *…v odnoj ruke* ***čemodan***, *v*
in one:**F**.SG.LOC hand:**F**.SG.LOC case:**M.**SG.NOM in

drug-om *sumka*
other–**M.**SG.LOC bag:**F**.SG.NOM
'…a case in one hand and a bag in the other'

Errors like (2a-g) indicate that grammatical feature selection is not an automatic consequence of lexical selection and suggest the existence of a distinct production level where grammatical features are assigned to lexical items.

4. Competition at the morphophonological encoding level

Inflectional affix substitutions shed light on another debatable point: the selection of bound morphemes such as inflectional affixes. Similar to grammatical feature substitutions, bound morpheme substitutions can be either context-free or contextual. Although examples of inflectional affix substitutions are fairly scarce in the speech error corpus, they seem to indicate certain tendencies in the selection of bound morphemes.

4.1. *Context-free substitutions of inflectional affixes*

In CONTEXT-FREE SUBSTITUTIONS OF INFLECTIONAL AFFIXES, a non-existent inflected word form is produced by adding a synonymous inflectional affix from a different inflectional paradigm to the target stem. The corpus includes 32 examples of this kind.

In (3a), the 3PL.FUT affix *–at* of the verb *zaxotet'* 'want', which belongs to the 2^{d} conjugation class, is replaced by the 3PL.FUT affix of the 1st conjugation class, *–ut* (the target and error affixes are in bold capital letters):

(3a) *Vdrug oni* **zaxotj-*AT*,** *čtoby nas pozdravili* **→…zaxotj-UT**...
suppose they want-3PL.FUT that us congratulated
'Suppose they want us to be congratulated?'

In (3b), the plural noun *duši* 'showers', instead of the target plural genitive affix *–ei*, gets the plural genitive case morpheme *–ev* from a different plural declension class (the affix *–ev* is taken by the nouns whose stems end in a hard consonant while *–ei* is taken by the nouns whose stems end in a soft consonant or sibilant):

(3b) **Duš-EI** *to u nas net* → **Duš-EV** *to u nas net*
shower-PL.GEN but at us no
'But we have no showers'

Substitutions of plural genitive affixes of nouns are predominant among the examples of context-free affix substitutions. This is likely to be a result of the complexity of the plural noun declension system. Thus, (3c) and (3d) are two opposite examples. In (3c), the plural genitive affix *–ov* (taken by nouns whose stems end in a hard consonant) is substituted for the target zero morpheme (taken by a small part of masculine and neuter nouns and some pluralia tantum nouns) of the pluralia tantum noun *brjuki* 'trousers:'

(3c) *Ona tak sprjatalas' sredi* **brjuk** → *...sredi* **brjuk-OV**
it so hid among trousers:GEN among
'It [the blouse] kind of hid among the trousers [on the rack]'

(3d) is a reverse example, where the target plural genitive case affix *–ov* of the plural noun *cveta* 'colors' is replaced by the zero morpheme:

(3d) *– Etot čainik čem-to na naš poxož.*
– This teapot looks a bit like ours.
– Po cvetam tol'ko... nabor **cvet-OV…** → **…cvet**
by colors only combination color-PL.GEN color
'It's just the colors…The combination of colors…'

4.2. *Contextual substitutions of inflectional affixes*

In CONTEXTUAL SUBSTITUTIONS OF INFLECTIONAL AFFIXES, the synonymous affix of a distractor word from the same sentence is substituted for the target affix, yielding a non-existent word form. There are only 12 examples of this kind available in the speech error corpus. The scarcity of the examples is partly due to the fact that the scope of their occurrence seems to be limited to sentences with homogeneous members of a clause joined by the coordinating conjunctions 'and' or 'or.'

In (4a), the plural genitive case form morpheme *–ov* of the noun *paketik* 'bag' is suffixed to the stem of the noun *karandaš* 'stick' although the plural forms of the two nouns belong to different plural declension classes (the affix *–ov* is taken by the nouns whose stems end in a hard consonant while *–ei* is taken by the nouns whose stems end in a soft consonant or sibilant) and thus have different PL.GEN affixes (the target and error affixes are in bold capital letters, and the distractor affix, in bold italics):

(4a) *Nam nado budet zakupit' klejuščix* **karandaš-EI** *i*
we need be:3SG.FUT buy glue stick-PL.GEN and

paketik-***ov***
bag-PL.GEN
→ … **karandaš-OV** *i* pake-
tik-***ov***
'We'll need to buy glue sticks and bags'

In (4b), the feminine noun *malina* 'raspberry' gets the masculine instrumental

case ending *–om* instead of the target feminine instrumental case morpheme *–oj*. The substitution is caused by the interference of the instrumental case ending *–om* of the following masculine noun *med* 'honey':

(4b) *Budeš'* *čai* *s* **malin-OJ** *i* *med-**om***
be:2SG.FUT tea with raspberry-SG.**F**.INS and honey-SG.**M**.INS
→ ... *s* **malin-OM** *i* *med-**om***
with raspberry-SG.**M**.INS and honey-SG.**M**.INS
'Would you like raspberry [jam] and honey with your tea?'

Errors like (3a-d), (4a-b), presumably resulting from competition during affix selection, indicate that bound morphemes, like freestanding items, compete during lexical processing, and that inflected forms can be computed (formed by adding an affix to the stem) at the morphophonological encoding level. At the same time, the available examples of context-free affix substitutions suggest that when contextual effects do not interfere with the process of a word's morphophonological encoding, the competition might cause a speech error mainly when the most complex parts of the inflection system (such as the elaborate plural noun declension paradigms) or the weakest affixation types are involved.

5. Discussion

An advantage of speech error evidence is that it reveals the processes that occur in natural language production and are not dependent on any preset experimental conditions. In this paper, speech error data were used to explore the mechanisms of grammatical feature selection and inflectional affix retrieval by speakers of a highly inflected language like Russian.

First, speech error evidence suggests that the selection of inflected word forms is generally competitive. This conclusion runs counter to most theories of lexical retrieval, which argue that while the selection of lexical nodes may be competitive, the selection of their grammatical properties is an automatic consequence of lexical selection (Caramazza et al. 2001; Schiller and Caramazza 2002; Costa et al. 2003; Schiller and Caramazza 2003; Bordag and Pechmann 2008), and is in line with Schriefers' (1993) results. At the same time, whereas picture-word interference studies focus on the competition resulting from the interference of the gender or number feature of a distractor word, examples (1a-h) of context-free substitutions of a grammatical feature indicate that even when the selection of a word's inflected form is unaffected by any distracting context, word forms with different grammatical properties can still compete for selection within the word's declension paradigm. In addition, it is obvious from both con-

text-free and contextual grammatical feature substitutions that the list of competing grammatical features is not confined to gender and number. Other features such as case, tense, aspect, and person can also be selected by competition as in (1a-c), (1f, g), (2a-c), (2e, f). In other words, the question as to whether grammatical features do compete for selection has to be answered in the affirmative.

Assuming that context-free substitutions of a grammatical feature result from competition among the grammatical forms of a target word during lexical retrieval, are there some inflected forms that dominate the word's inflection paradigm, i.e. some forms that are more likely to be selected?

A comparison between the relative frequencies of the target and error inflected forms of a word in the Russian National Corpus shows that, at least for the case feature, the frequency of the error form within the word's declension paradigm is generally higher than that of the target form, suggesting that some forms may have a priority within the paradigm when the appropriate inflected form is being selected. Thus, the noun and pronoun case forms most frequently used in spoken Russian (nominative, genitive, and accusative) tend to substitute for the less frequent oblique case forms such as dative; at the same time, the nominative and accusative forms tend to replace the less frequent genitive. The homonymy of some noun and pronoun case forms may add to the strength of the substitute case forms, e.g. the fact that the nominative and the accusative case forms (the most robust case forms) are homonymous may make a GEN→NOM/ACC substitution more likely to occur. Such examples suggest that the frequency effect may be due to the combined frequency of the two homonymous case forms involved rather than to the priority of certain grammatical features over other features, i.e. that it is in fact inflected word forms rather than words' grammatical properties that may be selected by competition.

It thus seems plausible to assume that the different inflected forms that make up a word's declension paradigm are coded for frequency of occurrence in the speaker's production lexicon, which may make the more robust higher-frequency forms more readily accessible and thus more likely to substitute for the weaker low-frequency forms.

This is consistent with the finding that lexical processing is affected by the frequency of a grammatical word form (e.g. Kostić and Mirković 2002; Milin et al. 2007). Some evidence supporting this view comes from the studies of language deficit in agrammatism. Stemberger (1984, 1985) used an associative network model of sentence production, claiming that since more frequent word forms have lower activation thresholds, they tend to replace less frequent word forms in agrammatic speech (cf. Bybee 1995). Faroqi-Shah and Thompson

(2004), who analyzed verb inflection errors observed in English-speaking agrammatic individuals, concluded that the errors are likely to be a consequence of a pre-phonological diacritical deficit. They further proposed that, in case of a diacritical failure, word form frequency affects sentence production (but see Janssen and Penke (2002) for contradicting evidence from the speech of agrammatic aphasics). Recent statistical studies provide growing evidence for the availability of probabilistic information about individual inflectional variants of a word in lexical memory (see Baayen 2007).

Second, speech error data are not consistent with the view that unlike free-standing morphemes such as determiners, the selection of morphophonological transformations is a noncompetitive process. Caramazza et al. (2001), Schiller and Caramazza (2002), and Costa et al. (2003) claim that competition is restricted to freestanding items whereas bound morphemes cannot be selected by competition. However, substitutions of inflectional affixes such as (3a-d), (4a, b) indicate that bound morphemes are also subject to competition, i.e. that morphophonological processes may be competitive. This finding is in line with Bordag and Pechmann (2008)'s conclusion that the phonological forms of inflected words are involved in the competition and with the view that free-standing and bound morphemes are basically processed in the same way (Schriefers et al. 2005; Lemhöfer et al. 2006). Besides, the evidence from speech errors finds some support from the results of Russian child language studies showing that children tend to supply an illegal case ending of a target noun if this ending is more familiar or productive than the correct one (Zeitlin, 1982; cf. Dąbrowska and Szczerbiński (2006)'s experimental results on Polish children's use of the Polish dative).

In addition, context-free substitutions of inflectional affixes suggest that the competition at the morphophonological encoding level is likely to result in affix substitution when an affix has to be retrieved from a particularly complex inflectional paradigm or when weaker affixation types are involved. In such cases, more robust affixation types may inhibit weaker types. Thus, in (3b), the more productive plural genitive affix *–ev* is substituted for the less productive *–ei*. However, there are reverse examples like (3d), and the available examples of context-free affix substitutions are still too scarce to arrive at any definite conclusions about whether their processing is affected by the affix frequency. What can be proposed so far is that inflected word forms may be computed by adding an affix to the stem and that there may be a competition of bound morphemes involved in the computation process.

Dąbrowska (2008), in a study of the use of Polish dative by native speakers of Polish, found that the frequency of dative noun case inflections affected the

speakers' performance on inflecting nonce words: speakers performed better on the inflections that apply to larger classes of nouns. She concluded that this result provides strong support for usage-based models of language which hypothesize that mental grammars contain low-level schemas instead of, or in addition to, more global generalizations. The ability of a particular speaker to productively use a certain inflection pattern largely depends on how frequently this speaker has experienced word forms with this inflection.

It seems that the examples of context-free inflectional affix substitutions provide further evidence for the assumption that low-level inflection schemas contained in speakers' mental grammars may have a priority over more general rules of inflection and, at the same time, support the experimental data suggesting that the productiveness of different affixation types may be an important factor in inflecting a word (Dąbrowska 2004; Dąbrowska and Szczerbiński 2006; Dąbrowska 2008).

Finally, there is another question to be resolved, and it concerns the locus of the competition. Both context-free and contextual grammatical feature substitutions suggest the existence of a distinct grammatical encoding level of sentence production, where abstract grammatical features compete for selection. This view is consistent with Schriefer (1993)'s theory but it contradicts the conclusion made by other authors that it is only at a level of morphophonological transformations that the competition takes place (Schiller and Caramazza 2002; Costa et al. 2003; Bordag and Pechmann 2008). At the same time, inflectional affix substitutions indicate that a competition of inflectional affixes may indeed exist at the morphophonological encoding level. Thus, speech error data suggest that the scope of the competition encompasses both the grammatical and the morphophonological encoding levels.

These conclusions may not hold for free-standing determiner languages that are not as highly inflected as Russian; hence the negative results obtained for the competition of grammatical features in Germanic and Romance languages. More surprisingly, the results of the present study partly diverge from those obtained for inflected languages like Croatian and Czech. Bordag and Pechmann (2009) have recently proposed that the occurrence of the congruency effect might depend on whether a given grammatical feature is indispensable or dispensable for further encoding, i.e. whether the given feature is externally or internally specified at the lemma level. On this view, internal features like gender that become available only after the lemma (a word representation marked for its grammatical category—see Roelofs 1992) has been activated can be bypassed by the encoding process if the information about external features like number and case is available earlier and is sufficient for the determination of the word's inflectional

variant. Clearly more experimental research may be needed to explore whether it is the language-specific properties such as the degree of inflectionality and the interaction of the gender feature with other grammatical features or perhaps the specificity of the experimental designs that account for the differences in the data. A comparison of Russian speech error data with the experimental results obtained for other languages suggests that grammatical and morphophonological encoding processes may function differently in languages of different families.

6. Conclusion

Russian speech errors contribute to the issue of grammatical feature selection during lexical retrieval. They show that, in a highly inflected language, both the selection of grammatical features at the grammatical encoding level and the selection of bound morphemes at the morphophonological encoding level may be subject to competition. Speech error evidence suggests that the frequency of an inflected word form affects the selection of the word's grammatical features.

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SUPARNIČKI KARAKTER IZBORA GRAMATIČKIH SVOJSTAVA: PROUČAVANJE GOVORNIH POGREŠAKA U RUSKOM

Na temelju analize govornih pogrešaka u ruskome koje uključuju fleksiju riječi može se zaključiti da su u jeziku s razvijenim fleksijskim sustavom kako izbor gramatičkih svojstava na nivou gramatičkog kodiranja tako i izbor vezanih morfema na nivou morfofonološkog kodiranja suparnički procesi.

Ključne riječi: gramatička svojstva; fleksijski afiksi; govorne pogreške; jezična proizvodnja; ruski jezik.