Mental Lexicon Structure in Language Collapse: Experimental Evidence from a Morphologically Rich Language
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Background
The debate around the structure of mental lexicon lasts for more than 30 years. Based on studies, which focus predominantly on English regular and irregular past-tense inflection, two main approaches were elaborated: dual-system and single-system. According to the dual-system (UG-based) approach (Pinker 1991, Prasada & Pinker 1993, Ullman 2004), regular and irregular verbs are processed by two distinct mechanisms, or modules: regular verbs are computed in a rule-processing system and are not governed by frequency factors, while irregular verbs are processed in associative memory. If it is necessary to produce a form from unknown or nonce verb a default symbolic rule automatically are applied (in case of English it is ‘add -ed’). The opposite single-system (network) approach (Plunkett & Marchman 1993, Bybee 1995) claims that both regular and irregular verbs are processed by a single mechanism in associative memory, and frequencies play crucial roles. In case of nonce and unknown words forms are produced based on analogy with known verbs.

It is clear that the properties of English past-tense inflection cannot be generalized to languages with developed inflectional morphology. Very few studies analyze linguistic processing in languages with complex verbal morphology (Ragnasdóttir et al. 1996, Orsolini & Marslen-Wilson 1997, Simonsen 2000, Gor & Chernigovskaya 2004, Черниговская et al. 2007). In the view of the discussion between two approaches Russian is a perfect object: it has numerous verbal classes and more than one ‘regular’ class.

So this study explores the structure of the mental lexicon and processing of Russian verbal morphology by three groups of subjects: adult native speakers of Russian as a baseline (N=22), aphasic agrammatic Broca patients (N=6), and patients with Alzheimer disease (N=6).

Design of the study
The tests included either 80 or 60 Russian verbs of 4 verbal classes according to the one-stem system developed by Jakobson and his followers (Jakobson 1998) which identifies 11 verbal classes. Each class is of a specific conjugational type, and can include consonant mutations, stress shift, and suffix alternation. We used the following classes: -aj (non-past-tense form chit-aj-u ‘I read’ vs. infinitive chit-a-t ‘to read’), -a (pish-u ‘I write’ vs. pis-a-t ‘to write’), -i (nosh-u ‘I carry’ vs. nos-i-t ‘to carry’) and -ova (ris-uj-u ‘I draw’ vs. ris-ova-t ‘to draw’). Respondents were asked to generate non-past-tense forms of the stimuli presented either in the infinitive or in past tense, plural. In each class there were 5 high-frequency and 5 low-frequency real Russian verbs, and nonce verbs composed by manipulating the initial segments of the high-frequency real Russian verbs. In case of 60-verb variant of the test there were 5 nonce verbs derived only from high-frequency real verbs. In case of 80-verb variant there were 10 nonce verbs. The experiment was conducted orally and individually with each subject, and recorded.

Results
Adult native speakers of Russian perfectly well produced forms from three productive classes (-aj, -i, and -ova) and had some problems with nonproductive -a class. They preferred apply -aj model to the stimuli of -a class, especially in case of nonce verbs. The frequency influenced the rate of correct answers in all classes except -ova.

Aphasic patients produced more correct answers on stimuli of the default -aj class (which was identified based on the previously obtained data on native adult speakers and children) than on stimuli of other classes. It conflicts with the results of (Ullman et al. 1997) that subjects with non-fluent aphasia have problems with production forms from regular verbs.
In processing forms from nonce verbs they apply a lot of different models (much more than normal adults), and some of them are very specific: for example, morphological markers of past and infinitive forms together (*trosít’ → *trosítili), or, instead of verbal forms, they used other parts of speech (*znavíli → znakomaja ‘a frend, acquaintance’).

The frequency factor influence the rate of correct forms in all classes except default -aj class.

Patients with Alzheimer disease produced more correct responses on stimuli of -ova class and also the frequency factor did not play role in production forms from stimuli of this inflectional verbal class.

In contrast to English experiments (Ullman et al. 1997) nonce verbs had the lowest rate of correct answers. However, as distinct from aphasic data these patients tried to find a phonologically similar real word (e.g. *okožat’ → okazyvaju ‘I provide’). This strategy was absent in answers of normal adult speakers.

We suggest that aphasic patients have problems with rules as a result of impairment of a grammar component of the language system. Patients with Alzheimer disease prefer to use analogy in form production that may be caused by impairment of a semantic component of the language systems.

Also we claim that both models, dual-system and single-system, conflicts with Russian data. On the one hand the frequency factor did not influence form production by aphasic patients from verbs of the default -aj class that very similar to the predictions of dual-system approach. However, the results of normal adults and patients with Alzheimer disease demonstrate that the frequency factor influence all classes (default -aj, productive -i and non-productive -a), except -ova. It conflicts with both models. Probably, the clear morphological structure of such verbs plays the crucial role in the recognition of -ova class.

Literature

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