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MORPHOLOGICALLY RELATED WORDS: LEXICAL ACCESS AND STORAGE IN THE MENTAL LEXICON

Dissertation Summary

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My thesis presents the results of a psycholinguistic experimental study devoted to the mechanisms of lexical access to morphologically related words and the principles of their storage in the mental lexicon. I tackle the problem by looking at Russian verbs; specifically, I address the question of what characteristics play a role in accessing morphologically related verbs in memory while reading words out of context.

This summary consists of Introduction (Section 1), Sections 2-5, which present the experimental studies and their results, Conclusions, and List of References.

Introduction gives an overview of the materials used in my study (1.1). The next section summarizes the findings across various languages brought by the five decades of this field of research (1.2). The bulk of the thesis is a description of the data collected by me in four behavioral experiments. The last section describes the results of replications of the aforementioned experiments in the online format.

The main **method** of this study is experimental: a lexical decision task with masked visual priming. The participant sees a sequence of letters on a screen; the task is to indicate, by pressing one of the two keys, whether it is a valid word or not (the present study uses words of the Russian language). The sequences of letters that do not constitute valid words will be subsequently referred to as nonwords.

The central components of the procedure are the prime sequence and the target sequence, or the stimulus. The former may flash on the screen for such a short time that the participant will not be consciously aware of having been exposed to it; alternatively, the prime may linger longer on the screen. The first of these settings is intended to explore early stages of the access to the word in memory, whereas the second setting targets late access stages. The prime is followed by the target sequence, which is aimed to be processed consciously and to which the participant is expected to react by pressing a key. By controlling the degree of similarity between these two sequences the researcher may gain an understanding of what information is relevant for word recognition.

One of the pioneers of this method, Kenneth Forster (Forster, Davis 1984) explains this process as follows: imagine three points in a space, one being the system's starting point in word recognition, and the two others representing the prime word and the stimulus word in memory. The time required to recognize the stimulus word will depend on traveling the path from the already activated prime word. The nearer these two representations stand to each other, the less time will be needed for activating the stimulus. The location of the representations in the space, i.e. in the mental lexicon, reflects the similarity or the differences between the words in spelling, pronunciation, and meaning. If the prime is a nonword which resembles a real word, the process will follow the direction prompted by the partial match of the orthographic forms.

The study presented in Section 2 uses this logic to illustrate the early and the late stages of lexical access to verb pairs of the Russian language. I conducted two experiments with the same set of experimental materials; in the first experiment, the exposure time for the primes was 60 ms, whereas in the second it was 150 ms. The target stimuli were verbs with no derivational suffixes or prefixes, and the primes were the prefixed and suffixed derivatives of these verbs (e.g. *motat′* 'to wind'– *motnut′, zamotat′*). I found that the association between base verbs and their suffixed derivatives is stronger than with their prefixed derivatives, as manifested in accelerated reaction to the base verb after exposure to a suffixed derivative, in comparison to a prefixed derivative. The base verb and a prefixed verb bear greater formal resemblance, while the similarity between the base verb and the suffixed derivative is semantic in nature; consequently, the results suggest that the similarity of meaning is of a greater importance to storing morphologically related words in the mental lexicon.

The research reported in Section 3 utilizes the data obtained in the two above-mentioned studies, supplementing their design with a measure of syntactic variability of the stimulus verbs, which was computed in a subsidiary corpus study. I showed that changes in the syntactic properties of derivatives, as compared to the original verb, also affect the strength of association between them.

Section 4 describes two more experiments, which address the question of the relevance of individual morphemes and their orthographic integrity for storing morphologically related words in memory. I begin by describing an experiment with character substitution within the affixal morpheme, proceeding to an experiment with a substitution within the root. In both designs, the substitution was made in suffixed and prefixed prime verbs, while the stimulus verbs remained the same as in the first and the second experiments. Following the same method, the exposure time for the primes was set to 60 ms.

Section 5 is devoted to reproducing the experiments presented in Sections 2 and 4 by means of an online-based tool for collecting experimental data. The main results were replicated, now with larger numbers of participants; besides, some of the earlier conclusions were elaborated on, and a number of methodological observations was made.

The aim of the thesis is to describe the principles of storing morphologically related words in the mental lexicon, as well as the peculiarities of accessing them, using evidence from Russian verbs.

The relevance of the study lies in the ability of Russian, which is a morphologically rich language, to promote investigation into the relevance of various types of information for storing related words in memory and accessing them, via adjusting their degree of relatedness and phonological and semantic similarity, as well as by accounting for the role of various grammatical categories of words within a morphological family. These questions were discussed in previous research, yet experiments conducted on various languages have yielded contradictory results.

The novelty of the work consists in it being the first attempt at examining the features of derivational morphology in question from the standpoint of their juxtaposition – an opportunity offered by the Russian data. Although the body of research on morphological processing of words is substantial, evidence from Russian sheds new light on the properties of the word-formation process and allows direct comparison between the results of suffixation and prefixation of the same stem (e.g., *tolkat'* ‘to push’– *tolknut', zatolkat'*).

The objectives of the research are, firstly, to provide an overview of literature dedicated to recognition and storage of morphologically related words in memory, as evidenced in various languages; and, secondly, to conduct the experiments aiming to:

1. compare the strength of association between the base verb and the two types of derivatives – the suffixed and the prefixed ones;
2. to study the relation between lexical access and the syntactic properties of the base verb and its derivatives;
3. to analyze the impact of quasi-suffixed and quasi-prefixed derivatives with an orthographic substitution in the affix or in the stem (**zesvistet'* or **zasvirtet'* instead of *zasvistet'* 'to start whistling'; **svistlut'* or **svirtnut'* instead of *svistnut'* 'to whistle once') on recognition of the base forms (e.g. *svistet'* 'to whistle'), and thus to investigate the role of various morphemes in recognizing morphologically related words.
4. to demonstrate that psycholinguistic tools may be instrumental in tackling the dilemmas that have been thoroughly studied in theoretical linguistics.

The findings of the present research offer new insights into the existing models that describe the principles of storing morphologically related words in the mental lexicon and accessing them, which determines **the theoretical relevance** of the work.

The practical relevance of the work consists in providing evidence for designing models of the mental lexicon. Besides, my results will promote more informed selection of stimulus data in future research involving verb stimuli.

The main results of the study and theoretical proposals for the defense can be summarized as follows:

1. Representations of suffixed verbs have a stronger association in the mental lexicon with the base verb than representations of prefixed verbs. This conclusion is prompted by the greater acceleration in lexical access to the base verb when the prime is suffixed, as opposed to prefixed primes. Such closer association may be due to the greater affinity in meaning within the pair 'verb – suffixed derivative'.

2. When accessing a word, the associated set of syntactic contexts is also activated, which can affect recognition of subsequent words. Due to stronger resemblance between the syntactic properties of suffixed and base verbs, as compared to base vs. prefixed verbs, the effect of priming with a suffixed derivative is more pronounced for base verbs, which are characterized by greater variability of syntactic contexts, whereas prefixed verbs manifest an inverse pattern.
3. There is a difference in organization of morphologically related verbs in the mental lexicon: while the suffixed relation has a stronger reliance on semantic affinity, which is localized in the stem, the prefixed relation is primarily based on orthographic similarity. This conclusion complements the ongoing discussion on the existence of morphology as an independent system. Some researchers state that morphological affinity can be reduced to phonological/orthographic and semantic similarity. Meanwhile, we see that speakers of Russian, for instance, in fact rely on morphological organization for storing words in memory – at least when the words are connected by certain morphological processes.

The results of the work were presented in the following publications:

- Chuprina A. *K probleme rodstvennyh glagolov v mental'nom leksikone*. Vestnik Pravoslavnogo Sviato-Tikhonovskogo gumanitarnogo universiteta. Seriia III: Filologiia, 2019. № 59, P. 36–53 (in Russian) (ISSN of printed version – 1991-6485, ISSN of online version – 2409-4897)

- Chuprina A. *Processy affiksacii v mental'nom leksikone: morfologicheskij prajming pri orfograficheskih izmenenijah v rodstvennyh glagolah russkogo jazyka.* Vestnik Pravoslavnogo Sviato-Tikhonovskogo gumanitarnogo universiteta. Seriia III: Filologiia, 2022. № 70, P. 63–91 (in Russian) (ISSN of printed version – 1991-6485, ISSN of online version – 2409-4897)

- Chuprina A. Russian verbal affixation in mental lexicon: priming study and its online replication with true and stem-modified relative prime verbs // Computational Linguistics and Intellectual Technologies: Papers from the Annual International

Conference “Dialogue”. 2022. Issue 21. Pp. 106-113. (ISSN печатной версии 2221-7932, ISSN онлайновой версии 2075-7182, Scopus без квартиля).

- Slioussar N., Chuprina A. How derivational links affect lexical access: Evidence from Russian verbs and nouns // Italian Journal of Linguistics. 2016. Issue 27. Pp. 115-136 (IJL, ISSN 1120-2726, Scopus Q4).
- Chuprina A., Lester N., Slioussar N. Morphologically mediated effect of syntactic diversity // Proceedings of the 11th International Conference on the Mental Lexicon. 2019. № 137.

The main findings of the research conducted towards the thesis were delivered at international conferences in 2017-2022 in the form of three oral and three poster presentations:

- Morphological Processing 2017, Trieste, Italy, poster presentation *How strongly are morphologically related words connected: evidence from Russian verbs.*
- Rule and Reference Grammar 2017, Tokyo, Japan, oral presentation *Grouping morphologically related verbs in mental lexicon: evidence from Russian affixation.*
- Mental Lexicon 2018, Edmonton, Canada, poster presentation *Morphologically mediated effect of syntactic diversity: evidence from priming study of Russian verbs.*
- Night Whites 2018, St. Petersburg, Russia, poster presentation *Early and late lexical access to morphologically related words: evidence from Russian affixed verbs.*
- Words in the World 2020, hosted by McMaster University and the University of Alberta, Canada, oral presentation *On aspect and affixes, morphological priming in Russian verbs.*
- Dialogue 2022, Moscow, Russia, oral presentation *Russian verbal affixation in mental lexicon: priming study and its online replication with true and stem-modified relative prime verb*.

1. Introduction

Studies of the mental lexicon is a major area of research within psycholinguistics. The mental lexicon contains the knowledge of words' sounding, spelling, and meaning; together, they form what is called the lexical representation of a word. Research into the principles of storing and accessing such representations is one of the central issues in this field of investigation (Feldman, 1991; Baayen, 2014). The present work is a psycholinguistic experimental study of the mechanisms of access to word representations, as well as of the patterns of their organization in the mental lexicon. Namely, these questions are addressed by drawing evidence from Russian data, with a specific focus on the characteristics that play a role in defining the strength of association between morphologically related words in memory.

Morphologically related words are connected in human memory by virtue of certain shared properties, i.e. the affinity in the form, in the position of the stress, the meaning, and the combinability with other words. The tight association between morphologically related words stored in the mental lexicon is corroborated by evidence from a large number of experimental studies (i.e. on data from English: Marslen-Wilson et al., 1994; Italian: Traficante, Burani, 2003; Dutch: Bertram et al., 2000; Serbian: Milin et al., 2009; Hebrew: Frost et al., 1997; Arabic: Boudelaa, Marslen-Wilson, 2015; and Russian: Slioussar, Chuprina, 2016). The fundamental question in this vein of research is as follows: how do humans memorize and then 'retrieve' from memory morphologically complex words?

Derivational associations can be viewed from the perspective of presence of properties that are shared by a group of words. In this thesis, I raise the question of whether it is the affinity in form or in meaning that plays the dominant role in tying the base word with its derivatives. This question is of particular interest in view of the existing body of psycholinguistic research. Some studies interpret their results in favor of the 'form-then-meaning' model, i.e. when access to word meaning takes place only at the later stages of word recognition (Rastle, Davis, 2008). Others say that their results support the model of simultaneous access to form and meaning (Feldman et al., 2015). The present research is the first to examine this question in relation to the Russian language.

Although the above juxtaposition between form and meaning in the process of recognizing morphologically related words occupies the bulk of existing research, it was also shown that, in English, the syntactic information also affects the speed of word recognition (Lester et al., 2017). The present study uses SynTagRus, a syntactically tagged corpus of Russian (Богуславский и др., 2000), in order to obtain a measure of syntactic variability for the set of selected verbs. Therefore, this work contains a section on how the differences across this parameter impact on the strength of association between morphologically related verbs.

Lastly, conducting a series of experiments with various types of data – such as real words and orthographically modified words – allows the researcher to trace the changes in perception of the original word as conditioned by modifications in specific morphemes. This gives insight into the extent to which the morphological information about a word is independent, for example, from its orthographic integrity or from the semantic interpretation. Work on orthographically distorted material with modifications in various morphemes led to the hypothesis that access to words may occur along two routes (Diependaele et al., 2012). Namely, a twofold analysis of word composition is at play – firstly, the morpho-orthographic one, which heavily relies on the order of characters in the sequence; and, secondly, the morpho-semantic analysis, which does not demand complete observance of order in character positions. Applicability of this theory to morphologically related words of the Russian language forms a part of the present research.

This work addresses the above-formulated questions through the prism of Russian morphologically related verbs. Some of the relevant properties of such verbs are discussed in the next section.

1.1. Word formation in verbs: prefixed and suffixed verbs in the Russian language

The processes of suffixation and prefixation differ in the formal and semantic changes which occur within a pair of morphologically related verbs (Русская грамматика, 1980). When comparing the forms of the base verb and its suffixed derivative, one may note more pronounced differences than is the case with prefixed derivatives (e.g. *tolkat'* ‘to push’–

tolknut', zatolkat'). But the character of semantic changes in suffixation is more predictable, whereas prefixation, on the contrary, gives rise to ambiguity.

Let us examine these statements in more detail. The suffixed and the base verb belong to different inflectional classes. The position of the stress may differ; besides, in suffixation, the base verb loses its thematic vowel, and sometimes even the final vowel of the stem (*dvigat'* 'to move' – *dvinut'*), which intensifies the difference in terms of form. At the same time, the meaning of the base verb can be distinctly traced in the suffixed derivative. In case of the most frequent word-formation suffixes of verbs, *-nu-* and *-va-*, the former expresses a single, non-recurring completed action denoted by the base verb, while the latter signals the process of secondary imperfectivization of the base verb.

Prefixation, on the contrary, does not imply such dramatic formal transformation within the pair. Both verbs belong to the same inflectional class; the position of the stress is preserved in most cases. As for the semantics, the common meaning is of course present, yet the changes are less predictable and more diverse. A prefixed verb, as a rule, allows of several interpretations, when regarded out of context.

Let us now dwell on the change of aspect within a pair of verbs. In prefixation, it is only the imperfective base verb that becomes perfective (cf. *svistet'* 'to whistle' – *zasvistet'*), which never occurs to perfective verbs (cf. *sbit'* 'to knock down' – *posbit'*). In suffixation, the change of aspect takes place in both cases (*svistet'* 'to whistle' – *svistnut', sbit'* 'to knock down' – *sbivat'*).

In addition to the descriptive analysis of the verbs used in my research, I conducted a corpus analysis of syntactic variability of morphologically related verbs. To do so, I used the StimulStat database (Alexeeva et al., 2018) and the project "The frequency grammar of the Russian language" (Ляшевская, 2013) available through it, as well as the SynTagRus corpus (Богуславский и др., 2000). I found that syntactic properties of the base and suffixed verb are closer to each other than those of the base and prefixed verb. I hypothesized that this could have an effect on accessing the verbs of these groups. I also calculated syntactic variability measures for base verbs used in my study.

The above findings show that, when examining Russian verbs, it is impossible to dismiss the aspectual information from the design of the study. Previous experimental works (Риехакайнен, 2014) and the theoretical discussion on aspectual verbal pairs (e.g. Маслов, 1963; Бондарко, 1971; Горбова, 2014, 2017; Зализняк Анна А. и др., 2015) suggest that a pair consisting of a verb and its *-va-* derivative has a stronger bond than pairs tied by word-formation processes involving other affixes. In prefixation, the strength of association may vary across prefixes, or it can be weakened due to a difference in meaning (e.g. Janda et al., 2013). Thus, in the first scenario, an imperfective verb with the *-va-* suffix may be expected to grant an advantage in recognition to its perfective counterpart (*sbivat' – sbit'* 'to knock down'), as compared to other pairs (*tolknut' – tolkat'* 'to push'), which will affect the speed of answers given by the participants. In the second scenario, it may be expected that prefixed verbs in most cases will not facilitate recognition of their counterparts, which also will be reflected in reaction time – more exactly, in absence of acceleration in comparison with morphologically unrelated primes.

To summarize, my main hypothesis is that the mental lexicon of a Russian speaker reflects the word-formation interrelations within a group of morphologically related words. Moreover, some words enjoy stronger bonds with each other than with others. The strength of relationship depends on the overall information – orthographic, syntactic, and semantic, which is either preserved or lost in the course of the two processes, suffixation and prefixation. Thus, one of the central goals of the present research is to establish which of the types of information are more relevant for the strength of this association.

1.2. Morphological information in memory

The discussion of morpheme as an element of form and meaning, of segmenting words into meaningful parts and processing them as holistic entities has a very long history. In his overview of contemporary theories of morphological word processing, Jim Blevins (2012) recalls that one of the traditions has its roots in the first description of Sanskrit grammar (the works of Panini), according to which the pivotal challenge of morphology is to split words into constituent parts of lower levels, or to define the morphological

properties of a word along with its spelling. Another tradition emerged from descriptions of Ancient Greek and Latin grammar, and the theory of teaching these languages. Here, the basis of morphological analysis lies in the levels above individual words – namely, in the association between words and paradigms or other formal groupings.

Accumulation of psycholinguistic knowledge on the morphological organization of a word began with emergence of the theory of morphological decomposition in lexical access to word (Taft, Forster, 1975). This theory came into being in the 1970s, stemming from the interest to the mechanisms of memorization (Kintsch, 1972) in experimental psychology. Since selection of stimuli in psychological studies involves linguistic material, amongst the others, the issue of concrete and abstract words came to the fore. It was noticed that memorization of stimuli, especially of morphologically complex abstract words like *thought / ability* poses a challenge to participants. However, a closer analysis of data led researchers to a new hypothesis: possibly, what was seen as an impact of words' concreteness and abstractness could be due to a purely morphological effect, as in the majority of experiments abstract words were complex in terms of morphology, while concrete words were morphologically simple.

The theory of decomposition of morphologically complex words postulates mandatory decomposition of a word into morphemes prior to locating its representation in the memory, i.e. morphological analysis of words is attempted prior to lexical search, where the lexical representation of a complex word is most likely to be its stem or root. Almost 20 years later, an author of this theory, M. Taft, admitted that the obligatory demand for decomposition could be mitigated, which resulted from the accumulated body of data and, more importantly, from the diversity of the linguistic material that supplied the evidence.

It was English prefixed verbs that served as materials for the first studies towards the theory of decomposition and formed its basis. Comparison with access to suffixed words arrived much later (Marslen-Wilson et al., 1994). By now, a substantial body of evidence from diverse languages has been collected; it can be stated that in speakers of some languages, morphological processes under consideration show no difference in storing and

accessing morphologically complex words and their relation with the stem, whereas in others these are psycholinguistically different processes.

For instance, in recognition of Basque and Spanish words suffixed primes were shown to accelerate perception of the target word faster than prefixed ones, whereas no difference in storage was found: the researchers concluded that both processes rely on morpheme-by-morpheme storing in memory (Eddington, 2004; Duñabeitia et al., 2008). Experiments with lexical decision and simultaneous magnetoencephalography on English words confirm morpheme-by-morpheme storage of both suffixed and prefixed words; yet, they add to the picture by reporting differences in activation of the cortex. The right hemisphere more readily reacts to prefixed words, while zones in the left hemisphere are more active in recognition of suffixed words (Stockall et al., 2019).

Meanwhile, results from experiments with Korean and Italian reveal more profound dissimilarities (Ferrari, Kacinik, 2016; Kim et al., 2015), pointing to differences in storing suffixed and prefixed morphologically related words. Evidence from Korean (Kim et al., 2015) shows that both conditions accelerate recognition of a related stimulus word following a real prime, yet only pseudo-suffixed primes demonstrated a priming effect against unrelated words, which was not the case with prefixed primes. The authors conclude that, while the suffixed relation is based on early decomposition of the so-called prelexical type, prefixed words are likely to be accessed in their entirety.

Research on Italian (Ferrari, Kacinik, 2016) also reported stronger priming effect from suffixed rather than prefixed words. Besides, the authors extended their findings by comparing suffixes and prefixes of various types, concluding that, although suffixed words are in general closer to the base word than prefixed forms, this difference vanishes when both affixes change the part-of-speech assignment of the base word. The contradictory evidence produced by research on various languages calls for further investigation, which constitutes the aim of the present thesis.

2. Early and late lexical access to Russian verbs: difference between suffixed and prefixed verbs

Human memory stores a rich variety of information on words and their connections with morphologically related words. This includes the affinity – either complete or partial – in phonological and morphemic characteristics, as well the similarity of morphological features and syntactic behavior. Which is more impactful for the connections within a group of morphologically related words and for the access to these relations in the mental lexicon – the similarity in form or in meaning? There are two strands of psycholinguistic research: one argues that the form and the meaning of related words are equally important for actualization of information in the mental lexicon; the other says that only formal processing occurs at the initial stages of accessing the mental representation of a word.

I study a group of Russian verbs with their prefixed and suffixed derivatives to estimate which type of information plays a more important role in lexical access to the base word – stronger formal affinity between the base and its prefixed derivative, or greater predictability of the shift in meaning between the suffixed derivative and the base verb. To this end, I conducted psycholinguistic experiments with morphological priming. In one experiment, the primes were displayed for 60 ms, and in the other for 150 ms in order to explore the effects associated with the early and the late phases of lexical access.

The experiments demonstrated that predictability of meaning is of higher importance for accessing the representation of the base verb both in early and late access. Thus, even a short-term activation of the suffixed derivative prior to reading was sufficient for accelerating recognition of the subsequent base verb, as compared to preactivation with a suffixed derivative. This speaks in favor of regular and predictable changes in meaning being more important for organization of representations of morphologically related words than common phonological and morphological features.

3. The morphologically mediated effect of syntactic variability of verbs and its role in lexical access

Representations of words in the mental lexicon may be connected by virtue of sharing information of different types. Studies involving English material showed that syntactic properties affect the speed of lexical access to a word presented out of context (Lester et al.

2017). The present research seeks to address the question whether the strength of association between morphologically related words in a mental lexicon depends on their syntactic characteristics.

I began by turning to the StimulStat database (Alexeeva et al., 2018) and to the project "The frequency grammar of the Russian language" (Ляшевская, 2013) available through it to obtain the counts of frequencies and the number of word forms of prefixed and suffixed verbs. This analysis showed that finite forms are predominant in both types of derivatives, yet the counts of non-finite forms vary: while prefixed verbs more often occur as participles, suffixed derivatives and base verbs tend to favor the infinitive. I tried to tie this observation to the variability of syntactic contexts a given verb can occur in. To have a quantitative measure of this variability, I used the syntactically tagged Russian corpus SynTagRus (Богуславский и др., 2000).

Subsequently, I performed an additional analysis of the experimental data presented in the previous section. According to the results, reaction times are indeed dependent on the syntactic variable. Higher degrees of syntactic variability positively correlate with a stronger priming effect by a suffixed derivative. For prefixed primes, no such correlations are observed. An explanation to this morphosyntactic correlation may be that in a pair 'base verb – suffixed derivative', the similarity in syntactic distribution of forms is greater than in a pair 'base verb – prefixed derivative'.

4. Morphological priming with orthographic transformations of morphologically related Russian verbs

The above findings point to differences in storage of Russian verbs connected by the derivational processes of suffixation and prefixation. Remarkably, the same results were demonstrated in both early and late lexical access, indicating that the shared semantics is actively involved in the early phase, which is commonly associated with recognition of the formal features of a word. Therefore, in the subsequent experiments the duration of exposure to prime was set to 60 ms.

Thus, the relation between the motivating verb and its suffixed derivative is likely to be based on shared semantic properties, whereas the relation with the prefixed derivative is more of a formal one. I reinforce this conclusion by conducting two experiments with the same set of stimulus verbs, yet containing orthographic substitution in the affix or the root of the prime verb. Acceleration from suffixed prime verbs was replicated, even when their orthographic integrity was disrupted in the suffix position, but not in the root position. Contrariwise, no acceleration of access after prefixed prime verbs was observed regardless of the type of orthographic transformation. Moreover, the experiment once again showed that the characteristics of verb storage in the mental lexicon depend on the category of aspect within the verb pair. This should be taken into account when selecting verbs for future studies.

5. Reproducing the results of experiments with morphological priming using real verbs and verbs with orthographic substitution in the word root.

Reproducibility of research results is a very acute issue in contemporary experimental psychology and linguistics. Thus, an attempt to replicate 100 psychological studies published in the top-tier journals revealed that only 35 replications yielded similar results – moreover, in many cases the scale of the effect was smaller than in the original paper (Open Science Collaboration, 2015). This situation is far from being necessarily connected with the unscrupulousness of researchers. There is always a risk of false positives (when chance differences may turn out to be statistically significant). The problem is that significant results will be more likely to be published, while other similar studies which did not boast of statistically significant differences will never see publication. Besides, publishing replications of previous experiments is not commonly practiced since they, as a rule, do not satisfy the requirement of novelty: the above-mentioned project of psychologists was a remarkable exception, as it suggested a novel and very important generalization concerning the entire body of the selected experiments, which showed that most of the results cannot be reproduced due to various reasons.

A primary method for countering false positive results is to replicate your own experimental studies. The probability of chance differences to appear statistically significant in two independent experiments is very low. Therefore, I replicated the two experiments described in Sections 2 and 4 using the online experiment builder Ibex Farm (https://farm.pcibex.net/) and the Yandex Toloka platform (https://toloka.ai/) to recruit subjects.

In designing the replications, I applied strength of effect analysis to the data presented in the previous sections. I succeeded in replicating the main results and recorded differences between the two morphological processes depending on the amount of time allocated for answer submission in the online collection process. Thus, I uncovered overall decrease in reaction times in the online setting and a greater ratio of correct answers in the condition of quasi-prefixed verbs (**zesvistet'*). Consequently, the respective chapter contains a diagnostic commentary on data collected via online platforms, summarizing the experience of conducting this online-based research.

6. Conclusions

The present thesis investigates the mechanisms of lexical access and the principles of storing morphologically related words in the mental lexicon, using evidence from verbs of the Russian language. The data was collected by means of experiments with morphological priming. Beside the main goal, the present research also examines the role of verbal aspect in accessing verbs in Russian.

My results demonstrate that representation of the base verb becomes more accessible following exposure to suffixed derivatives with their more predictable change in meaning, as compared to prefixed derivatives, whose meaning cannot be predicted unambiguously; moreover, each prefixed verb typically has several meanings, the choice of which is context-dependent. Therefore, regular and predictable changes in meaning play a more important role in representing the connection between related words than their shared phonological and morphological features, which are more pronounced in the pairs consisting of a base and a prefixed verb.

The subsequent application of syntactic variability measures in analyzing the obtained data led to posing the question about the relevance of syntactic connections in storing morphologically related words. Higher degrees of syntactic variability positively correlate with a stronger priming effect by a suffixed derivative. For prefixed primes, no such correlations are observed. This can be explained by greater similarity of syntactic properties between the base and suffixed verbs than between the base and prefixed verbs.

Finally, eroding the integrity of the formal relations between verbs via orthographic substitutions revealed that access to the base word following a quasi-suffixed verb is accelerated faster than in priming by a verb with an orthographically impaired prefix. Measuring my results against the theory of parallel processes in the analysis of words (Diependaele et al. 2012), I conclude that storage of the pair 'base verb – suffixed derivative' is predominantly morphosemantic in nature, whereas for the pair 'base verb – prefixed derivative' it is largely based on orthographic similarity.

In conclusion, I would like to remark that, although the bulk of results obtained through in-person, offline procedure was reproduced in the online setting, the weakness effects called for extra analysis and explanation. In my case, the slower speed of online answering may indicate that a new process is triggered, different from early lexical access to word. Thus, the suffixed over prefixed advantage observed in the offline version did not recur in the online study. This may be due to the fact that the additional time for decision, which was available to participants in the online setting, gives them the opportunity to analyze larger volumes of information on the relation within a verb pair. This may mean that the two morphological process at the later stage of lexical access also differ as more and more information is being analyzed. Therefore, in replicating previous results it is crucial to control for the technical parameters, which may eventually highlight the properties of the cognitive organization of the process under investigation which were not contained in the initial hypothesis.

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