Final report on NetWords exchange visit *Internal and external prefixation: approaching theoretical postulates through a psycholinguistic experiment*

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Host institution: University of Patras (Greece)
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Purpose of the visit

The main purpose of the visit was to bring together a morphosyntactician with expertise on Slavic verbal prefixation, a morphologist with expertise on Greek verbal prefixation and an experimental psycholinguist, with the goal of investigating how one could experimentally probe the theoretical postulates of the study of the complexities of verbal prefixation, and of designing a psycholinguistic experiment investigating certain aspects of Slovenian prefixed verbs. Compared to previous studies on the processing of Slavic (as well as French) prefixed verbs, which at best differentiated between two types of prefixed verbs, we wanted to get a design that would be able to show whether the several types of prefixed verbs that were more recently proposed in the theoretical literature to have distinct structural configurations will also exhibit distinct processing patterns, or be experimentally traceable in some other way. This would also make it possible to evaluate competing theoretical proposals on the points of disagreement. We planned to conduct a pilot study during the exchange, using Slovenian Erasmus students at the host institution (the actual running of the experiment was not part of the goals for the exchange, being left for a later period at the home institution of the grantee/in Slovenia with easier access to Slovenian-speaking subjects).

In addition to the direct results described above, the exchange was also planned as a means for the establishment of lasting research connections between the participating researchers and institutions and as a means to provide the grantee and by extension the linguistic team at his institution with initial training in experimental linguistic work.

Description of the work carried out during the visit

Building on the state of the art of theoretical work on Slavic prefixation as described in the proposal at the time of the application, the first phase of the exchange sought to review the latest findings in descriptive and theoretical literature that could be relevant for the theoretical basis on which our project was originally proposed, to determine whether there are overlaps between Slavic and Greek prefixation that go beyond terminology and the general approach (=structural explanation of various types of prefixation), and to determine whether the different approaches in which they were modelled (syntax vs. morphology) might lead to different psycholinguistic predictions.

  In the second phase of the exchange, we designed a series of experiments involving both healthy adults and brain-damaged populations (agrammatic aphasics). The experiments with healthy adults include two lexical decision experiments (simple lexical decision task and lexical decision task with masked priming) and a timed-grammaticality judgement experiment, while the experiments with agrammatic aphasics include a sentence completion task, a reading task and a sentence grammaticality judgment task.

  In the last stage of the exchange we were not able to find Slovenian-native-speaker students at the host institution (July – outside the class period), and were therefore unable to run a pilot test. We hope to be able to do this in the fall at the University of Nova Gorica. For

the experiment with brain-damaged subjects (not envisaged at the time of the preparation of the proposal), a pilot test would not have been possible at the host institution at all.

Description of the main results obtained

I.   The theoretical background on Slavic prefixation with which we started out is as follows. Slavic verbal prefixes were long assumed to fall into two large classes: 'internal' prefixes, whose main characteristic is that they can affect the base-verb's argument structure, can radically affect the verb's core meaning and cannot stack, and 'external' prefixes, which do not affect the base-verb's argument structure, contribute modifier-like meanings, and can stack. Such differences between internally and externally prefixed verbs had been assumed for quite some time to reflect structural differences. In Svenonius' (2004) or Ramchand's (2008) account, internal prefixes have a structure in which the prefix originates below the verb, in its complement, (1a), and external prefixes originate above the verb, (1b).

(1)   a.   [VP [prefix]]
         b.   [prefix [VP]]

More recent work has proposed that we can actually define more than just two classes. Svenonius (2004) already suggests that different external prefixes may be located in different positions above the VP. Tatevosov (2008) explicitly splits external prefixes according to their relative position with respect to VP into two subgroups ('intermediate' and 'external'), (2a)-(2b), and Žaucer (2009) reanalyzes the former of these two subgroups as a subtype of internal prefixes, consequently arriving at two subgroups of internals ('resultatives' and 'result-modifiers'), (3a)-(3b), of which the latter subgroup, when occurring unstacked, is claimed to realize both VP-internal subconstituents from (3b). Žaucer (2009) further proposes to reanalyze a subset of Svenonius' externals ('cumulatives', 'saturatives') as internal.

(2)   a.   [vP [prefix [VP]]]
         b.   [prefix [vP [VP]]]
(3)   a.   [VP [prefix]]
         b.   [VP [prefix […]]]

In the first phase of the exchange, we reviewed the most recent proposals in the theoretical literature on Slavic prefixation and the distinctions between various types of prefixes (Wiland 2012, Ziková 2012, Biskup 2012, Markova 2011, Arsenijević 2011, Łaziński 2011) in order to assess whether they are compatible with the above assumptions, on the basis of which our project was planned. The general conclusion is that they are: these proposals either advocate an even more fine-grained split (into even more than three classes of prefixes), or they assume a binary split but stay silent on the possibility of further subtypes, none argues against it.

Specifically, Wiland (2012) presents a detailed cartographic proposal where each type of prefix heads a different functional projection above the VP.

Markova (2011) proposes a structurally defined ternary split into 'outer', 'inner' and 'lexical': [outer [inner [lexical]]]. These categories define syntactic *fields* in a syntactic tree, whereas each type of prefix is—like in Wiland (2012)—assumed to be located in a dedicated functional projection in a cartography-style functional sequence. More precisely, the 'lexical' category represents head adjunction of the prefix to V^0, whereas the other two categories comprise prefixes that are either complements of V^0 or FPs above the VP and/or vP.

Biskup's (2012) proposal is not as fine-grained with respect to the various types of prefixes. Whereas it argues against placing what was often seen as the higher class in a position different from the VP-internal position of what was typically seen as the lower class,

it also posits that a higher-class prefix such as the cumulative type merges low, but that there is also a CumP above the vP that restricts the interpretation of the direct object (it may be that with other types of externals, other FPs would be assumed to be involved above the vP – if so, there is a certain parallel with the proposals of Wiland 2012 and Markova 2011).

Ziková's (2012) offers phonological evidence for the external/internal split in Czech, which she explains by positing a structural difference. The evidence splits prefixed verbs in only two groups, but there is no implication that there could not be more groups.

Arsenijević's (2011) proposal posits a clear structural difference between internals and externals but explicitly leaves the group of external types hierarchically unordered, thereby allowing different types of externals to occur in variable orders.

With the exception of Arsenijević (2011), the predominant view in these most recent proposals (as in the previous proposals mentioned above) is thus that whereas the labels internal and external may reflect a binary partitioning of prefixes according to their relative height with respect to a specific projection (VP), this does not reflect reality in the sense that there must either be more subgroups of prefix types (e.g. Tatevosov 2008, Žaucer 2009) or prefix types simply each correspond to their own functional projection (e.g. Wiland 2012).

Next we wanted to determine whether there are possible overlaps between Slavic and Greek prefixation. The reasoning was as follows. Theoretical work on verbal prefixation in Slavic and theoretical work on verbal prefixation in Greek have both operated with cover terms such as 'internal' and 'external' (refs above for Slavic, Ralli 2004 for Greek), and both have identified further subtypes of the two classes (refs above for Slavic, Ralli 2004 for Greek). And although the models in which the proposals for Slavic and Greek were couched are different (syntactic vs. morphological), the two classes in Slavic and Greek have both been proposed to differ structurally in rather similar ways. The accounts of Slavic were given in (1)-(3), with the possible more recent upgrades or competing analyses, Ralli's (2004) account of Greek is as follows. Internally prefixed verbs have a structure in which a prefix that represents a subword unit combines with a stem, (4a), whereas externally prefixed verbs have a structure in which a prefix that represents a subword unit combines with a word, (4b), or a prefix that represents a word combines with a stem or word, (4c)-(4d).

(4) a. [[[prefix][stem] stem][infl] word]
     b. [[prefix][[stem][infl] word] word]
     c. [[[word(=prf)][stem] stem][infl] word]
     d. [[word(=prf)][[stem][infl] word] word]

Both Ralli's (2004) morphological account of Greek prefixation and any comprehensive syntactic account or a combination of partial syntactic accounts of Slavic prefixation thus converge on having an internal/external split that, when looked at more closely, merits further splitting into several types, and on having their prefix types defined structurally.

In view of this observation, it was plausible to ask whether the more fine-grained version of the internal/external split that was posited for Slavic overlaps with the more fine-grained version of the internal/external split that was posited for Greek, since that would allow designing an experiment that could directly be used for both. The result was largely negative, in that other than in the case of Ralli's (2004) prefixes of type (4a) and Slavic (1a), we found no straightforward correspondences. For example:

- we found no evidence for stacked resultative prefixes in Greek matching the Slavic cases from Arsenijević (2007) or Žaucer (2009) – no argument structure-changing effects with any of the stacked prefixes (a standard diagnostic for resultative prefixes)
- we found no solid evidence in Greek for what Žaucer (2009) calls result-modifying prefixes. At first sight, Ralli's (2004) 'internal' *para-* and 'external' *apo-/kse-* could be

that. The 'internal' *para-* , however, also attaches to activity verbs, so it is not a result modifier. The 'external' *apo-/kse-* are more likely candidates, *kse-*, for instance, *does* seem to only be possible on accomplishments but not activities or states (Ralli 2004); still, they do not seem to be found stacked over internals such as the internal *para-*, for which—from the perspective of Slavic result-modifiers—there is no obvious reason.
- we found no Greek *ksana-*type prefix in Slavic (cf. Žaucer 2009 for Slovenian "repetitive" *pre-*, Wiland 2012 for the Polish "repetitive" *prze-*), no Greek *poli-*type prefix in Slavic (cf. Žaucer 2010 against seeing the cumulative *na-* as such), no Greek 'external' *para-*type prefix in Slavic. More work is needed to determine whether the stressed prefix *so-* 'co-' could be a structural parallel to one of these; this prefix clearly forms a type distinct from all of the other Slavic prefixes discussed here (as evidenced by the fact that it is stressed, can attach to any kind of verb-type input, has no aspectual effects on the input) and has not attracted any attention in the theoretical literature on Slavic prefixation (e.g. Svenonius 2004, Slabakova 2005).

Given that structural differences between internal and external Slavic prefixation have been proposed to yield not only to a syntactic but also to a morphological account (Borik 2009), we also tried to determine whether the syntactic and morphological accounts of the structural differences between internal and external prefixation make different experimental predictions.

With respect to processing, it does not seem that the two accounts (syntactic vs. morphological) would make obviously different predictions. They both appear to operate with levels of derivation, so that syntax-only models would have levels of derivation that replicate the different levels of the morphology-as-a-separate-module models (e.g. Ramchand 2008, Marantz 2007, Arad 2003, Travis 2000). For example, Ralli's (2004) distinction between the morphological objects of stem and word, which play an important role in distinguishing between the four types of prefixed verbs, would thus translate to syntactic derivations of two sets of elements that span (distinct numbers of) distinct word-building domains.

Similarly, whereas the combination of the tree-pruning hypothesis of language degradation in agrammatic aphasics (Friedmann & Grodzinsky 1997) and syntactic accounts of prefixation predicts that we will find patients who have problems with external but not internal prefixes, and assuming versions such as Wiland (2012) perhaps even to find patients who show implicational hierarchies of lost external prefix types, this may also be derivable for a morphological account; one like Ralli's (2004) could derive this from different structural complexities (different number of 'words', etc.) of its four prefixed-verb templates.

II. In order to determine whether the several prefix types that were recently posited in the theoretical literature can also be discerned experimentally, and if so, to be able to experimentally evaluate the competing theoretical proposals on the points in which they diverge (e.g. with respect to the nature of some of the prefixes or prefix types), we designed experiments with both healthy adults and brain-damaged populations. For the purpose of the experiment descriptions, prefixed-verb types structurally defined above will be referred to as:
Type I = (1a) above
Type II = (1b)/(2b) above
Type III = (2a)/(3b) above

Experiments with healthy adults

Experiment 1: simple lexical decision task
Initial psycholinguistic insight into the theoretically posited distinction between three types of prefixed verbs will be sought via a simple lexical decision task. The aim of this task is to investigate issues pertaining to the lexical access and mental representation of the prefixed verbs under investigation and also to obtain any possible insight about issues pertaining to

their theoretical analysis, i.e. internal/external/neither. More specifically, we will compare lexical access of prefixed verbs of Type I, II and III, along the lines of Tsapkini et al. (2004), who have confirmed this task to be sensitive to configurational differences of the type proposed between the three Slavic prefix types. If externally prefixed verbs require more processing resources (given the prefix's position outside the verb projection), then longer RTs will be expected for Type II verbs compared to Type I (internal). As for verbs of Type III, they will reveal whether the task differentiates only between configurations with the prefix inside and outside the verb's argument-structure domain or whether it also differentiates between different configurations within these two templates, and secondly, their lexical access patterns will help us evaluate competing analyses by grouping them either together with/closer to Type II (external), thus supporting the analysis of Svenonius (2004)/Tatevosov (2008), who have it outside the verb's argument-structure domain together with Type II, or together with/closer to Type I (internal), in support of Žaucer (2009), who places them inside the verb's argument-structure domain together with Type I.

Materials
For all prefix types, we will include only transparent prefixed verbs which have a corresponding prefixless verb. All prefixed verbs will be in the perfective aspect form. Items will be presented in the infinitival form (citation form for Slovenian verbs). The materials will comprise 24 items per condition (type of prefix), which will be matched for frequency (base and prefixed form) and length. The stimulus list will also include word and pseudoword fillers, which will be matched for frequency and length with the critical stimuli.

Depending on the success/results of this task, we might also have to conduct a lexical decision task with priming and/or masked priming, with the same materials. In the priming experiment the prefixed form would act as a prime and participants would have to make a lexical decision on the unprefix root. This is considered a more direct way of tapping into the processing of the prefixed form and detecting possible effects of decomposition. This becomes especially powerful in masked priming, which is considered to tap into early stages of word recognition. In this paradigm, since the priming is not consciously perceived, any possible priming effects are thought to reflect fast, early and robust decomposition.

Experiment 2: Timed grammaticality judgment
This experiment targets a subgroup of the prefixed verbs under investigation, namely, two types of prefixed verbs whose nature is disputed in the theoretical literature ('cumulative' and 'saturative') – they are external/Type II according to Romanova (2007), Tatevosov (2008), Wiland (2012), internal/Type I according to Arsenijević (2007), Žaucer (2009). Since the particular type of prefix being used in these cases remains potentially ambiguous until the verb has been paired with an internal argument, the stimuli cannot only consist of the verb, as was the case in Experiment 1; rather, they have to minimally consist of the verb and an internal argument. This task will therefore present participants with prefixed verbs in small phrases—the infinitival (citation) form of the verb with an internal argument (e.g. 'to tie shoes')—which will eliminate any possible ambiguities that could surface with these types of prefixed verbs in a simple lexical decision task. The subjects will have to decide as quickly as possible whether the phrase is grammatical or not.

As the prefixed-verb stimuli will include internally and externally prefixed verbs (Types I and II) in addition to the targeted/disputed prefixed verbs, the addition of timing to the grammaticality judgement task will provide the advantage that the relevant measure is not just the judgement itself, with which we could not make inferences about the correct analysis of the disputed prefix types. The timing measure should indicate possible levels of difficulty in making the judgment (with extra processing time indicating increased levels of difficulty) and

reveal patterning of the disputed prefix types with respect to the better established internal (Type I) and external (Type II) prefixes. In addition to directly addressing the issue of the correct theoretical analysis of the disputed two types of prefixes ('cumulative' and 'saturative'), the results of this task with respect to the patterning of internal/Type-I and external/Type-II prefixes will also offer material for comparison and possible corroboration with the internal/Type-I and external/Type-II patterning results from Experiment I.

Materials
For all prefix types, we will include only transparent prefixed verbs which have a corresponding prefixless verb. All prefixed verbs will be in the perfective aspect form. The nominal objects (internal arguments) will be morphologically simple. The verbs will be presented in the infinitival form (citation form). The materials will comprise 40 items per condition (type of prefix), which will be matched for frequency (base and prefixed form of the verb, the object, and the combination of the prefixed verb and the object) and length. The stimulus list will also include filler phrases, which will be matched for frequency and length with the critical stimuli.

Experiments with brain-damaged populations (agrammatic aphasics)

The main points on which the current investigation could have implications for competing theoretical accounts are: a) the type of certain Slavic prefixes—whether they are external, internal, or a distinct class (e.g. Arsenijević 2007, Žaucer 2009 vs. Svenonius 2004, Arsenijević 2011), and b) whether the external prefixes are a hierarchically ordered (Wiland 2012) or unordered (Arsenijević 2011) set. At least with respect to a), obtaining data from brain-damaged populations with reported syntactic difficulties may be the safest way to probe the issue. We thus plan to test agrammatic aphasics, a population with syntactic deficits, on a variety of tasks with prefixed verbs. According to Friedmann & Grodzinsky (1997), the impaired performance of such patients can be explained by the tree-pruning hypothesis (TPH), which posits that the syntactic deficits observed in agrammatic Broca's aphasia are highly selective. For instance, tense inflection can be impaired and agreement inflection preserved. In the split-Infl analysis adopted by Friedmann & Grodzinsky, the functional category agreement (AgrP) is located below tense (TP). According to the TPH, the syntactic tree of Broca's aphasics with moderate agrammatism is pruned between AgrP and TP, which causes an impairment of TP and all categories above it but leaves intact AgrP and all nodes below it.

Data from agrammatic aphasics could thus shed light on the external/internal/neither status of certain prefixes (such as Type III), and perhaps also on the hierarchical/unordered relations among external prefixes. In other words, if the syntactic deficits of this population obey the TPH, then we expect the subjects to have more difficulties producing external/Type-II prefixes than internal/Type-I prefixes, given their Infl-level position in the tree. Similarly, if the syntactic deficits of this population obey the TRH, then according to Wiland's (2012) strict-order account of different external prefixes, we might expect to find implicational patterns of lost and retained external prefix types (e.g. if the external prefix from FP4 is retained, so must be any lower external prefix, and if the external prefix from FP4 is lost, so must be any higher external prefix), whereas according to Arsenijević's (2011) account, we expect no such patterns.

To address the first question, we decided to test agrammatic performance in the three types of prefixed verbs defined above, and for the second question, agrammatic performance on lists of prefixed verbs selected according to Wiland's (2012) ten types of VP-dominating prefixes. The tasks would be as follows:

a) **Grammaticality judgment task** (here we would use the frames from the timed-grammaticality task used for non-impaired populations)

    b) **Reading** (patients would have to read out loud prefixed verbs belonging to the types under investigation – see Semenza et al. 2002)
    c) **Sentence completion task** (patients would have to fill out a sentence frame by using the correct prefixed verb from a list of 4 verbs).

If agrammatic performance is indeed governed by the TPH, then we expect a difference between internal (Type I) and external (Type II) prefixes in all of the above tasks, with the external prefixes posing more difficulties for agrammatic participants, and the patterning of the theoretically disputed prefixes (Type III) could reveal their correct analysis. Secondly, the patterns of lost and retained external prefix types should be suggestive of the correct view of external prefixes (hierarchical, unordered) (though wrt this second question, whereas the predictions are clear, we have doubts about the feasibility of successfully using this paradigm for such finegrained theoretical postulates and will continue to look for additional input on the issue before embarking on any data collection).

Patients for this task will be recruited from the University Medical Centre in Ljubljana (Slovenia). The assessment and diagnosis of the patients will be performed by clinicians and neuropsychologists employed in the above unit.

Future collaboration with host institution (*if applicable*)

The goal of the exchange was to investigate the possibilities of experimental testing of theoretical linguistic postulates from the domain of prefixation, in the context of Slavic and Greek, and to design an experiment, so the plan for future collaboration is clear: running the experiment and then analyzing and interpreting the results. As the grantee has a theoretical linguistics background, these next steps will require close collaboration with the experimental expert from the exchange host institution (Manouilidou).

One of the host institution researchers (Manouilidou) has been involved in independent collaboration with medical colleagues at the University of Ljubljana, Slovenia, on identifying potential linguistic biomarkers of neurodegenerative states. Their collaboration has been missing a theoretical linguist, and given that the research will be carried out with Slovenian speaking patients, in particular a linguist with detailed knowledge of Slovenian. During the NetWords exchange visit, the grantee—a theoretical linguist and native speaker of Slovenian—has been introduced into the work that is being done within this collaboration to possibly provide the missing expertise, and Manouilidou and the grantee have been able to do initial work on the preparation of stimuli.

Projected publications/articles resulting or to result from your grant

The goal of the exchange was to investigate the possibilities of experimental testing of theoretical linguistic postulates from the domain of prefixation and to design an experiment, which cannot directly result in a publication. However, we expect that once the designed experiments have been conducted, they should yield results that can be published in psycho-/neurolinguistic or theoretical journals/volumes. In addition, we expect that some small-scale results ensuing from the background review of the theoretical Slavic-prefix literature from the initial phase of the exchange will be publishable as sections of bigger articles in the grantee's continued theoretical work on the topic.

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