

FORMALIZATION OF UKRAINIAN VERBS WITH NOOJ: A PEDAGOGICAL APPLICATION TO THE LEARNING OF ASPECTUAL PAIRS

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Abstract

The verbal system occupies a central role in the Ukrainian language. It is characterized by its morphological richness and by a distinctive feature shared with other Slavic languages: the opposition between perfective and imperfective aspects. This aspectual distinction enables the precise expression of temporality and the degree of completion of actions. A thorough understanding of these features is essential for grasping the subtleties of the language and developing a solid command of its grammar, posing a significant challenge for non-native learners.

In this context, the present article aims to formalize the structure of Ukrainian verbs using the NooJ linguistic platform. We begin by outlining the primary morphosyntactic characteristics of Ukrainian verbs, with particular focus on the mechanisms involved in forming aspectual pairs. We then examine how these phenomena are represented through inflectional (FLX) and derivational (DRV) paradigms within NooJ's Ukrainian module. Finally, we propose a practical pedagogical application of this modeling, demonstrating how it can support the teaching of Ukrainian as a foreign language – specifically by helping students to identify, analyze, and master aspectual oppositions through guided learning activities.

Keywords: NooJ, Ukrainian verbs, Ukrainian as a foreign language, inflectional paradigms, derivational paradigms.

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FORMALIZACIÓN DE LOS VERBOS UCRANIANOS CON NOOJ: UNA APLICACIÓN DIDÁCTICA AL APRENDIZAJE DE LOS PARES ASPECTUALES

Resumen

El sistema verbal constituye un componente central del idioma ucraniano. Se distingue por su riqueza morfológica y por una característica compartida con otras lenguas eslavas: la oposición entre los aspectos perfectivo e imperfectivo. Esta distinción aspectual permite expresar con precisión la temporalidad y el grado de finalización de las acciones. Comprender en profundidad estas particularidades resulta clave para acceder a las sutilezas del idioma y alcanzar un dominio sólido de su gramática, lo que representa un desafío considerable para quienes aprenden ucraniano como lengua extranjera.

En este marco, el presente trabajo se propone formalizar la estructura de los verbos ucranianos mediante la plataforma lingüística NooJ. En una primera instancia, se describen las principales características morfosintácticas del sistema verbal ucraniano, con especial atención a los mecanismos de formación de los pares aspectuales. Luego, se analiza cómo se representan estos fenómenos en los paradigmas flexivos (FLX) y derivativos (DRV) dentro del módulo ucraniano de NooJ. Finalmente, se plantea una aplicación didáctica de dicha formalización, con el objetivo de favorecer la enseñanza del ucraniano como lengua extranjera, particularmente mediante el desarrollo de actividades orientadas que permitan a los estudiantes identificar, analizar y dominar las oposiciones aspectuales.

Palabras clave: NooJ, verbos ucranianos, ucraniano como lengua extranjera, paradigmas flexivos, paradigmas derivativos.

1. The Ukrainian Verbal System

1.1. Description

Ukrainian verbs express actions, processes, or states, such as *čytaty*³ [*to read*] = action, *zelenity* [*to turn green*] = process, *ležaty* [*to lie (in a vertical position, for an object)*] = state.

Ukrainian verbs are marked by the following grammatical categories:

- **Aspect**, expressed through prefixes, suffixes, or sometimes by word stress. This category encompasses the notion of aspectual pairs, which consists of two semantically related verbs: an imperfective (IPF) and a perfective (PF) form. The perfective aspect emphasizes the result or completion of an action, while the imperfective focuses on the process or duration. For example: *čytaty* (IPF) – *pročytaty* (PF) [*to read* _{*to be reading*} – *to read* _{*to finish reading*}];
- **Sub-aspects: Determinate and Indeterminate**, applicable to motion verbs. The determinate verb indicates unidirectional movement with a specific goal or direction, while the indeterminate verb refers to multidirectional, habitual, or repetitive movement, or simply the ability to move. For example: *bihty* (determinate) – *bihaty* (indeterminate) [*to run*];
- **Voice**:
 - o **Active**, found in both transitive and intransitive verbs, e.g., *žinka čytaje* [*a woman is reading*];
 - o **Passive**, expressed in three ways:

³ Ukrainian is written in Cyrillic script; however, for ease of reading, we have chosen to present all examples using scientific transliteration. We have italicized all the transcribed words and their translations.

- with the suffix *-sja* added to an imperfective transitive verb: *knyžka čytajet'sja* [*the book is being read*],
- through a construction using the auxiliary verb **buty** and the perfective passive participle of the main verb: *knyžka bude pročytana* [*the book will be read*],
- or via an impersonal construction with **buty** and a fixed form derived from the perfective passive participle: *knyžku bulo pročytano* [*the book was read*].
- **Reflexive verbs**, where the subject performs the action on itself, e.g., *dytyna myjet'sja* [*the child is washing (him/herself)*];
- **Person** (first, second, third), marked by verb endings, e.g., *ja čytaju* [*I read*] (1st), *ty čytaješ* [*you read*] (2nd), *vin čytaje* [*he reads*] (3rd);
- **Number** (singular and plural), also marked by endings, e.g., *ja čytaju* [*I read*] (singular), *my čytajemo* [*we read*] (plural);
- **Gender** (masculine, feminine, and neuter), expressed through suffixes and endings, e.g., *vin čytav* [*he read*] (masculine), *vona čytala* [*she read*] (feminine), *dytja čytalo* [*the child read*] (neuter);
- **Mood:**
 - o **Infinitive**, marked by the suffix *-ty* or *-t'* (a dialectal form typical of Left-Bank Ukrainian), e.g., *maljuvaty* or *maljuvat'* [*to paint*];
 - o **Indicative**, combined with tense, marked by endings, e.g., *my čytajemo* [*we read*] (*present indicative*);
 - o **Imperative**, marked either by specific endings or by the particles *xaj, naj, nexaj* [*let*], followed by the verb in the present or future form, e.g., *čytaj* [*read!*], *xaj čytaje* [*let him read*], *nexaj pročytiae* [*let him read (perfective)*];
 - o **Conditional**, combining mood and tense. It is formed either:
 - with a suffix and endings (identical to the past indicative) and the particle **by (b)**, e.g., *my čytaly b* [*we would read*],
 - or with the past tense of the auxiliary verb **buty** and the previous form, e.g., *my buly b čytaly* [*we would have read*].
- **Tense** (excluding the past conditional, only relevant in the indicative mood):
 - o **Present**, marked by endings, e.g., *my čytajemo* [*we read*];
 - o **Past**, formed with a suffix and endings, e.g., *my čytaly* [*we were reading*];
 - o **Pluperfect**, expressed by combining the past tense of the main verb with the past tense of **buty**, e.g., *sprobuvala bula* [*she had tried*];
 - o **Future**, formed in three ways:
 - synthetic imperfective future using specific endings: *my čytatymemo* [*we will read*],
 - analytic imperfective future using **buty** + infinitive: *my budemo čytaty* [*we will be reading*],
 - present-future form for perfective verbs: *my pročytajemo* [*we will read (to completion)*].
- **Participles**, formed with suffixes and endings, e.g., *spočyvajučyj* [*resting*], *posyvilyj* [*graying*], *čytanyj* [*read*], *vzjatyj* [*taken*];
- **Gerunds**, formed with suffixes, e.g., *čytajučyj* [*while reading*], *pročytavšy* [*having read*];
- **Impersonal verb forms**, typically expressed with suffixes, e.g., *pročytano* [*read*], *povernuto* [*returned*].

It should be noted that not all grammatical categories apply to every verb form. For instance, the infinitive only marks aspect; gender appears only in the past tense, pluperfect, and conditional forms.

1.2. Conjugation

Traditionally, Ukrainian verbs are divided into two conjugation groups based on the ending of the third person plural in the present tense: First conjugation verbs end in **-ut'** or **-jut'**, while Second conjugation verbs end in **-at'** or **-jat'**. In addition, verbs are categorized into 10 to 14 morphological classes, depending on the classification system⁴. These classes are further divided into productive and non-productive types: productive classes continue to expand with the formation of new verbs, whereas non-productive classes do not. Morphological classification is primarily based on suffixes and, in some cases, also on the conjugation group. Historical factors in the development of verb stems are also considered in this categorization⁵.

It is important to note that every Ukrainian verb has two stems:

- the infinitive stem, used to form the synthetic future tense, the past tense (indicative and conditional), the pluperfect, the past participle, and the anterior gerund;
- the present stem, used to form the present tense, the present-future (for perfective verbs), the imperative, the present participle, and the concomitant gerund.

These morphological classes are summarized in *¡Error! No se encuentra el origen de la referencia.*, based on the descriptions provided in the grammar of Vyxovanec' & Horodens'ka, p. 281 [10]. Classifications proposed by other linguists differ only slightly from this framework.

Table 1: Morphological Classes of Ukrainian Verbs

Class	Infinitive Stem	Present Stem	Examples	Group
1	-uva-	-uj- ⁶ *	rysuvaty – nočujut'	I
	-juva-	-juj-	maljuvaty – maljujut'	
2	-a-	-aj-*	čyataty – čyatujut'	I
	- ja-	- jaj-*	minjaty – minjajut'	
3	-i-	-ij-	zelenity – zelenijut'	I
4	-nu-	-n-	hynuty – hynut'	I
5	ø ⁷	ø	povzty – povzut'	I
6	-va-	- vaj-*	kyvaty – kyvajut'	
7	-a-	ø	rvaty – rvut'	I
	- ja-	-j-*	vijaty – vijut'	
8	ø	-j-	čuty – čujut'	
			byty – bjut'	
9	-i-	ø	xotity – xočut'	I
10	-va-	-j-*	davaty – dajut'	I
11	-y- (-ji-)	ø	bačyty – bačat'	II
			pojity – pojat'	
12	-a-	ø	ležaty – ležat'	II
13	-i-	ø (-j-*)	sydity – sydžu/ sydjet'	II
14	ø	ø	bihty – bižat'	II

⁴ There is no universally accepted morphological class classification. According to Horpynyč [3], there are 10 classes; according to Rusanivs'kyj [7] and Pljušč [6], there are 12 classes; and according to Vyxovanec' and Horodens'ka [10], there are 14 classes..

⁵ This means that verbs belonging to the same class may include both those that have undergone modifications (such as consonant alternation or vowel deletion) and those whose stem has remained unchanged.

⁶ Here, “j” represents the yod sound, which is rendered by the letters *ja* and *ju* in verb endings.

⁷ Here, “Ø” indicates the absence of a suffix.

1.3. Aspectual Pairs

As discussed in our previous work (Saint-Joanis & Silberstein [9]; Saint-Joanis [8]), the concept of verbal aspect was first introduced in 1603 in the Czech grammar *Grammaticae Bohemicae* by Vavrinec Benedikt Nedožerský. At that time, it was used – according to Mazon [5] – to distinguish between simple and derived verbs. The notion of aspect later spread to the grammatical traditions of all Slavic languages.

Aspect is a verbal category that reflects different ways of conceptualizing the progression of an action over time. It is expressed through the opposition between the perfective aspect (PF), which indicates the completion of an action, and the imperfective aspect (IPF), which emphasizes the process, duration, or repetition of the action. These two forms constitute aspectual pairs, representing the same action from two temporal perspectives.

To illustrate this, consider the aspectual pair *čytaty* (IPF) / *pročytaty* (PF) [*to read*]. The imperfective form has neither a suffix nor a prefix, whereas the perfective form consists of the stem *čyta-* and the perfectivizing prefix *pro-*.

This pair can be used in the following sentences:

- *Ivan čytav stattju dvi hodyny.* [*Ivan was reading an article for two hours.*]
- *Ivan pročytav stattju za dvi hodyny.* [*Ivan read the article in two hours.*]

The first example emphasizes the duration of an ongoing action, while the second highlights the action's completion within a specific time frame.

Ukrainian has nine so-called “empty” or “desemanticized” perfectivizing prefixes – a concept introduced by Agrell [1] and later refined by Guiraud-Weber [2] – which serve to form the perfective aspect without altering the core meaning of the verb.

In total, there are 37 simple morphological variants, 3 double-prefix forms, and a few triple-prefix forms:

- Common prefixes: *v-* (or *vi-*), *u-*, *uvi-*, *vid-* (or *vidi-*), *vy-*, *do-* (or *di-*), *z-* (or *zi-*, *iz-*, *s-*), *za-*, *nad-* (or *nadi-*), *o-*, *ob-* (or *obi-*), *pid-* (or *pidi-*), *pere-*, *po-*, *pry-*, *pro-*, *roz-* (or *rozi-*);
- Rare prefixes: *pred-*, *pre-*, *obez-*, *zne-*;
- Borrowed prefixes: *de-* (or *dez-*), *dy-* (or *dys-*), *re-*;
- Double prefixes: *ne-do-*, *pid-na-*, *po-* + any other prefix;
- Triple prefixes, most often combining *po-* + *na-* + another prefix, such as in ***po-na-vy-haduvaty*** [*to invent many things on multiple occasions*].

An imperfective verb can thus be associated with multiple perfective forms, each carrying distinct semantic nuances (e.g., *perečytaty* [*to reread*], *začytaty* [*to read a passage aloud*]).

These variants can, in turn, form new aspectual pairs through the addition of specific suffixes:

- *perečytaty* – *perečytuvaty* [*to reread*],
- *začytaty* – *začytuvaty* [*to read a passage aloud*].

Thus, perfective aspectual pairs can be morphologically distinguished by suffixes, sometimes combined with consonant alternations. The following suffixal oppositions are commonly observed in aspectual pairs (PF/IPF⁸):

- **ø (PF) / a (IPF):** *vbihty – vbihaty* [to come running in], **ø (PF) / va (IPF):** *zabuty – zabuvaty* [to forget], **ø (PF) / – uva(juva) (IPF):** *sklasty skladuvaty* [to pile up],
- **y(i) (PF) / a(ja) (IPF):** *vbačty – vbačaty* [to see], **y(i)(i) (PF) / uva(juva) (IPF):** *vdoskonalyty – vdoskonaljuvaty* [to perfect], **y (PF) / ovuva (IPF):** *vyhranyty vyhranovuvaty* [to engrave],
- **a(ja) (PF) / uva(juva) (IPF):** *vhadaty – vhaduvaty* [to guess], **a (PF) / ovuva (IPF):** *vykorystaty – vykorystovuvaty* [to use], **a(ja) (PF) / – va:** *zasijaty – zasivaty* [to sow],
- **uva(juva) (PF) / ovuva (IPF):** *areštuvaty – areštovuvaty* [to arrest],
- **o (PF) / juva (IPF):** *vykoloty – vykoljuvaty* [to puncture],
- **nu (PF) / a(ja):** *vdjahnuty v vdjahaty* [to dress], **nu (PF) / uva(juva) (IPF):** *vyhuknuty vyhukuvaty* [to exclaim],
- **u (PF) / uva(juva) (IPF):** *obmanuty – obmanjuvaty* [to deceive].

These suffixal changes are often accompanied by modifications of the verb stem, such as:

- consonant alternation: *kryknuty – kryčaty* [to shout];
- palatalization: *tyč'nuty – tycjaty* [to point];
- insertion of a mobile vowel: *vymknuty – vymykaty* [to turn off];
- vowel alternation: *perevezty – perevozaty* [to transport].

There are also cases where the difference between the two aspects, *vyklykáty – vúklykaty* [to summon], is marked solely by word stress, or where there is partial or complete suppletion of the stem, as with *braty* (IPF) – *vzjaty* (PF) [to take].

However, pairs like *čytaty* (IPF) – *začytaty* (PF) cannot form an aspectual couple due to their semantic distance. This is why we refer to dominant aspectual couples to designate the most regular and productive pairs.

Automatic language processing tools (NLP) often fail to account for these aspectual pairs, which adversely impacts the quality of linguistic and statistical analyses. Furthermore, the aspect remains a challenging feature for learners of Slavic languages to master. Both students and NLP systems must be familiar with these pairs to accurately perform transformations, translations, or paraphrases. Therefore, it is essential to establish explicit connections between the members of these pairs.

2. Formalization of the Ukrainian Verb System in NooJ

2.1. Formalizing Paradigms with NooJ

To describe verbal morphology, NooJ offers two types of grammars: FLX and DRV.

FLX grammars allow a lexical entry to be linked to a set of inflected forms. For example, for the verb to read, an ‘FLX’ paradigm makes it possible to describe all its conjugated forms: **read**, **reads**, **been read**, **will read**, etc.

⁸ This is the process of secondary imperfectivization, where the imperfective verb is most often derived from the perfective verb.

DRV paradigms allow a lexical entry to be linked to a derived form, which involves more substantial changes, such as a shift in inflectional class or grammatical category. For example, for the verb to read, a “DRV” paradigm could describe a derived noun like **reader**.

2.2. FLX Paradigms for Ukrainian Verbs

To describe verbs, we used two types of grammars: FLX, which formalize conjugation, and DRV, which formalize the link between the IPF (imperfective) verb and the PF (perfective) verb in the dominant aspectual pair. All verbs were associated with FLX paradigms; additionally, only those IPF verbs that form an aspectual pair with a PF verb were linked to a DRV paradigm as follows:

čytaty,VERB+Pair="čytaty/pročytaty"+FLX=ČYTATY+DRV=PRO:ČYTATY_P

Here, the entry “čytaty” is associated with the label « Pair="čytaty/pročytaty" », which describes the aspectual pair that the verb *čytaty* [to read] belongs to. This label was created for pedagogical purposes: it displays the aspectual pair during text annotation, allowing students using the platform to quickly see both verbs of the aspectual pair. The first element of the label ("čytaty") corresponds to the IPF verb listed in the dictionary entry, while the second ("pročytaty") corresponds to the PF verb, linked to the first via the derivational paradigm $DRV=PRO$. The paradigm *ČYTATY* generates the inflected forms of the IPF verb. The PF verb, formalized using the DRV paradigm, is then linked in turn to the inflectional paradigm *ČYTATY_P* using the operator “:”.

It should be noted that some aspectual pairs are asymmetric:

- ~~An IPF verb linked to two synonymous PF verbs, for example: *nalyvaty,VERB+Pair="nalyvaty/nalyty,nalljaty"+FLX=ČYTATY+DRV=TY_B4:LYTY_P* F +DRV=LJATY:ČUTY_PF;~~
- ~~Two synonymous IPF verbs linked to a single PF verb, for example: *vysuvaty,VERB+Pair="vysuvaty,vysuvaty/vysunuty"+FLX=ČYTATY+DRV=NUTY_B4:RVATY_PF*.~~

In the first case, the entry has as many DRV paradigms as there are PF verbs associated with the IPF verb. In the second case, the DRV paradigm is indicated only for the first IPF verb of the asymmetric pair, and the second IPF verb is listed in the dictionary as an independent entry (without a DRV paradigm), with the first verb mentioned after the comma:

vysuvaty,vysuvaty,VERB+Pair="vysuvaty,vysuvaty/vysunuty"+FLX=RYSUVATY

The three *FLX* paradigms that formalize the conjugation of the IPF verbs *čytaty* and *vysuvaty*, and the PF verb *pročytaty*, are presented in **¡Error! No se encuentra el origen de la referencia.**

Table 2: FLX Paradigms « ČYTATY » and « ČYTATY_PF »

Paradigm ČYTATY	Paradigm ČYTATY_PF
<E>/Imperfective+Infinitive	<E>/Perfective+Infinitive
<B2>v/Imperfective+Masculine+Singular+Past	<B2>v/Perfective+Masculine+Singular+Past
<B2>la/Imperfective+Feminine+Singular+Past	<B2>la/Perfective+Feminine+Singular+Past
<B2>lo/Imperfective+Neuter+Singular+Past	<B2>lo/Perfective+Neuter+Singular+Past
<B2>ly/Imperfective+Plural+Past	<B2>ly/Perfective+Plural+Past

<B2> <i>ju</i> /Imperfective+1+Singular+Present <B2> <i>ješ</i> /Imperfective+2+Singular+Present <B2> <i>je</i> /Imperfective+3+Singular+Present <B2> <i>jemo</i> /Imperfective+1+Plural+Present <B2> <i>jete</i> /Imperfective+2+Plural+Present <B2> <i>jut'</i> /Imperfective+3+Plural+Present <E> <i>mu</i> /Imperfective+1+Singular+Future <E> <i>me</i> /Imperfective+3+Singular+Future <E> <i>meš</i> /Imperfective+2+Singular+Future <E> <i>memo</i> /Imperfective+1+Plural+Future <E> <i>mete</i> /Imperfective+2+Plural+Future <E> <i>mut'</i> /Imperfective+3+Plural+Future <B2> <i>j</i> /Imperfective+2+Singular+Imperative <B2> <i>jmo</i> /Imperfective+1+Plural+Imperative <B2> <i>jte</i> /Imperfective+2+Plural+Imperative <B2> <i>jučy</i> /Imperfective+Gerund+Concomitant <B2> <i>všy</i> /Imperfective+Gerund+Anterior <B2> <i>no</i> /Asubj ectal+Imperfective+Passive;	<B2> <i>ju</i> /Perfective+1+Singular+Present <B2> <i>ješ</i> /Perfective+2+Singular+Present <B2> <i>je</i> /Perfective+3+Singular+Present <B2> <i>jemo</i> /Perfective+1+Plural+Present <B2> <i>jete</i> /Perfective+2+Plural+Present <B2> <i>jut'</i> /Perfective+3+Plural+Present <B2> <i>j</i> /Perfective+2+Singular+Imperative <B2> <i>jmo</i> /Perfective+1+Plural+Imperative <B2> <i>jte</i> /Perfective+2+Plural+Imperative <B2> <i>všy</i> /Perfective+Gerund+Anterior <B2> <i>no</i> /Asubj ectal+Perfective+Passive;
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We can observe that the paradigm describing the IPF verb is more complete, as it includes the future tense and the concomitant gerund, marked in red in the table. We could have created a single paradigm for both the IPF and PF verbs, since they share the same conjugation, and distinguished between the “Imperfective” and “Perfective” values by adding:

- the “Imperfective” label to the dictionary entry;
- the “Perfective” label to the DRV paradigm;
- the “Imperfective” label to the lines marked in red in our first paradigm.

This technically simpler solution would have allowed us to avoid duplicating paradigms. However, in order to maintain clarity for the linguist user, we preferred to build one paradigm for the IPF verb and another for the PF verb. Furthermore, having two distinct paradigms will later make it easier for us to create the morphological grammar that formalizes participles⁹.

Thus, we have formalized 96 paradigms, of which 89 are duplicated for the IPF and PF verbs, with the full description found in [8].

2.3. DRV Paradigms for Ukrainian Verbs

The 114 DRV paradigms we have formalized to link the IPF verbs listed in the dictionary with their corresponding dominant aspectual PF verb pairs are fairly simple¹⁰. Some add a prefix, as is the case with the paradigm “PRO”:

PRO=<LW>*pro*/VERB,

⁹ We will specify for the constraint that the imperfective participle is created from the IPF verb, whereas the perfective participle is created from the PF verb.

¹⁰ We decided to include the IPF verbs in the dictionary purely by convention, and not because we consider that all PF verbs are derived from IPF verbs.

which adds the prefix *pro-* and allows us to recognize the pair *čytaty* (IPF) / *pročytaty* (PF) [*to read*].

Other paradigms replace the suffix and/or the ending, as is the case with the paradigm “*YTY_B3*”:

YTY_B3 = <B3>*yty*/VERB;

which formalizes the aspectual pair *vbačaty* (IPF) / *vbačyty* (PF) [*to perceive*], by replacing the suffix *-a-* and the ending *-ty* with the suffix *-y-* combined with the same ending.

The paradigms of the third type account for vowel alternations, as is the case with the paradigm “*ALT_10*”:

ALT_10 = <B5><L2>o<RW>*aty*/VERB;

which handles both the vowel alternation *-i-/o-* in the root and the change from the suffix *-uva-* to the suffix *-a-*, allowing us to formalize the aspectual pair *vypoliskuvaty* (IPF) / *vypoloskaty* (PF) [*to rinse*].

We have also described the “0” paradigm, which adds an empty suffix to link the IPF verb to the PF verb that has the same graphic composition:

0 = <E>/VERB;

This paradigm allows us to treat the verb *akcentuvaty* [*to accentuate*] both as the IPF verb, inflected according to the paradigm *RYSUVATY*, and the PF verb, inflected according to the paradigm *RYSUVATY_PF*:

akcentuvaty,VERB+FLX=*RYSUVATY+DRV=0:RYSUVATY_PF*

A detailed description of all our DRV paradigms, along with application examples, is presented in [8].

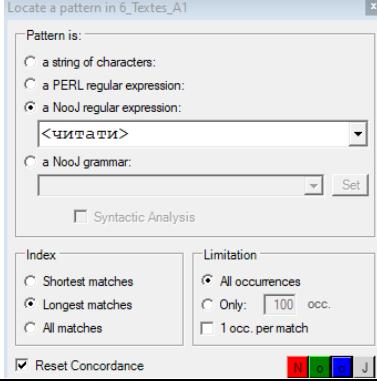
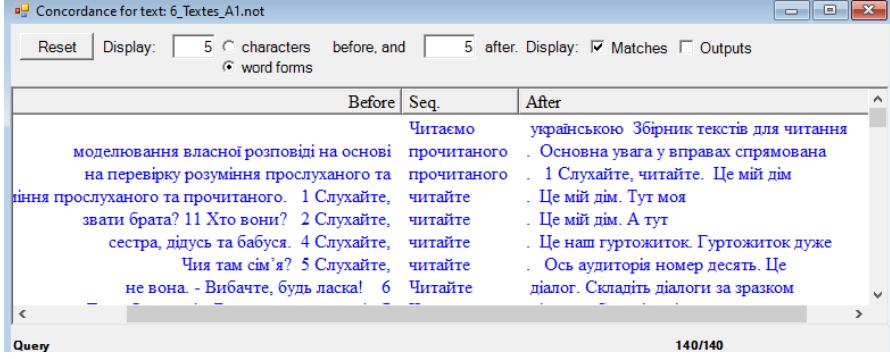
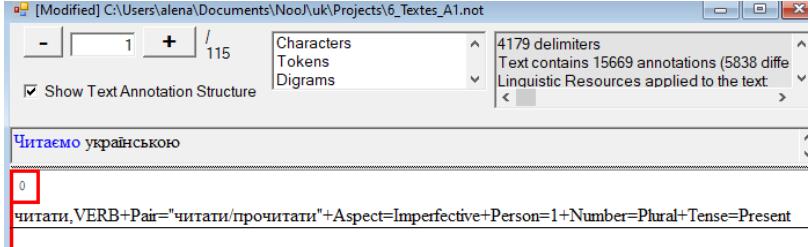
3. Pedagogical Application

The NooJ platform can be effectively incorporated into the practical grammar course for second-year Ukrainian language students at INALCO. It offers a hands-on approach where students engage directly with authentic texts. For example, students can be tasked with identifying specific verb types within a given text, conducting detailed morphological analyses, and then constructing sentences using those verbs to reinforce their understanding.

Table 3 provides a sample exercise designed to help students learn and practice aspectual verb pairs such as *čytaty* (IPF) / *pročytaty* (PF) [*to read*], *vyvčaty* (IPF) / *vyvčyty* (PF) [*to learn*], *pysaty* (IPF) / *napysaty* (PF) [*to write*], *povtorjuvaty* (IPF) / *povtoryty* (PF) [*to repeat*], and *vidpočvaty* (IPF) / *vidpočyty* (PF) [*to rest*]. This exercise can be implemented using the A1–A2 level text collection *Čytajemo ukrainins'koju* [*Reading in Ukrainian*], developed by *Oksana Mal'arenko* and *Alina Ševcova*, lecturers at Sumy University [4].

By integrating NooJ in this way, learners not only gain theoretical knowledge of Ukrainian verb aspects but also apply it practically, enhancing both their analytical skills and language production.

Table 3: Sample Pedagogical Activities

Instruction	Application
1. Find all forms of the verb <i>čytaty</i> . How many times is this verb used?	<p>Perform a linguistic analysis of the text (right-click, then select “Linguistic Analysis,” then search for the lemma <читати>(<i>čytaty</i>) (right-click, then select “Locate Pattern,” “a NooJ regular expression,” and check “All occurrences”)).</p> <p><i>Result:</i> The number of occurrences found is 140.</p> 
2. Identify the PF verb that forms the aspectual pair.	<p>A. Display the concordance and verify the found forms.</p>  <p>B. Then, highlight these forms in the text (right-click, then select “Color matching sequence in text”).</p> <p>C. Display the annotations for the first highlighted form (check “Show Text Annotation” and click on the colored form).</p>  <p>The form <i>читаємо</i> (<i>čytajemo</i>) /we read/ is the IPF verb in the first person plural present tense. The corresponding aspectual pair is <i>читати/прочитати</i> (<i>čytaty/pročytaty</i>).</p>
3. How many times is the IPF verb used? How many times is the PF verb used?	<p>Search for the lemma <читати+Perfective>(<i>čytaty</i>) (right-click, then “Locate Pattern,” “a NooJ regular expression,” check “All occurrences”), then for the lemma <читати+Imperfective> (<i>čytaty</i>).</p> <p><i>Result:</i> Three PF verbs and 137 IPF verbs were found.</p>

Instruction	Application
4. Repeat the same process for the verbs <i>vyvčaty</i> [<i>to learn</i>], <i>pysaty</i> [<i>to write</i>], <i>povtorjuvaty</i> [<i>to repeat</i>], <i>vidpočyvaty</i> [<i>to rest</i>].	Follow the same steps as described above.
5. Rewrite Text 27 starting from the sentence “Студенти вивчають ...” (<i>Studenty vyvčajut</i>) by replacing the imperfective verbs from step 4 with their perfective counterparts.	<p>A. Enter the expression: <читати> <вивчати> <писати> <повторювати> <відпочивати>. (<čitaty> <vyvčaty> <pysaty> <povtorjuvaty> <vidpočyvaty>.)</p> <p>B. Highlight all occurrences of these verbs in the text.</p> <p>27 Слухайте, читайте.</p> <p>Це наш підготовчий факультет. Тут наші аудиторії. Ми там навчаемся кожного дня. Студенти-іноземці працюють завжди багато, тому що українська мова - дуже важка мова.</p> <p>Зараз урок. В аудиторії знаходиться викладач і іноземні студенти. Студенти вивчають нові правила, нові слова та фрази. В зошиті вони пишуть вправу, а в словнику - незрозумілі слова.</p> <p>Вдома увечері вони будуть знову читати тексти, вивчати напам'ять нові і повторювати старі слова.</p> <p>Увечері в гуртожитку - вільний час. Студенти будуть відпочивати: слухати музику, читати книги і журнали, дивитися цікаві програми.</p> <p>C. Rewrite the text by replacing the IPF verbs with their conjugated PF forms; note that other verbs beyond the studied ones may also need to be changed to PF. How has the meaning of the text changed?</p> <p>D. Rewrite the text in both the imperfective past and perfective past tenses. How has the meaning of the text changed?</p>

This exercise may be conducted in a computer lab setting or assigned as independent homework.

In our view, it offers an effective means for students to internalize aspectual verb pairs and to develop greater accuracy and confidence in using these verbs in context.

Comparable exercises can be developed to explore other grammatical phenomena, such as the comparative, the superlative, and the absolute superlative forms, as well as diminutive forms of nouns, expressive adjectives, adverbs of intensity, and more.

The NooJ platform proves to be a valuable tool for computer-assisted language learning (CALL), particularly in the teaching of conjugation and declension patterns, case usage, and other key elements of Ukrainian morphology and syntax.

4. Conclusion

The integration of the NooJ platform into the teaching of Ukrainian grammar offers significant pedagogical benefits, particularly in the context of second-language acquisition. By formalizing paradigms for imperfective and perfective verb pairs and applying them through targeted exercises, we provide learners with both theoretical understanding and practical tools for analyzing and producing morphologically accurate language.

The exercises developed – especially those based on authentic texts – facilitate the internalization of complex grammatical concepts such as aspectual distinction. They also encourage active learning through tasks that combine linguistic analysis, form recognition, and guided text

transformation. The adaptability of NooJ makes it a powerful resource for exploring a wide range of grammatical phenomena, from aspect and verb conjugation to case usage, comparison structures, and diminutive formation.

By embedding NooJ into classroom practice and independent work, we promote a data-driven approach to grammar instruction that aligns well with the needs of university-level language learners. In doing so, we not only enhance the learning experience but also contribute to the development of digital tools for Slavic language pedagogy.

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