TransVar – the Corpus for Variation and Change Study of the Historical Transcarpathian lects

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Abstract

The paper introduces TransVar – the corpus of the historical Transcarpathian lects (the first half of the XX century, the territories of modern Ukraine, Poland, Slovakia, and Romania). The corpus contains data from Lemko, Bojko and Hutsul small territorial lect groups. It is crucial for studies of the people of these territories, who witnessed forceful deportation from their homeland in the 1940s – 1950s, soon after the recordings were made (1920s – 1930s). The article also provides a brief overview of their linguistic properties, as evident in the material.

The corpus is morphosyntactically tagged. It contains data on part-of-speech, morphological features, lemmata and syntactical dependencies. The study stresses the crux of manual analysis of the errata made in an automatic tagging phase for further improvement. The supplementary information includes named entities encountered in the text and the basic vocabulary. All the texts are accompanied by metalinguistic information, required for the sociolinguistic study.

After the analysis of the current stage of the corpus creation, the article outlines further research prospects. Apart from more thorough manual annotation, one of the prospects is to add English translation with the purpose of making the material more accessible to scholars without a background in Slavic studies.

Keywords: Transcarpathian, sociolinguistics, Universal Dependencies, low-resourced language modelling, part-of-speech tagging, lemmatisation, dependency parsing, qualitative analysis

1. Introduction

Historical low-resourced, small territorial lects[1] are probably among the most understudied types of resources in computational linguistics (Miletić and Siewert, 2023). This material is severely low-resourced and highly non-standard, lacking normalisation. This makes it especially challenging for NLP tools, even in comparison with modern non-standard varieties (Piotrowski, 2012). Still, there is a significant number of resources containing texts produced by speakers of these lects. This article considers material gathered in the Transcarpathian region in the twentieth century (in the territories of modern Ukraine, Poland, Slovakia, and Romania) by several groups of scholars and published either concurrently (Nakonečna and Rudnyc'kyj, 1940) or subsequently (Kuraszkiewicz, 1963; Zheguc, 2001), and presents a corpus based on this material. An overview of the resources used to compile the corpus is provided in Section 4.

All the lects are East Slavic[2]. They belong to three main groups: Bojko, Lemko, and Hutsul (Section 3 describes their linguistic features and position within the Slavic clade). These lects have never been the subject of a quantitative variationist study due to the absence of an open-access corpus—a gap this study intends to close (Section 2 contains a short overview of variationist studies of East Slavic languages, including the Transcarpathian lects, using NLP tools).

The corpus contains part-of-speech and morphological tags, along with lemmatisation and dependency parsing. It also includes specific tags for basic vocabulary items and named entities that facilitate historical research. Each text is accompanied by a set of extralinguistic (metadata) tags containing information about the speaker, the dialectologist who conducted the recording, and the source itself. Section 5 outlines the corpus design, the tagging schema, and the annotation tools. It

[1] The article denotes any given language variety (idiolect, doculect, dialect, regiolect, sociolect, standard) as *lect*. This choice enables the elimination of overly hierarchical dichotomies, namely, `X is a dialect of Y`, which imply some degree of **X** being a lesser version of **Y**; the study of **X** can thus only be comparative, guided by differences from **Y**. Rejecting this differential approach is paramount for building a corpus, an integrative endeavour by definition (Goldin and Kryuchkova, 2011).

[2] Within historical Slavic studies, there is no consensus on whether West Slavic, South Slavic, and East Slavic are valid groupings or whether Proto-West Slavic, Proto-South Slavic, or Proto-East Slavic actually existed (Nikolaev, 1988, p. 116; Krys'ko, 1998, p.85–89; Zaliznyak, 2004, p. 7–8; Matasović, 2008, p. 83; Saenko, 2020). This article uses the term *East Slavic* in a purely geographical sense to denote the eastern part of the Slavic continuum, including the territory from eastern Slovakia in the south-west to the coast of the White Sea in the north-east.

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also discusses the importance of shared lexicons for NLP in low-resourced settings. Section 6 places this analysis in the context of possible future improvements.

1.1. Contribution

The study introduces a new resource for the study of historical Transcarpathian lects from both quantitative and qualitative perspectives: a morphosyntactically tagged corpus in the Universal Dependencies (UD) format (de Marneffe et al., 2021). It also provides a linguistic analysis of the performance of the Stanza model trained on modern Ukrainian and initiates the development of guidelines for the automatic annotation of small territorial East Slavic lects.

2. Related Work

2.1. East Slavic Small Territorial Lects Corpora

While gathering the material of small territorial lects has been a pivotal part of dialectology studies from their wake (Wenker et al., 1889–1923) for the recent two hundred years (Kalnyn', 1973; Nazarova, 1977), the push for digitisation is relatively recent, especially for the digitisation of texts (Goldin, 1990). Most digitisation efforts still consider atlases (Trüb, 1989) that get transformed into digital maps (Marchenko et al., 2025). Nevertheless, the Russian National Corpus (Kachinskaya and Sichinava, 2015) and the Belarusian N-Corpus both (National Corpus of the Belarusian Language, 2018) have dialectological subcorpora. While the General Regionally Annotated Corpus of the Ukrainian Language includes some regional variation, there are almost no autochthonous small territorial lects within the material (Shvedova et al., 2017–2025). Aside from the large national-level corpora, there are other initiatives. The most notable are the TrimCo corpus (Wiemer and Seržant, 2020), containing small territorial lects of East Baltic, including multiple Belarusian and Russian small territorial lects, and the HSE collection of the East Slavic small territorial lect corpora (Daniel et al., 2013–2018; Garder et al., 2018; Ter-Avanesova et al., 2018, 2019; Ronko et al., 2019; Ryko and Spiricheva, 2020), each containing some hundred thousand tokens, enabling medium-scale variation research, including quantitative approaches. Aside from them, there are local initiatives dedicated to thorough investigation of a particular group of lects. The Saratov dialectological corpus comprises material from three small territorial lects, Northern Russian Megra, Middle Russian Belogornoje, and Middle Russian Zemlianyje Hutora, gathered over the last forty years (Goldin, 1990; Goldin and Kryuchkova, 2011). The Tomsk dialect corpus is a digitisation of materials from many different lects of the Tomsk Region and Western Siberia in general, adding up to 3.5 million tokens (Zemicheva et al., 2023).

Overall, there is a significant number of corpora for modern East Slavic territorial lects. Yet, historical variations are clearly underrepresented, and there are no corpora for the western part of the continuum representing the small territorial lects and not the more modern regiolects (for the whole territory of the standard Ukrainian distribution and further to the West into the territories of Poland and Slovakia).

2.2. East Slavic Language Variation and NLP Tools

There is a rich tradition of variationist studies of Slavic languages in general, and East Slavic in particular. There are works dedicated to the variation in phonetics (Moroz, 2024), morphology (Ryko, 2024), lexicon (Zemicheva, 2020), and syntax (Moroz, 2016). Some take a wider typological approach (Wiemer et al., 2017), others restrain the comparison to the smaller areas (Ryko and Spiricheva, 2022).

However, there is one gap in this body of research. Despite the widening application of computational methods in variationist studies of East Slavic languages (Koile and Moroz, 2024), there is a relatively small number of studies that consider the role of variation in building language resources, specifically oriented towards East Slavic in general and Transcarpathian in particular (Scherrer and Rabus, 2017; Rabus and Scherrer, 2017), when contrasted to the other Slavic groups (Ondrejová and Šuppa, 2024; Lendvai et al., 2025). This article aims to outline the project of a corpus that facilitates closing the gap.

3. Transcarpathian Lects

This section gives a short overview of all of the Transcarpathian lects used to build the corpus from both the diachronic and synchronic perspectives.

3.1. The General Description History of the Clade

The *Transcarpathian* lects are a group of East Slavic small territorial lects spoken in the geographical region of Transcarpathia. There are three main groups, for which the researchers collected the databases: Bojko, Lemko and Hutsul (Kuraszkiewicz, 1963, pp. 67–72; Zilyns'kyj, 1933, pp. 8–10; Del Gaudio, 2017, pp. 64–85). The

first two are Slavic lects that are the closest to being autochthonous (by the terminology of Barannikova (2005, p. 193)) on these territories. The Hutsul lects are late settlement (by the terminology of Barannikova (2005, p. 193)). The map 1 from (Zilyns'kyj, 1933) shows the geographic distribution of the lects in the 1920s – 1930s.

3.2. Morphology

The scholars (Kuraszkiewicz, 1963; Myholynec', 2004; Del Gaudio, 2017) report on a set of common Transcarpathian features that divide this area from the neighbouring East Slavic languages. The most prominent features include:

- Transcarpathian lects retain short forms of personal pronouns, for instance, ç'a 'self-ACC.SG' that in some cases can undergo root reduplication: seç'a 'self-ACC.SG'. The frozen form ç'a 'self-ACC.SG' denoting the reflexivity of the verb is not restricted in its distribution within the clause, in contrast (Kuraszkiewicz, 1963, p.71).
- In Transcarpathian lects INS.PL of names has -ma, a former INS.DU ending, cf. ps'oma 'dog-INS.PL'. The standard Ukrainian has form ps'ami 'id.'.
- Present tense third person singular and plural, along with imperative, have -t ending, in contrast to standard Ukrainian ∅ or -t^{j}: Transcarpathian xod'i-t 'walk-PRES.3SG' – standard Ukrainian xod'i-t^{j} 'id.' (Myholynec', 2004, p. 18).

To summarise, there are many common archaisms within the Transcarpathian area, which alternate the texts enough for the NLP tools to struggle, presenting a well-suited material for variation study research.

3.3. Lexicon

The lexicon of Transcarpathian lects is both highly innovative and highly archaic. There are many borrowings from the neighbouring languages across all the Transcarpathian lects (Nakonečna and Rudnyc'kyj, 1940, p. 71). At the same time, there are a lot of archaisms (Del Gaudio, 2017, p. 85). One of the most prominent features is the word for 'one'. In the Transcarpathian lects it is jed'en, a form closer to West and South Slavic, while in standard it is the usual East Slavic od'in (Kuraszkiewicz, 1963, p.72). This may cause some issues, similar to the out-of-domain problem (Afanasev and Lyashevskaya, 2023), but as the Transcarpathian lects contributed a lot to the standard Ukrainian vocabulary (Del Gaudio, 2017, p. 85), not crucial ones.

3.4. Syntax

There are several peculiar constructions in the Transcarpathian lects not present in standard Ukrainian, including:

- The Transcarpathian lects use prepositions na 'on' and k 'to' to express the direction instead of the standard Ukrainian do 'towards'.
- The Transcarpathian lects use conjunction ńi in comparative constructions.

Some of these, like the accusative possessed construction, are less likely to cause issues with syntactic tagging. The others, like the causative construction, seem to present a bigger problem.

4. Resources

The texts that comprise the corpus are mostly a product of the collective effort of a single group of scholars, who, during the 1920 – 1930s, documented various East Slavic lects spread mostly in the Transcarpathian geographical region from Central Slovakia to Western Ukraine and from Southern Poland to Northern Romania. More texts are available via the efforts of the 1950s researchers, but these are relatively more scarce. The following paragraphs describe each of the books that came out of the efforts in terms of the presented texts, their description, and metalinguistic information.

4.1. Nakonečna and Rudnyc'kyj (1940)

Nakonečna and Rudnyc'kyj (1940) contains texts, a dictionary and general information on three southwesternmost East Slavic small territorial lects of Transcarpathian territories. The book consists of three parts: the general introduction, the description of the material lect by lect, and the short differential[3] dictionary of the lexical items from all the lects. Of these three, all are relevant for the digitisation effort and corpus creation.

The introduction starts with the general information on the linguistic features of the analyzed lects, which are common for all of the analysed lects, when they are compared to other East Slavic lects and especially Ukrainian (Nakonečna and Rudnyc'kyj, 1940, pp. 7–8).

The introduction continues by providing metainformation on the speakers of all three lects, mainly stating their linguistic and social background (date of birth, education, exposure to standard Ukrainian).

[3]The one that contains only the items that differ from the standard language, in this case, Ukrainian, as opposed to the full, which contains all the lexical items from the studied lect.

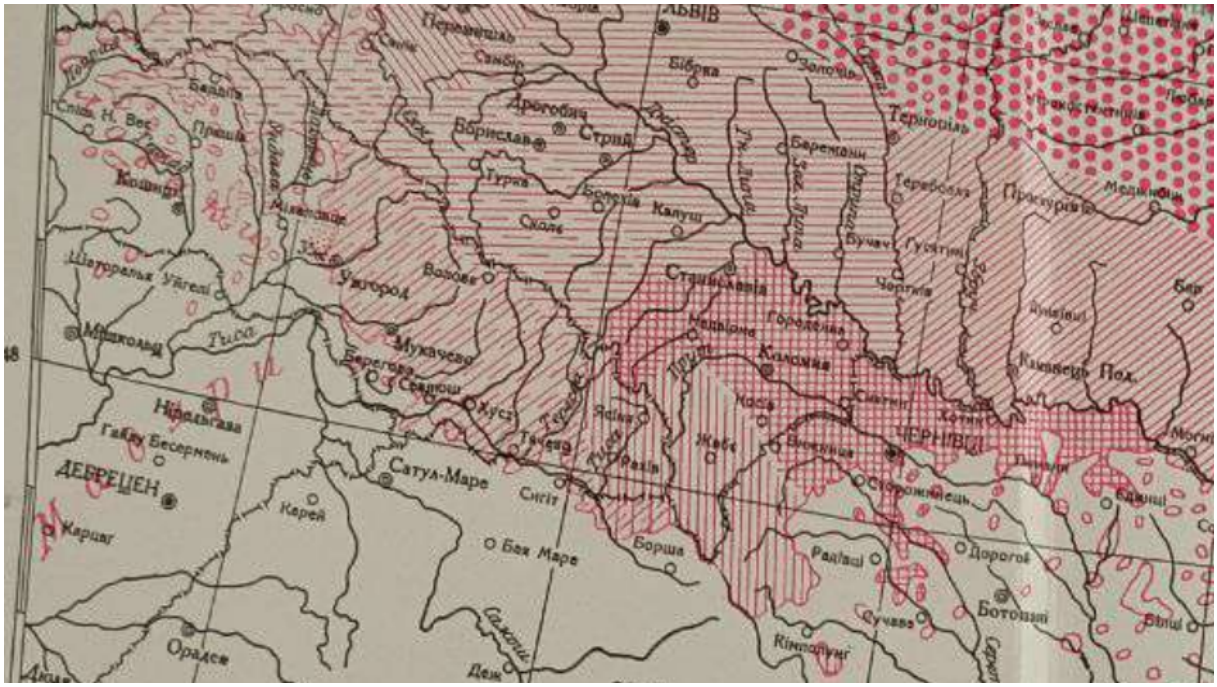

Figure 1: The map of Transcarpathian lects distribution in the beginning of the XX century (Zilyns'kyj, 1933). Rare horizontal strikes denote Lemko (in the left corner), more dense horizontal strikes (closer to the center) denote Bojko, dense vertical strikes (closer to the right) denote Hutsul.

The introduction also outlines the research methodology. The crucial part is an extremely detailed table of phonetic transcription (Nakonečna and Rudnyc'kyj, 1940, pp. 17–18) providing key information for digitising the texts in a more common format.

The next section of Nakonečna and Rudnyc'kyj (1940) consists of three parts, each dedicated to one particular idiolect from Lemko (Nakonečna and Rudnyc'kyj, 1940, pp.23–37), Bojko (Nakonečna and Rudnyc'kyj, 1940, pp.49–62) and Hutsul (Nakonečna and Rudnyc'kyj, 1940, pp. 65–82) parts of the continuum. Each of these parts outlines the phonetic, morphological, and lexical peculiarities of the lect, as well as provides the texts in these lect. The main issue is that the comparative research does not represent small territorial groups of Lemko, Bojko and Hutsul, but a single speaker out of each of these groups, which can complicate a variation study (including a historical phonology one). Metainformation on the texts (there is no split between the texts, only between – it seems – the recordings) and the speakers is not present in these parts, which is especially problematic, given that it is already significantly restricted in the introductory part of the book.

The representation of texts is rather detailed, with three forms: the phonetic transcription[4], the standardised[5] transcription, and the German translation[6]. Table 1 shows an example.

to sut fʂ'ɯtkɣ lemk'ӧwskɣ s'elɑ
de po lemk'ӧwskɣ fiw'ɑrjɑt
То сут вши́тки лемки́вски се́ла,
де по лемки́вски гва́рят
Das sind alles lemkische Dörfer,
wo lemkisch gesprochen wird.

Table 1: LA1407.1.4, an example of a sentence from Nakonečna and Rudnyc'kyj (1940, p. 31). At the top, there is phonetic representation and in the middle is a standard-based transcription. The German translation is at the bottom. The translation of the sentence is *These all are Lemko villages, where one speaks Lemko.*

The fine-grained transcription is, on the one hand, a serious advantage for the reconstruction of the phonetic system. However, there is no understanding of how reliable it actually is, especially without surviving recordings. One more issue is that there is almost no possibility to use either original transcription or its IPA rendering for automatic tagging. For the latter purposes, the study is going to use a standard-based transcription, also provided in Nakonečna and Rudnyc'kyj (1940).

After a short conclusion (Nakonečna and Rudnyc'kyj, 1940, pp. 83–85), the book provides a dic-

[4] I provide the IPA version, as it is more well-known and easy to use than the original transcription.

[5] Using the same set of graphemes as standard Ukrainian of the time.

[6] German seems to be L2 for authors, as previous research has claimed (Afanasev, 2025).

tionary of the words, specific for the small territorial lects under study. While not providing the full information required for a lexical study, this is especially helpful for lemmatisation. Overall, Nakonečna and Rudnyc'kyj (1940) provides a material of high quality for the time given, though lacking clarity and transparency.

4.2. Zheguc (2001)

Zheguc (2001) is a collection of texts, collected in different time periods (1920s – 1930s and 1990s) in the Hutsul part of the Transcarpathian region. For chronological uniformity, the corpus takes only the texts that come from the 1920s – 1930s. While this restricts the overall quantity of the material and does not allow for a proper language change study, it greatly assists in balancing the corpus. The modern material is the result of continuous field trips; thus, it is going to reduce the historical material to residuals if put in the same corpus. This is not to mention that due to the Soviet era deportations the linguistic landscape has probably drastically changed between the 1920s – 1930s and the 1990s, therefore it is hardly suitable for a proper comparison.

The transcription system of texts is clear. It is standardised phonetic/phonematic transcription, based on standard Ukrainian, but depicting the key phonetic and lexical features of the Transcarpathian lects, relevant for the purposes of the study. It does not represent all the phonetic nuances and interidiolect variation, but preserves the crucial characteristics and acts as a compromise solution, necessary for the texts for which there is no recording available. The established rules of the transcription system allow it to be unified with the standardized transcription system of Nakonečna and Rudnyc'kyj (1940). Pivotally, Zheguc (2001, p. 8) provides the description of the phonetic features of the lects, which assists in unifying the transcription.

From the sociolinguistic point of view, Zheguc (2001) provides the best possible ground for tagging metadata. It contains standard sociolinguistic information about the speakers (age, occupation, level of education, name) and the dialectologist who had initially recorded the texts, Ivan Paňkevyč. This not only enables providing the research with more data for the variationist study, but possibly facilitates insight into how a particular scholar chooses to represent a non-standard variety (Saenko, 2018).

Thus, while the representation of the texts is not the most detailed among the other resources, the quality of the material is probably the best. The transcription transparency and the relative abundance of sociolinguistic information make the data useful for sociophonetic, sociolexical, and sociogrammatical studies alike and necessitate including this resource in the corpus.

4.3. Kuraszkiewicz (1963)

Kuraszkiewicz (1963) contains a short description of each of the East Slavic small territorial lect groups, as well as texts from the lects of these groups. Among these are several texts from the Transcarpathian lects, recorded and transcribed mostly at the beginning of the XX century (Kuraszkiewicz, 1963, pp. 124–128).

The possible digitisation of the texts from Kuraszkiewicz (1963) faces some significant issues. The transcription system here, on the contrary to Nakonečna and Rudnyc'kyj (1940), is not explained, and it is rather hard to make a proper correspondence between it and IPA, or even standard Ukrainian. There are also no signs of either a standard-based additional transcription or a translation into any other language. Given the lack of audio recordings, this is quite problematic. The crucial issue, however, is the lack of metadata, aside from the group (Lemko/Bojko/Hutsul) and the source of transcription, including the dialectologist's name. Kuraszkiewicz (1963) also generally provides the particular area where the recording took place. This facilitates some understanding on how different researchers represented different varieties; however, studying the varieties themselves is going to be significantly complicated.

While not exactly rich with metalinguistic and linguistic information, Kuraszkiewicz (1963) possesses one crucial advantage over all the other sources, namely, the geographical distribution of the lects. It covers at least two lects from each group, bringing much-needed diversity to the dataset.

5. Corpus Creation

5.1. Corpus Design

The main purpose of the corpus is to provide insights into the processes of variation and change that were going on in the Transcarpathian lects, as illustrated by the morphosyntactic properties of the texts. The most widely distributed format to represent the morphosyntactic properties is `.conllu`, so this is the main format of the corpus.

The transcriptions within the different sources are drastically different, so the research opts to unify them. The main transcription system is IPA. The main representation system for morphological tagging, however, is a standard Ukrainian phonetic/phonematic rendering, applied by both Nakonečna and Rudnyc'kyj (1940) and modern small territorial lects corpora of East Slavic languages, for instance, Goldin and Kryuchkova (2011) or Ryko and Spiricheva (2020). This system renders non-standard texts in something more resembling a neighbouring standard, but with faith-

ful depiction of key phonetic, morphological, lexical and syntactical features (von Waldenfels et al., 2014). This helps to present the corpus to the audience unfamiliar with the IPA conventions. Crucially, this system also facilitates more effective automatic processing. The corpus has two layers of tagging: morphosyntactic for each token (part-of-speech, morphological tags, lemma, syntactic features), and an additional linguistic one. When possible, the corpus also provides translations into other languages.

5.2. Manual Digitisation

Due to the specific system of transcription for the given lects, using OCR techniques of e-Scriptorium (Kiessling et al., 2019) or Transkribus (Kahle et al., 2017) proved to be impossible. Therefore, the performance of digitisation process is manual.

The workflow was the following:

- Manually type the material into a machine-readable form.
- In cases of Kuraszkiewicz (1963) and Zheguc (2001) it is necessary to add a standardised layer.
- Split the whole material into documents (especially relevant for Kuraszkiewicz (1963) and Zheguc (2001); Nakonečna and Rudnyc'kyj (1940) already contains splits by document.
- Split the document into texts (especially relevant for Nakonečna and Rudnyc'kyj (1940), which does not provide splits by texts within the documents).
- Split the texts into sentences (mostly done by the scholars).
- Perform manual word tokenisation.
- Put data in `.conllu` format.
- When required, provide additional information about the ASJP basic vocabulary list and named entities to the *misc* section of the token. In the *misc* section, there are also WF and TF fields, the latter providing the IPA-based transcription (if the original data contains phonetic transcription), and the former – normalised token (standard-based representation with removed diacritics).

5.2.1. Manual Digitisation Case Study: Kuraszkiewicz (1963)

The section outlines the workflow of transforming the original transcription from Kuraszkiewicz (1963) to IPA transcription and standardised Ukrainian orthography. Example 1 below shows the original rendering. It is accompanied by a glossed[7] version and a translation of the sentence.

(1) Hutsul (Kuraszkiewicz, 1963, p. 125)

Ta̯i̯		pip
ta̯i̯		pip-∅
and.so		priestling-NOM.SG
l̥edwy	u̯kik	
l̥edwy	u̯-kik-∅	
barely	away-run-PST.MASC.3SG	
witt'oho		gikka
wit-t-'oho		gikk-a
from-DET-MASC.GEN.SG		devil-GEN.SG

.
.
.

'And so the priestling barely ran away from that devil.'

The next step requires the conversion of this example into IPA and standardised Ukrainian, with the preservation of its main features. In this text, the most notable feature distinguishing Hutsul from Modern Standard Ukrainian is the sound change from the dental plosive *t̯* to the velar plosive *k* before palatal vowels or palatalised consonants. Two words exhibit this change: *u̯kik* 'ran away' (Modern Standard Ukrainian *ut͡ʲ'ik* 'id.') and *gikka* 'devil' (Modern Standard Ukrainian *'d͡ʲad͡ʲko* 'uncle'). As this appears to be an important feature of the lect, it should be preserved. At the same time, since the preposition від is generally a separate token in Modern Standard Ukrainian, the standardised version should separate it from the determiner т'ого. Thus, the preliminary reconstruction, based on other already processed texts from the corpus that have been standardised by the scholars who originally transcribed them, as well as on corpora of Modern Standard Ukrainian (Kopp et al., 2023), would be as follows: Тай піп ле́дви вкі́к від то́го гіккя.

IPA transcription should also rely on other texts and previous studies (Zilyns'kyj, 1932; Nakonečna and Rudnyc'kyj, 1940; Ševel'ov, 1979; Zhovtobriukh et al., 1979). Using this information, it is possible to reconstruct the following sound form of the sentence: taj pʲ'ip ledvï wkʲ'ik wit‿tˈoɦo gikʲkʲ'a //. One of the key changes employed here is the placement of stress on the last syllable of gikʲkʲ'a (by analogy with pˈip – popˈa). Another change is the substitution of *a* with a, which is characteristic of Hutsul in the GEN.SG of masculine nouns (Nakonečna and Rudnyc'kyj, 1940, p. 74). It is unclear what sound *l̥* designates; given other contexts in Kuraszkiewicz (1963) and the data from Nakonečna and Rudnyc'kyj (1940), the best option seems to be the IPA *l*. As the transcriber joined

[7] Glosses are given according to Comrie et al. (2008)

wit⌣tˈoño into a single sequence, the IPA transcription uses the ‿ symbol to indicate the pronunciation of two words without a pause. The IPA transcription also uses ʲ instead of an acute accent to indicate the palatalisation of consonants. Consequently, word stress is marked with the special symbol ˈ. The last crucial transformation is the use of *v* for original *w*, as the latter is most probably due to the transcriber using the Polish designation of this sound as part of the transcription, and *w* for original u̯, as *w* is a standard IPA designation of non-syllabic *u*. Other symbols coincide between the transcription in Kuraszkiewicz (1963) and the IPA. The only addition in this transcription is the / symbol marking the end of the sentence to denote a pause in the speaker's speech. After this conversion, the next step was to transform all the gathered data into the `.conllu` format. Table 2 shows the result.

```
# sent_id = chłopiec000.14
# IPA_transcription = tɑj pʲˈip ledvï wkʲˈik
wit⌣tˈoño gikʲkʲˈɑ //
# standard_text = Тай пíп лéдви вкíк від тóго
гíкькя.
# english_text = And so the priestling barely ran
away from that devil.

1 Тай _ _ _ _ _ _ _ wf="Тай"|tf="tɑj"

(...)
```

Table 2: The `.conllu` representation of `chłopiec000.14`. As the table is an illustration, it shows (for brevity) only the first token.

Repeating these steps for all sentences prepared the corpus for the next phases of tagging. These stages included automatic annotation, manual correction, and the provision of sociolinguistic information about the speakers.

5.3. Automatic Annotation

The code used for automatic annotation is available in an Open Science Framework (OSF) repository[8]. The annotation process follows the workflow described in the `README.md` file in the repository.

The main tool of automatic annotation is Stanza (Qi et al., 2020), a well-known set of pre-trained models designed to perform basic NLP tasks, providing output in the Universal Dependencies (UD) format (de Marneffe et al., 2021). Among others, the ones especially relevant for this study are: part-of-speech tagging, morphological tagging, lemmatisation, and dependency parsing. The automatic annotation pipeline includes running the Stanza model, trained on the standard Ukrainian corpus from UD (Nivre et al., 2020). This is due to the similarity of the selected representation system and the standard Ukrainian graphic system: it allows for the best possible results.

When having performed tagging, the script deletes XPOS, replacing them with underscore symbol: these are language-specific tags for standard Ukrainian. While, due to the high degree of similarity, some of them still can be applicable to the Transcarpathian lects, the differences within the grammatical systems of even rather closely related varieties are generally still significant enough to cause issues in the XPOS schema (Shishkina and Lyashevskaya, 2021). Thus, the decision was to temporarily remove this feature. After XPOS deletion, the data are ready for manual correction.

5.3.1. Note on the Use of GenAI

While Generative AI (GenAI) is extremely useful in low-resourced settings, when compared to the more traditional models (Baturova et al., 2025), its zero-shot application, even when there are high-resource closely related languages in the pre-training dataset, may still be problematic (Umbet et al., 2025). At this stage, there are not enough resources in the corpus to provide examples for GenAI prompts. For the further stages of the research, when the first texts for each Bojko, Hutsul and Lemko are fully digitised and cross-checked, the experiments with GenAI, as compared to the traditional tools, are necessary.

5.4. Manual Correction and Preliminary Analysis

Manual correction includes the editing of incorrect part-of-speech and syntactic feature tags, along with lemma assignment. The manual correction was carried out by a single annotator with previous expertise in annotating East Slavic languages.

A crucial stage of manual correction is error analysis. As the automatic tagging stage relies on Stanza applied cross-linguistically, there are many errors, especially those caused by errors in previous tagging phases. Table 3 shows the quantitative evaluation of each category using traditionally applied metrics; the following paragraphs provide a qualitative analysis.

5.4.1. Part-of-Speech/Morphological Tagging

The errata in part-of-speech tagging and, subsequently, morphological tagging emerge heavily from the differences in distributions of some items between standard Ukrainian and the Transcarpathian lects. In this fashion, Stanza tags То (t-o, DET-NEUT.NOM.SG) in LA1407.1.4 as a particle

[8]OSF link: https://osf.io/528zy/overview (last accessed: March 22, 2026).

Task	Metric	Score
Part-of-speech tagging	F1-score	66.78
Morphological tagging	Macro-F1 score	71.00
Lemmatization	Accuracy	75.7
Dependency parsing	UAS	67.65
Dependency parsing	LAS	52.71

Table 3: Evaluation of Stanza using traditionally applied metrics: F1-score for part-of-speech tagging, macro-F1 score for morphological tagging, accuracy for lemmatization, and unlabeled and labeled attachment scores (UAS and LAS) for dependency parsing.

(PART). While in standard Ukrainian то (to) is indeed a particle, то in the analysed text is rather a demonstrative pronoun (det), more akin to standard Ukrainian це (t͡sʲ-e, DET-NEUT.NOM.SG).

This error also causes a subsequent chain of errors, the most prominent being the complete absence of the morphological tags required for the demonstrative pronoun. This underscores one of the crucial issues of Stanza-based pipelines: the simultaneous tagging of part-of-speech and morphology.

In other cases, the part-of-speech tag is correct, but some of the morphological tags are not. For instance, the model tags Фóльварк[footnotel] provide the form with stress for illustrative purposes. However, the forms that the model tagged underwent normalisation to exclude this factor of errata. (fˈolʲvɑrk-∅'Folvark.village-NOM.SG') as NAME-TYPE=SUR (family name). This is especially frequent with some village names that get confused with family names or given names, which underscores the issues of out-of-domain tagging (Lyashevskaya and Afanasev, 2021).

5.4.2. Lemmatisation

The lemmatisation errata often stem from the incorrect part-of-speech tags. This is the case, for instance, of the model transforming вши́тки (fʂˈɯtkɣ̞, 'every-NOM.PL') to вшиток as a consequence of NOUN part-of-speech tag. In fact, вши́тки is an adjective, and therefore should get lemma вшиткий. The other cases include, for instance, lemmatising ме́нджі (mˌd͡zɻ'between' to менедж, triggered by NOUN tag.

The other type of error is the combination of lexical differences and the inability of the models to account for phonetic or morphological properties. Thus, Русна́ці (rusˈɑt͡s-i'Rusnak-NOM.PL') becomes Руснац instead of expected Руснак. The phonetic changes that led to this ц/к alternation (Zhovtobriukh et al., 1979, pp. 119–120) are common for the Transcarpathian lects and standard Ukrainian, cf. році (rˈt͡s-i, 'year-NOM.PL') – рік. It is clear that the model does not grasp this kind of alternation.

In some cases, the combination of the lack of training material and the grammatical differences may also cause lemmatisation errata. For instance, ні́ма (n-ˈimɑ, 'they-INS.PL') is a form analogous to standard Ukrainian ними (n-ɪmɪ, 'id.'; see Section 3.2). Its lemma is вони. The model, however, picks Кіма, which is a clear generation error, caused by the absence of both ними and the words ending with ма and being in INS.PL in the training dataset. This shows that Ukrainian is still a low-resourced language in terms of the UD corpora.

5.4.3. Dependency Parsing

The dependency parsing errata are multiple, but mostly have a single cause: incorrect part-of-speech tag. Thus, the aforementioned То gets DISCOURSE tag, while in fact it is NSUBJ. In case it were tagged as DET (as it should have been), there is a high chance that the assigned syntactic tag would have been correct.

5.4.4. Discussion and Final Representation

Overall, the errata made by the model stem not from significant differences in the morphological or syntactical structure of standard Ukrainian and the Transcarpathian lects, but rather from their lexical differences, low training material (Ukrainian corpus in UD 2.12, on which Stanza for Ukrainian was trained, has only 114 000 tokens), and running Stanza as a pipeline without manual checks in-between. Still, the manual check significantly reduced the errata of the model. Table 4 shows an example of a data piece after the manual check.

5.5. Metadata

The tagging of metadata, while not pivotal in terms of, for instance, automatic processing, is a critical part of both language variation studies in general and corpus-based dialectology in particular (Tagliamonte, 2025, pp. 109–111). The texts within the corpus are thus going to receive the metadata tag of belonging to one of these three groups, according to their descriptions within the sources, as well as the discovered phonetic features of the lects.

Where it is possible, the texts receive the tags of information about the speakers themselves. The first name and the last name undergo encryption via being transliterated into the Roman script, and afterwards abbreviated to the format "first letter of the first name + second name + the last three digits

sent_id = LA1407.1.4
IPA_transcription = to sut fʂ'ɯtkɣ lemk'ŏwskɣ s'elɑ de po lemk'ŏwskɣ fiw'ɑrjɑt
standard_text = То сут вши́тки лемки́вски се́ла, де по лемки́вски гва́рят
variation_text = {То=>Тото:::variation_type=Morph~Pronoun_Long} сут вши́тки лемки́вски се́ла, де по лемки́вски {г=>г:::variation_type=Phon~G}ва́рят.
german_text = Das sind alles lemkische Dörfer, wo lemkisch gesprochen wird.
english_text = These are all Lemko villages where Lemko is spoken.

1 То то PRON _ Animacy=Inan|Case=Nom|Gender=Neut|Number=Sing|PronType=Dem
2 nsubj 2:nsubj wf="То"|tf="то"

(...)

Table 4: The manually checked annotation of LA1407.1.4. As the table is an illustration, it shows (for brevity considerations) only the first token.

of the year of birth, otherwise 000". Thus, Василь Кабалюк[9], born in 1870, has id *vkabaluk870*, while Гафія Прумптула[10], information on whose year of birth is not in the data, has id *hprumptula000*. This is due to the variationist studies conventions and the consensus about the anonymity of the speakers[11] (Tagliamonte, 2025, pp. 48–50). Other features of the speakers include year of birth, place of birth (if known), education and occupation, where available.

More information is available from the recordings themselves. The corpus takes date and place of original publishing, genre and form (there are some songs in the dataset, so it is necessary to distinguish between poetry and prose). This enables the basic discourse analysis.

5.6. Representation and Access

The corpus is available on Zenodo as a separate language resource[12]. The results of the experiments are available in the OSF repository[13].

6. Current State: Conclusion

The article presents the design of a corpus of historical Transcarpathian lects. The study outlines the resources used for the creation of this corpus. It demonstrates the research pipeline utilised in building the corpus, from resource collection and manual digitisation to the manual correction of errors produced by the Stanza model. The main contribution is the open-access texts forming the Lemko part of the corpus. Table 5 demonstrates the main characteristics of the corpus.

Parameter	Value
Number of lects	3
Number of speakers	3
Number of texts	9
Number of sentences	90
Tagging status	Gold
Number of data collectors	2
Number of annotators	1
Token count	1949

Table 5: Key characteristics of the corpus; a more detailed overview is provided in the supplementary material.

The study provides an analysis of the errors produced by the Stanza model. It shows that the performance of the part-of-speech and morphological models is pivotal for all subsequent stages. The analysis also demonstrates that lexical differences are among the most crucial factors affecting model performance and that Stanza is not able—at least when trained on 110,000 tokens—to capture certain phonetic change patterns present in the dataset.

The next stage involves further expanding the corpus. Now that part of the material has been manually checked, the next step is to use GenAI either as an aid to the Stanza toolkit or as the main tagger. The corpus also requires English translations of the sentences for improved accessibility and, possibly, a TEI representation for a more qualitative study.

Limitations

The corpus by now is in its development phase, which means that not all the texts from the resources are present and tagged. One of the key

[9] Fictionalised name, not attested in the data.

[10] Fictionalised name, not attested in the data.

[11] While the original resources are available for research purposes and have a permissive license, they have not been widely accessed before the publication. Thus, it is better to adapt additional measures for privacy safety.

[12] Zenodo link: https://doi.org/10.5281/zenodo.19158682 (last accessed: March 22, 2026).

[13] OSF link: https://osf.io/528zy/overview (last accessed: March 22, 2026).

issues is that only a single annotator worked on the gold tagging, which could have introduced bias into it.

Ethical Considerations

The data has been published in the printed form and available for research purposes for fifty to ninety years by the time this article was written. Still, I anonymise the metadata, where possible, masking the names of the speakers, to compensate for possible ethics violations that could have happened at the time of the material collection.

The data themselves can contain slight mentions of xenophobic behaviour and religious (mostly, Christian) imagery. Discretion is advised.

Disclosure of Generative AI use

This study does not employ generative AI in the research process. While Stanza (Qi et al., 2020) technically belongs to the broader class of generative models in the modern colloquial meaning (the decoder models with more than a billion parameters trained on high-resource corpora), it operates at a much smaller scale and is locally reproducible. During the editing stage, the author used generative AI tools (Grammarly and OpenAI) solely for language polishing where non-native proficiency might otherwise have limited grammatical or stylistic clarity. The intellectual content of the article is entirely human-authored.

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