

Modern Ukrainian Electronic Dictionaries: the Problem of Implementing Spelling Changes

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Abstract

The article analyzes nine famous electronic lexicographic works of various types, the complete sources of normalized and standardized Ukrainian vocabulary. The subject of the research is the implementation of changes in electronic dictionaries following the current Ukrainian spelling, which changed in 2019. The work aims to identify trends in compliance with orthographic norms. The research results will become the basis for improving electronic dictionaries regarding orthographic and grammatical lexicographic parameters so that users can receive reliable information about the spelling of lexical items, contributing to the approval of linguistic culture. Although electronic dictionaries, due to their mobility, can quickly eliminate outdated forms and consistently establish new orthographic norms, they still need to be taken for analysis. The electronic dictionary still needs to implement the innovation of the current Ukrainian spelling completely. The results of the study confirmed that only a few electronic dictionaries – "Slovnyk.ua", "SUO", "Horokh" – adhere to the norms of modern Ukrainian spelling, for the most part, studied criteria. However, normative innovations were not observed in almost all of the studied sources. It was established that ignoring the prescriptions of modern Ukrainian spelling needs immediate correction.

Keywords

Electronic dictionary, spelling norm, Ukrainian spelling 2019, non-alternative norm, version norm

1. Introduction

In the current civilizational conditions, electronic vocabulary is one of the most popular services served by all categories of users (both students, students, and adult Avilletoria - specialists of different specialties). Convenience in use, the ability to quickly find specific words or small phrases, in addition to taking into account morphological forms and the ability to find examples of use, sometimes with the option of changing the direction of translation (for example, Ukrainian-English or English-Ukrainian). Paper editions usually provide a narrower range of services and need more processing time. However, ordinary users often trust traditional book editions because they believe they can withstand numerous pre-emptive training; authors, editors, and correctors work on them. Mistakes or underwear in such lexicographic works are usually minimized. Electronic dictionaries, however, have another significant advantage - the ability to respond quickly to changes that the language system undergoes in evolution. One of these changes is the spelling reform introduced in modern Ukrainian.

The national language's functionality is based on a single orthographic code that includes current spelling. Respectively, speakers in daily speech communication adhere to recognized and codified lexicographic sources of rules. Strict spelling unites the verbal tradition and promotes literacy and the domestic and national community. The Ukrainian National Spelling Commission approved changes to the current spelling (Minutes No. 5 of October 22, 2018), which was approved by the joint decision of the Presidium of the National Academy of Sciences of Ukraine (Protocol No. 22/10 of October 24,

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2018) and the Board of the Ministry of Education and the Ministry of Education and Science of Ukraine (Protocol No. 10/4-13 of October 24, 2018). These changes were approved and implemented by the Cabinet of Ministers of Ukraine (Resolution No. 437 of May 22, 2019). Changes in socio-political character in Ukraine, the awakening of national-linguistic consciousness of Ukrainian society, raising the cultural level of the population, other, as well as, first of all, the deployment of intra-language processes aimed at strengthening autochthonous variants and preservation of self-formation, became the main linguistic and extra-linguistic factors of such innovations in Ukraine, the awakening [1].

So there are changes in Ukrainian spelling for the fourth consecutive year in Ukraine. The new spelling standard includes all linguistic space areas, so electronic lexicographic sources, being able to respond promptly to normative innovations, should reflect these changes and adequately orient users to spell on lexical units.

The lexicographic works of various types consider the complete sources of normalized and presented vocabulary. Therefore, dictionaries become the codifiers of the proper spelling of words. It is evident that if dictionaries occur outdated forms, errors, or spelling failures, they disorient the native speakers and reduce the literacy of the population. Thanks to their mobility, electronic dictionaries can quickly eliminate outdated options and consistently assert new orthographic standards. It is also important to emphasize that online dictionaries, being a universal source of scientific, historical, and cultural information, play a significant role in implementing and disseminating linguistic norms and raising the language culture of the nation. Therefore, the problem of adherence to spelling changes in modern electronic dictionaries is of considerable scientific interest and determines the relevance of the proposed topic.

The object of research is popular Ukrainian online dictionaries. The subject of the study is the introduction of electronic vocabulary changes following the current spelling of 2019.

The study aims to identify trends in compliance with orthographic standards based on an analysis of electronic lexicographic works. Achieving this goal involves the implementation of **the following tasks**:

- to create a sample of orthographic standards that have changed following the spelling of 2019;
- choose the most popular electronic lexicographic works for analysis;
- to analyze each lexicographic source for compliance with specific spelling norms;
- identify variable forms that are recorded by electronic dictionaries;
- to analyze the spelling changes recorded in modern online dances;
- identify trends in compliance with orthographic standards in the source base;
- the source base of the study is famous electronic lexicographic works.

2. Research methods

The research methodology is based on several sequential steps using general scientific research methods.

The first step involves the creation of a sample of spelling norms that have changed following the spelling of 2019. They are laid on non-alternative and variable.

The second step is to choose the most popular electronic lexicographic works for analysis. First, the criteria of volume, authoritativeness, and popularity are considered.

The third step is a comprehensive linguistic and statistical processing of electronic lexicographic sources for compliance with the 2019 spelling requirements. The study used the following methods: structural and system analysis made it possible to explore the most popular online dictionaries and electronic complexes for presenting lexicographic parameters. Descriptive-analytical and comparable methods are used to summarize the observation of the analyzed lexicographic material. Empirical research methods - observation, comparison, and monitoring of lexicographic sources - were used to describe the studied data and their systematization; The extrapolation method summarizes information and disseminates the conclusions obtained from observation.

The fourth step is to systematize the typical tendencies found in the analyzed source base regarding the presence of typical errors, the display of the variation of the proposed models' use, and the regular

changes approved by the latest edition of Ukrainian spelling. The conclusions, formulation, and recommendations affirm the current spelling of 2019.

Schematically, the research methodology is reflected in Fig. 1.

The study is practical - the results can be used to improve electronic dictionaries on orthographic and grammatical lexicographic parameters so that users can receive reliable information on the spelling of lexical units following the changes in the current Ukrainian spelling.

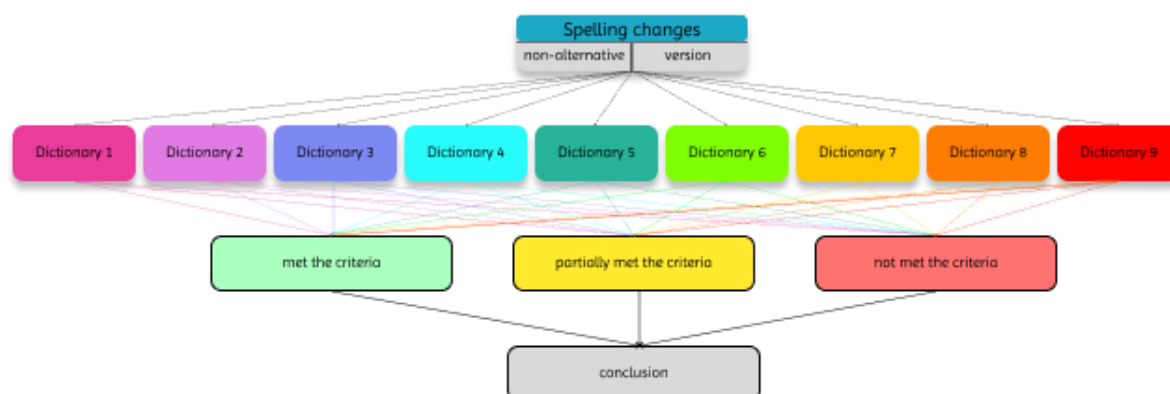


Figure 1: Research methodology.

3. Related research

In the Ukrainian literary language, stable language norms have been developed, setting the most typical and characteristic linguistic use. Normalizing literary language implies the presence of clear, mandatory writing rules and using words, creation, and use of grammatical forms, among others. Research [2] is essential for regulating spelling stability, whose authors, based on the French web dictionary, created a large-scale database of spelling errors that could inform psychological theories about spelling processes. Scientists analyze compliance with language norms, in particular in English [3], paying attention to the fact that the natural development of any language leads to the need to make some changes to the spelling code that influence communication in society. The confirmation of the above has Carol Shammas [4]. The author examines the correspondence of five generations of elite English families and traces how the standardization of popular writing was practically embodied. The author compares the spelling and punctuation recorded in the letters of family members with the books reflected in the printed books and states that even in elite families, only those who have received secondary education have firmly observed spelling rules.

An interesting way to analyze the spelling processes in Ukraine is the experience of Hungarian linguists. The article [5]. Describes the current state of Hungarian spelling in the double perspective of preservation and modification after the publication of the 12th edition of "Rules of Hungarian spelling". The author analyzes the Hungarian spelling system, deduces its fundamental principles, which interprets as norms, summarizes the main changes made by 2016, and submits their proposals for improvement. Similar spelling processes are observed in other national languages, for example, in the collapse of the Spanish Empire in the first half of the nineteenth century. It caused the need to reorganize the former colonial space into independent countries by creating territorial, political, and identity borders in Spanish-speaking America. As shown in the article "Official Orthographies, Spelling Debates, and Nation-Building Projects After the Fall of the Spanish Empire" [6], spelling is a political tool and marker of identity.

With the proclamation of independence of Ukraine, the need to return to the spelling standards of the Ukrainian literary language was destroyed in 1933, so the spelling commission worked on making appropriate recommendations. The authors of this linguistic law point out that they preserved "the approach to language as a sign system and social phenomenon from the standpoint of the historical and ethnographic cathedral of the Ukrainian language and the Ukrainian nation" [7, p. 1]. The Ukrainian spelling introduced in 2019 makes it possible to get rid of artificially thrown spelling and grammatical norms partially. However, there is still a debate in the scientific literature on the expediency of making

personal changes. Thus, researchers K. Bondarchuk and O. Chumachenko formulate the author's critical remarks about the clarity and accuracy of specific formulations of spelling norms in Ukrainian spelling 2019 [8]. The object of research of modern linguists was also the peculiarities of compliance with the rules of Ukrainian spelling in official and unofficial Internet communication [9], the practice of compliance with punctuation rules during Internet communication [10].

The next step towards spelling reform is to monitor the introduction of appropriate changes in lexicographic sources, especially in terminological dictionaries that record scientific terms, their definition, and grammatical and orthographic parameters. Terminologists pay particular attention to compliance with national standards when creating technical terms, discussing the consequences for practical issues of terminology processing [11]. Because the use of electronic resources makes it possible to speed up and reduce costs, electronic dictionaries are often used for machine translation. Cabezas-Marcía, M. & León-Araue, P [12], who were comprehensively exploring the translation of Anglo-Spanish multi-term terms in different machine translation systems, pay attention to numerous errors that can occur during this work and based on this knowledge they have formed their recommendations to achieve the translation. Mentynska I., who has analyzed the prospects for the development of online computer dictionaries, states that the requirements of current Ukrainian spelling are usually met in modern electronic terminological dictionaries of the computer sphere. However, several cases are found when the authors violate the norm or announce changes in spelling, but in the spelling, but in Vocabulary articles are not implemented (for example, instead of the project, they use the writing project) [13]. Note that linguists-terminologists have a topic of terminological variability and understanding the causes of several names of one concept in specialized texts [14]. Scientific sources also emphasize that compliance with spelling norms in electronic sources is essential for mastering the rules of writing and using words by international students [15].

4. Results of the research

Based on the processing of changes made to the Ukrainian spelling of 2019, those that significantly affect the writing of words or the creation of certain grammatical forms. Twelve criteria were selected for the study. Among them, we distinguish non-alternative - 8 criteria and version - 4 criteria, as in Table 1.

Table 1
Criteria for compliance with spelling rules

non-alternative criteria		version criteria	
1n.	Writing the numeral “нів [piv]” with the meaning "half" separately with the following word in the form of the genitive case.	1v.	In borrowings from the ancient Greek language, letter combinations au orthographic variants ay [au] і ae [av] are allowed: <i>αυδυτόρια [audytóriia]</i> and <i>αεδυτόρια [avdytóriia]</i> .
2n.	Use at the beginning of a word and in separate (<i>ύκαμυ [ýkamy]</i>).	2v.	The letter combination th in words of ancient Greek origin is usually given by the letter m . In words used in the Ukrainian language with φ , orthographic variants are allowed, for example: <i>κάφεδρα [káfedra]</i> і <i>καμέδρα [katédra]</i> .
3n.	Writing complex words together with the first foreign language component анти-, контр-, віце-, веб-, екс-, лейб-, обер-, топ-, штабс-, унтер- [anty-, kontr-, vitse-, veb-, eks-, leib-, ober-, top-, shtabs-, unter-] .	3v.	Nouns with -mь after a consonant, as well as words <i>κροῦν [krov]</i> , <i>любów [liubów]</i> , <i>όσινь [ósín]</i> , <i>силь [sil]</i> , <i>Русь [Rus]</i> in the genitive singular can acquire an ending -u or -i : <i>любówи [liubóvy]</i> and <i>любові [liubovi]</i> .

non-alternative criteria		version criteria	
4n.	Transmission of the sound [j] according to the pronunciation of a foreign word with the letter <i>й</i> , and in the composition of sound combinations [je], [ji], [ju], [ja] by letters <i>є, ї, ю, я</i> (проект [proiect]).	4v.	The names of settlements: Амстерда́м [Amsterdám], Го́мель [Hómel], Лі́верпуль [Liverpúl], Ло́ндон [Lóndon], Мадрі́д [Madrýd], Пари́ж [Parýzh], Чорно́биль [Chornóbyl] have a version ending in the genitive singular -у/-ю і -а/-я: Пари́жа [Paryzha] and Пари́жу [Paryzhu].
5n.	Doubling letters as a result of a match: священник [sviashchennyk].		
6n.	Reproduction of loanwords from English, German, Swedish and some other languages <i>ck</i> with ukrainian letter <i>к</i> : Ді́кенс [Díkens].		
7n.	Writing website names without a generic word with a lowercase letter (м@йтер [twitter]), гґґл [google]); with a generic word - with a capital letter and in quotes (мережа «Фейсбук» [merezha «Feisbúk»]); used as names legal entities - with a capital letter and without quotation marks (санкції проти Яндекса [sanktsii proty Yandeksa]).		
8n.	Spelling of complex words with a part дво-[dvo-]; три-[try-]; чотири-[chotyry-]: двоактний [dvoaktnyi].		

The electronic dictionaries presented in Table 2 were selected for the study. The main reasons for choosing an online source for analysis were its authority and popularity among users reflected in the number of visits, as well as the volume of cover material, which is reflected, first of all, in the number of registered words and in the range of services that can be obtained thanks to this dictionary.

Table 2

Electronic dictionaries are included in the analysis

№	Name of the Dictionary	Number of Register Words	Number of Visitors	Access Mode	Dictionary Type
1.	SLOVNYK.ua	more than 130 K	19 K	slovnyk.ua	electronic set of dictionaries
2.	Slovnyky Ukrainy online (SUO)	262.812	15 K	https://lcorp.ulif.org.ua/dictua/	electronic set of dictionaries
3.	Glosbe	64.550	600 K	https://uk.glosbe.com/uk/fr	a set of translation dictionaries
4.	Horokh	around 441 K	22 K	https://goroh.pp.ua	electronic

№	Name of the Dictionary	Number of Register Words	Number of Visitors	Access Mode	Dictionary Type
					set of dictionaries
5.	Slovopedia	46 dictionaries	20 K	http://slovopedia.org.ua/35/53407/142829.html	electronic set of dictionaries
6.	Akademichni tlumachnyi slovnyk (1970–1980) (ATS 1970–1980)	137 K	6.200	http://sum.in.ua/s/piv-oblychchja	dictionary
7.	Slovnyky ukrayins'koyi movy online (SUMO)	112 K	15 K	https://uk.worldwidedictionary.org/	electronic set of dictionaries
8.	Slovnyk ukrayins'koyi movy online. Volumes 1-13 (A–POKÍRNO)) (SUM-20)	127.763	18 K	https://sum20ua.com/Entry/index?wordid=1&page=0	orthographic
9.	Orfohrafichni slovnyk ukrayins'koyi movy (OSUM)	198.905	13 K	https://559.slovaronline.com/	orthographic

Following the research criteria, we present an analysis of the study's spelling changes in each electronic dictionary.

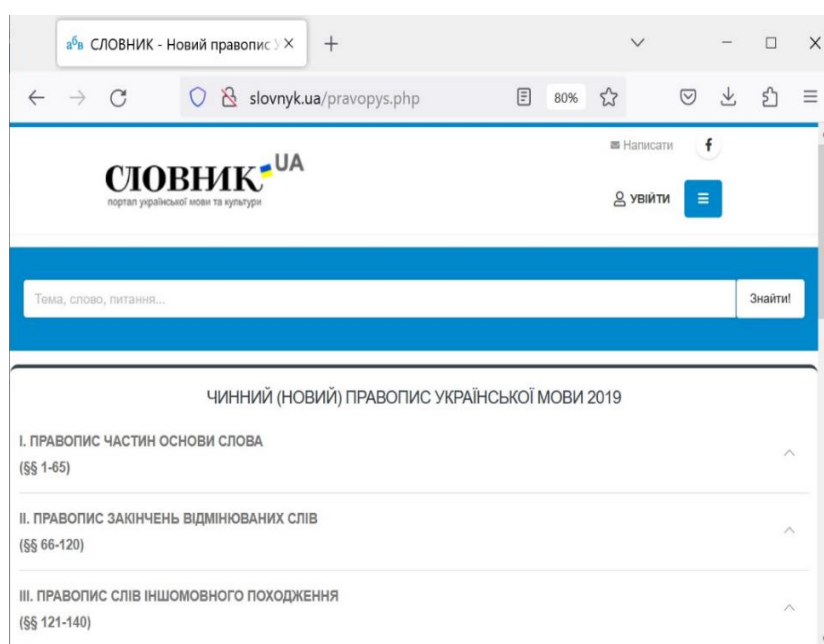


Figure 2: "Slovnynk.ua" in compliance with spelling changes.

We observe that "Slovnyk.ua" [16] (Fig. 2) has a specially formed and conveniently placed "Spelling-2019" page. Accordingly, this electronic edition reflects all the criteria that we marked as non-alternative: the use of **u** at the beginning of a word: *уч* [ych], *укання* [ukannia]; spelling **je**: *проект* [proiekt], *проекція* [proiektiia]; infinitive compound words in form **дво-** [dvo], **три-** [try], **чотири-** [chotyry]: *двоактний* [dvoaknyi]; doubling of consonants: *священник* [sviashchennyk]; the spelling of compound nouns: *тоннокілометр* [tonnokilometr], *мініавтомобіль* [miniavtomobil]; the spelling of words with **niv** [piv]: *нів Києва* [piv Kyieva], *нів кола* [piv kola]. As for the variant criteria, the authors adhere to only two: the letter combination **au**, **ou** to indicate the sound combinations [au], [ou]: *авдиторія* [avdytoriia] / *аудиторія* [audytoriia]; letter combination **th** in words of Greek origin *като́дра* [katedra] / *кафе́дра* [kafedra]. However, the dictionary does not record the variant endings **-i/-u** in the genitive singular of *радо́сти* [radosti] / *радо́сти* [radosty], *любо́ви* [liubovi] / *любо́ви* [liubovy]. In addition, we notice some spelling mistakes in this source: *інвестиційний проєкт* [investytiiniy proekt] instead of the expected *інвестиційний проєкт* [investytiiniy projekt]. Schematically, compliance with spelling changes in this source is shown in Fig. 3.

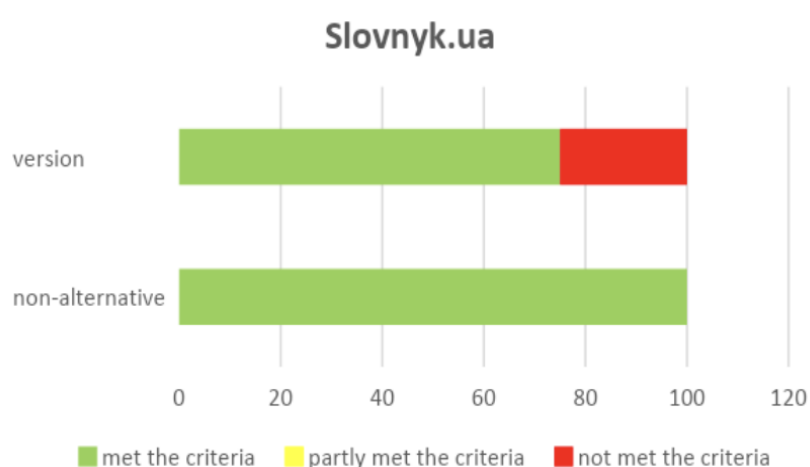


Figure 3: Display of spelling changes in "Slovnyk.ua".

The electronic edition of "Slovnyky Ukrainian online" (SUO) [17] (Fig. 4) contains five vocabulary subsystems-modules of word changes, transcriptions, synonyms, antonyms, and phraseology.

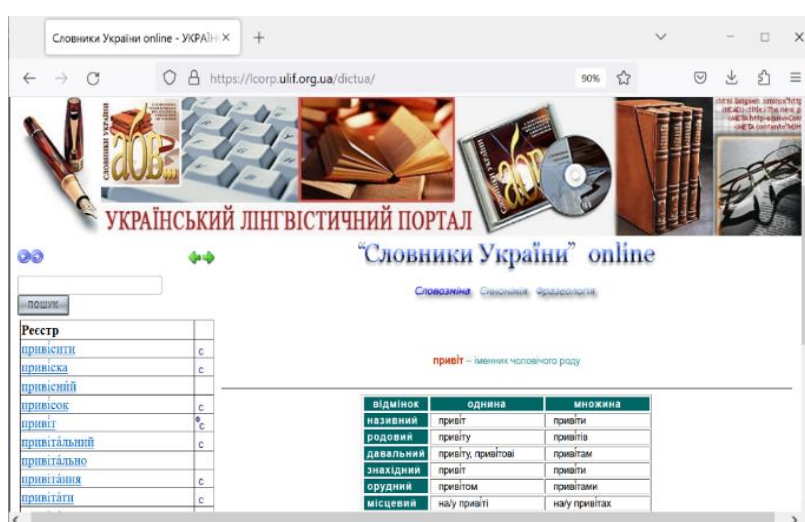


Figure 4: "Slovnyky Ukrainy online" in compliance with spelling changes.

We note the observance of the following non-alternative criteria: spelling **je**: *прое́ктний* [proiektnyi], *прое́ктантка* [proiektantka]; use **u** at the beginning of the word: *уч* [ych], *у́род* [yrod]

(only in one embodiment), *уродів* [yrodiv]; the spelling of complex words with foreign language components: *мінідержава* [miniderzhava], *мінідискусія* [minidyskusii], *вєбчат* [vebchat]; Complex words in the form of *дво-* [dvo-], *три-* [try-], *чотири-* [chotyry-]: *двоопуклий* [dvoopuklyi]; Double consonants: *святищенників* [sviashchennykiv], *святищенницький* [sviashchénnytskyi]. We do not see the spelling of words with the numerator of the *нів* [piv] since the dictionary does not present phrases like *нів острова* [piv ostrova], *нів Європи* [piv Europy], but the words *нівбак* [pivbak], *нівбаркас* [pivbarkas], *нівбог* [pivboh] is written correctly. However, unfortunately, the spelling of the token of ютубу [youtube], інстаграму [instagram], вайберу [viber] (7n criteria) is not reflected.

The imperfect dictionary variants: a) only the form of *Парижу* [Paryzhu], *Лондону* [Londonu] in the genit singular case, although Spelling norms-2019 presents variant forms of *Парижу* [Paryzhu] / *Парижа* [Paryzha], *Лондону* [Londonu] / *Лондона* [Londona]; b) nouns of the III cancellations with variant endings *-u* and *-i* (3v criteria) can be traced only in some words of *любові* [liubovi] / *любви* [liubovy], *Білорусі* [Bilorisi] / *Білоруси* [Bilorusy], but not parallel forms have been recorded: *радості* [radosty]; *соли* [soly], *кількості* [kilkosty]. Separate vocabulary articles, such as the tokens of *авдиторія* [avdytoria] та *аудиторія* [audytoria]; *катедро* [katedra] та *кафедра* [kafedra] have recorded other variant writings.

Schematic compliance with spelling changes in this source is reflected in Fig. 5.

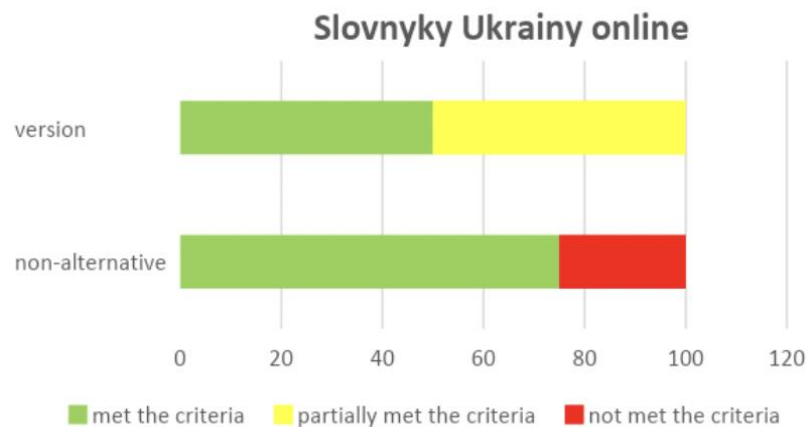


Figure 5: Display spelling changes in "Slovnyky Ukrainy online".

"Glosbe" [18] (Fig. 6) is a platform that provides free contextual translation dictionaries (translated sentences - the so-called translation memory).

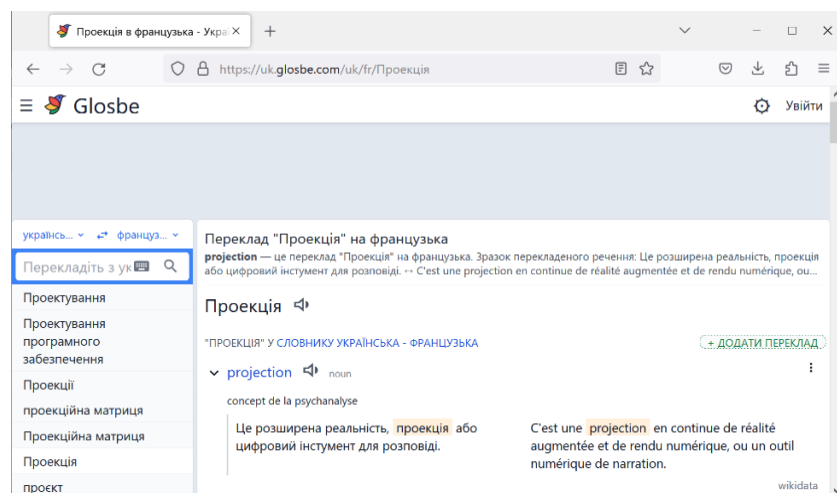


Figure 6: "Glosbe" in compliance with spelling changes.

Non-alternative changes in the vocabulary were partially recorded: spelling *je*: only in the word *проект* [proiekt], and in the derivatives left *e*: *проекція* [proektsiia], *проекційна матриця* [proektsiina matrytsia], *проектування програмного забезпечення* [proektuvannia prohramnoho zabezpechennia]; Use and at the beginning of the word: *икавка* [ykavka] is recorded, but not mentioned the exclamation *ич*, and other words are not mentioned; Complex county words are displayed in series: *двоопуклий* [dvoopuklyi]; the doubling of the consonants (*священник* [sviashchennyk]) is also recorded. We note that the 3n criteria is not fully observed: the spelling of complex nouns is presented through a hyphen: *мон-менеджер* [top-menedzher], *міні-драйвер* [mini-draiver], *міні-перекладач* [mini-perekladach], *веб-панку* [veb-papky]; Also, the criteria of 1n is not taken into account: writing words from *нів* [piv] (*ніввіку* [pivroku]) does not meet the norm of current Spelling-2019. Since the vocabulary is translated, the translation must be accurate, including spelling proper names. However, the 6n criteria for writing the letter of *ck* is not observed: *Діккенс* [Dikkens]. The dictionary completely ignores the variant criteria we analyzed: it does not propose an *авдиторія* [avdytoriia] / *аудиторія* [audytoriia] (1v criteria); Neither the *єфир* [efir] / *етер* [eter] (2v criteria), neither *любóви* [liubóvy] i *любові* [liubovi] (3v criteria) nor *з Парижу* [z Paryzhu] / *з Парижа* [z Paryzha] (4v criteria).

Schematic compliance with spelling changes in this source is reflected in Fig. 7.

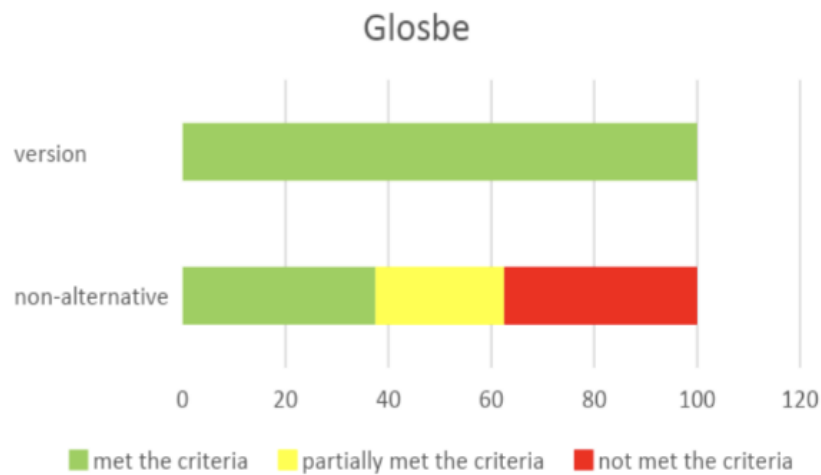


Figure 7: Display Spelling Changes in "Glosbe".

"Horokh" [19] (Fig. 8) is an online library that contains several dictionaries of the Ukrainian language: explanatory, phonetic, synonyms, etymological, phraseological, and affixal morphemes.

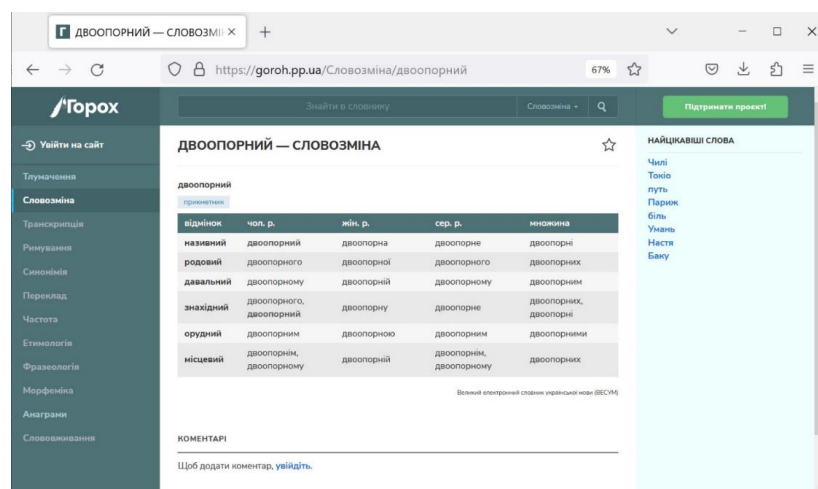


Figure 8: "Horokh" in compliance with spelling changes.

The "Word Change" section displays the words of the Ukrainian language according to their standard spelling. The section presents 6.3 million word forms for about 441,000 dictionary entries. On

this electronic platform, the norms are observed according to almost all non-alternative criteria, and comments were also submitted with a call for sections in the current Spelling-2019: spelling **-je**: *законопроект* [zakonoproiekt]; sound [j] in foreign words: *плеєр* [pleier]; indeclinable numeral **нів** [piv] with the meaning "half" with the following noun: *нів міста* [piv mista], *нів Європи* [piv Yevropy], *нів Києва* [piv Kyieva], *нів України* [piv Ukrainy]; the spelling of complex nouns: *вебсторінка* [vebstorinka], *віцеадмірал* [vitseadmiral], *топмодель* [topmodel], *тоннокілометр* [tonnokilometr], *людинодень* [liudynoden]; the spelling of compound words with a negative number: *двоопорний* [dvooporny]; doubling of consonants: *священник* [sviashchennyk]; site names in the genitive case are given according to the norms of current spelling: *ютубу* [yutubu], *інстаграму* [instahramu]. However, we should note that the use of **у** at the beginning of the word is given in the variants *іпод* [irod] / *упод* [yrod].

Variant spelling norms are partially reflected in the dictionary: the ending **-і/-у** in the genitive singular of *незалежності* [nezalezhnosti] / *незалежності* [nezalezhnosity], *радості* [radosti] / *радості* [radosty]; letter combination **au, ou** to indicate sound combinations [au], [ou]: *авдиторія* [avdytoriia] / *аудиторія* [audytoriia]; the letter combination **th** in words of ancient Greek origin *катедра* [katedra] / *кафедра* [kafedra] are recorded. Moreover, the names of the cities *Лондон* [London], *Париж* [Paryzh], *Ліверпуль* [Liverpul] in the genitive case are given with the inflection **-а/-я**, as it was in the previous version of the spelling. Note that in the "Word change" section, the form of the patronymic *Ігорьович* [Igor'ovich] is according to the current Spelling of 2019.

Schematically, compliance with spelling changes in this source is shown in Fig. 9.

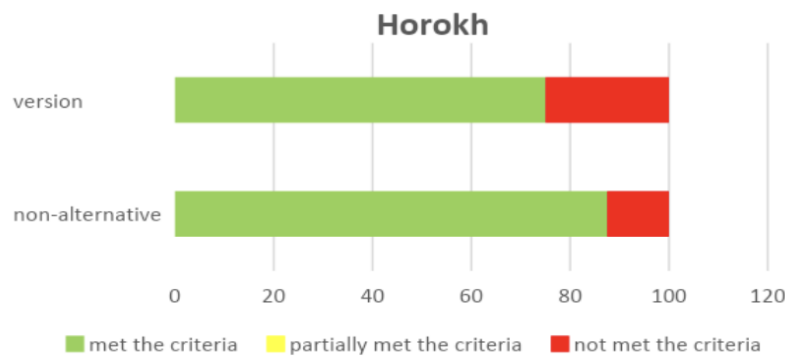


Figure 9: Display of spelling changes in "Horokh".

"Slovopedia" [20] (Fig. 10) is an electronic resource that is one of the complete encyclopedic publications in the Ukrainian-speaking Internet space and offers free access to numerous electronic sources.

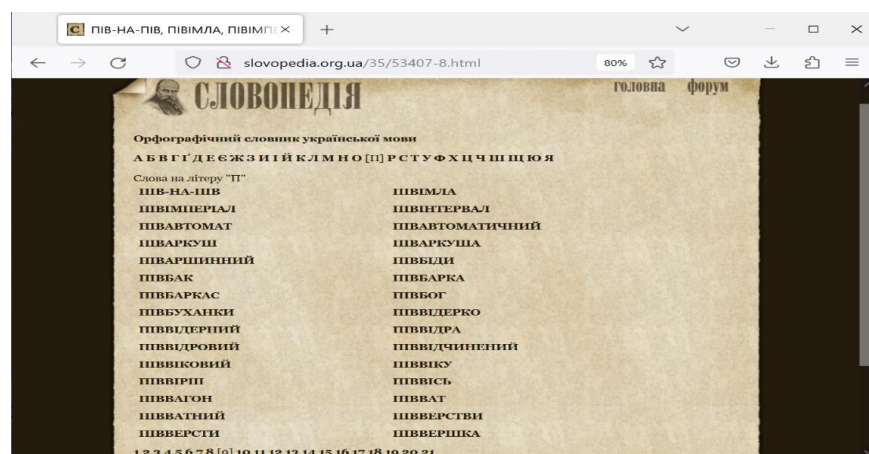


Figure 10: "Slovopedia" in compliance with spelling changes.

Analyzing the dictionary articles for compliance with non-alternative spelling norms, we discovered the following features:

- The use of **u** at the beginning of the word only in words of foreign origin, which does not correspond to the modern norm;
- The correct spelling of the lexemes *проект* [proiekt], *проекція* [proieksiia] only in the dictionary of S. Karavanskyi;
- Complex declination words (*двоопорний* [dvooporny]) and doubling of consonants (*священник* [sviashchennyk]) are recorded following the norm;
- Regarding the spelling of compound nouns: *тоннокілометр* [tonnokilometr], *мініавтомобіль* [miniavtomobil], we note the absence of these tokens;
- The spelling of words with the numeral **нів** is codified according to Spelling-2008: *ніввідра* [pivvidra].

Regarding variant criteria, the authors do not provide variant endings **-i/-u** in the genitive singular of *радоcтi* [radosti] / *радоcтu* [radosty], *любовi* [liubovi] / *любовu* [liubovy]; do not fix the variants **au**, **ou**. However, the dictionary records the letter combination **th** in words of ancient Greek origin *кате́дра* [katedra] / *кафе́дра* [kafedra].

Schematically, compliance with spelling changes in this source is shown in Fig. 11.

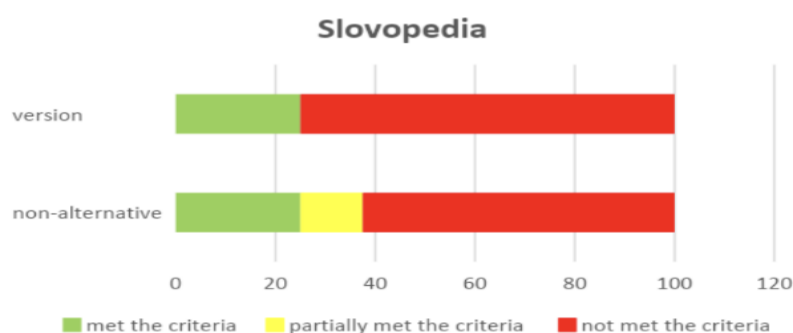


Figure 11: Display of spelling changes in "Slovopedia".

"Akademichnyy tлумachnyy slovnyk (ATS) 1970-1980" [21] (Fig. 12), which is based on the eleven-volume "Dictionary of the Ukrainian Language (SUM-11)", published in 1970–1980, became the first explanatory dictionary of the Ukrainian language in history.

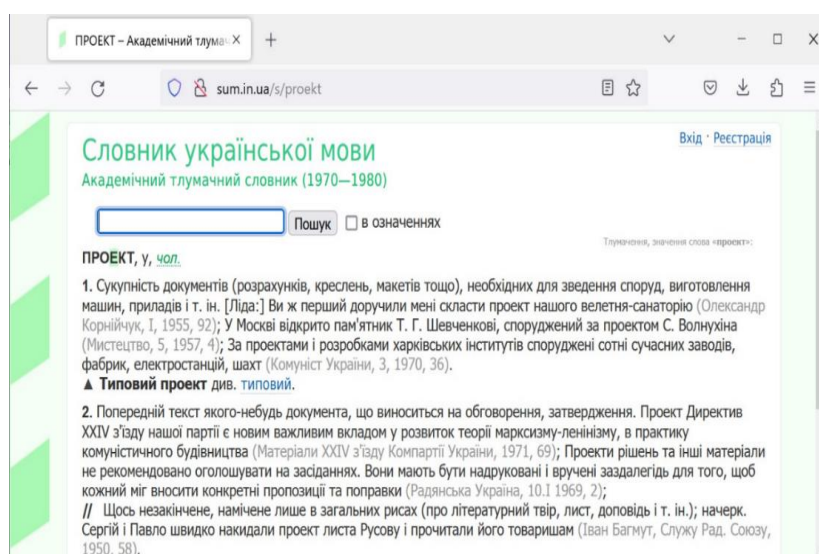


Figure 12: "ATS 1970-1980" in compliance with spelling changes.

Almost all modern Ukrainian explanatory dictionaries are based on it, notably the updated "Dictionary of the Ukrainian Language" in 20 volumes. Apparently, out of a desire to preserve the original wording, no-alternative criteria are not reflected in the dictionary:

- There is not used even **u** at the beginning of a word.
- The dictionary does not record the lexeme *проект* [proekt], *проекція* [proieksiia].
- Words with **nie** [piv] are written with a hyphen: *ніе-обличчя* [piv-oblychchia].

However, it is noted that this spelling is outdated. Interestingly, the dictionary records the numeral word *двоопуклий* [dvoopuklyi] in the Spelling edition of 2019, as well as the parallel use of *кафедра* [kafedra] / *кatedpa* [katedra]. These facts confirm the correctness of the changes introduced during the Spelling reform. Even in the 70s and 80s of the last century, such variants functioned, despite the spelling restrictions.

Schematically, compliance with spelling changes in this source is shown in Fig. 13.

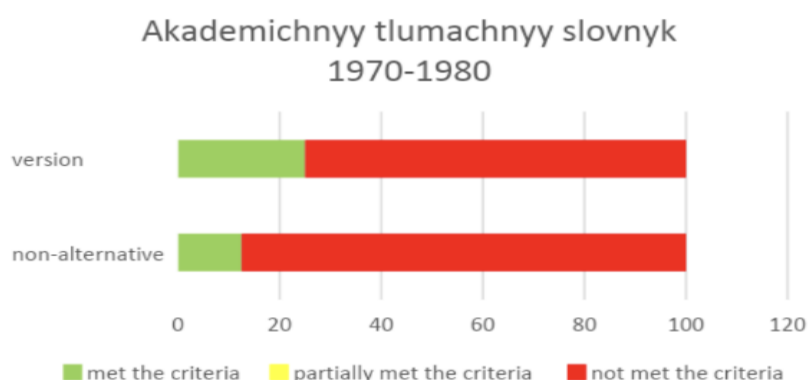


Figure 13: Display spelling changes in "ATS 1970-1980".

"Slovnky ukrayins'koyi movy online (SUMO)" [22] (Fig. 14) contains sections "Synonymy", "Spelling", and "Word Change", which has convenient navigation.

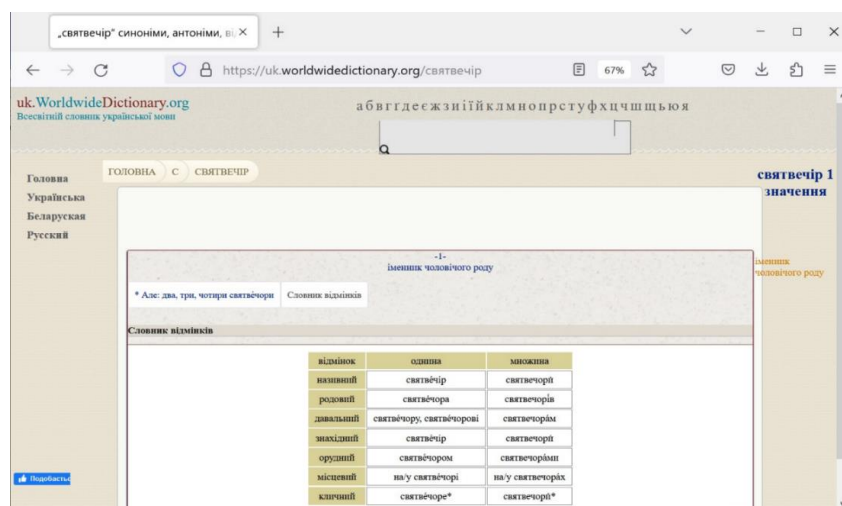


Figure 14: "SUMO" in compliance with spelling changes.

Mandatory changes in accordance with the non-alternative criteria are partially recorded in the dictionary: the spelling of words with **nie** [piv] (*нівмісяця* [pivmisiatsia]) does not meet the standard of the current Spelling-2019 (1n criteria); 4n criteria is also not met - the form with **e**: remains: *проект* [proekt]; the use of **u** at the beginning of a word (2n criteria) is given only in words of foreign origin; the spelling of compound nouns according to 3n criteria is not given according to the current norm: *віце-спікерство* [vitse-spikerstvo], *міні-держав* [mini-derzhava], there is no doubling of consonants in the word *святишник* [sviashchenyk]. Only 8n criteria is met: *двоокис* [dvoookys], *двооксид* [dvoooksyd]. From the variant norms, 2v criteria was observed regarding the words *кафедра* [kafedra]

i катедра [katedra]. Schematically, compliance with spelling changes in this source is shown in Fig. 15.

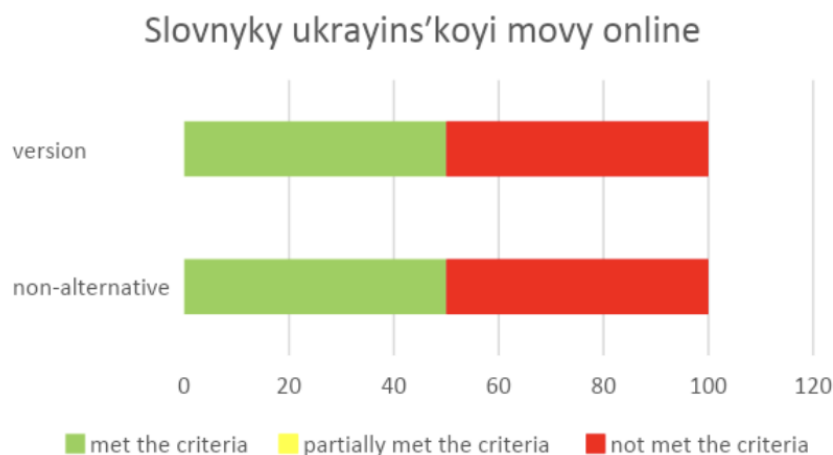


Figure 15: Display spelling changes in "SUMO".

"Slovnyk ukrayins'koyi movy online. Volumes 1-13 (A-POKÍRNO) (SUM-20)" [23] (Fig. 16) is a part of the National Dictionary Base of the Ukrainian Language and Information Fund, which, by order of the Cabinet of Ministers of Ukraine, is included in the scientific objects that constitute national property.

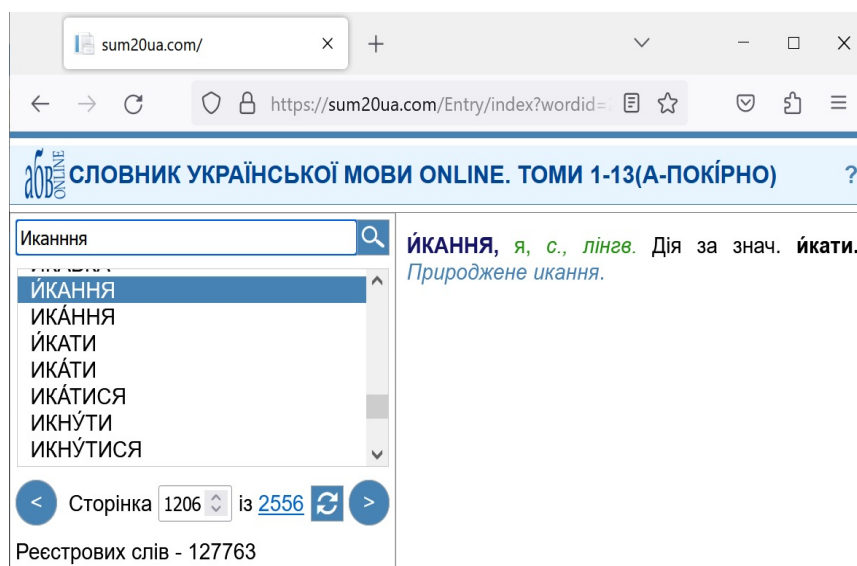


Figure 16: "SUM-20" in compliance with spelling changes.

Out of 20 volumes, only 13 volumes have been digitized to date.

We confirm compliance with the following non-alternative criteria: the use of *u* at the beginning of a word: *уч [ych]*, *упій [yrui]*, *икавка [ykavka]* (almost all lexemes recommended in Spelling-2019 are fixed); the spelling of words with the numeral *нів [piv]*: *за нів години [za piv hodyny]*, *за нів дня [za piv dnia]*; the spelling of compound words: *двоокий [dvooky]*, *двоосьовий [dvoosovyi]*.

However, the spelling of complex words with foreign language components is fixed with a hyphen, which does not correspond to the norm of the current spelling: *міні-футбол [mini-futbol]*, *веб-ресурс [web-resurs]*. We note in the dictionary variant forms *авдиторія [avdytoriia]* та *аудиторія [audytoriia]*; *катедра [katedra]* та *кафедра [kafedra]*. However, no parallel forms of *любови [liubovy]* and *кількості [kilkosty]* have been recorded as there were given only forms of *любові [liubovi]*, *кількості [kilkosti]*. Since the dictionary is incomplete, proper names are not codified in it, so we cannot check the spelling according to several criteria.

Schematically, compliance with spelling changes in this source is shown in Fig. 17.

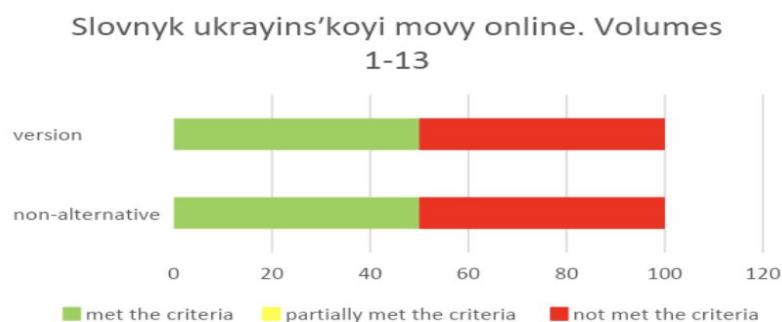


Figure 17: Display of spelling changes in "SUM-20".

"Orfohrafichnyy slovyk ukrayins'koyi movy (OSUM)" [24] (Fig. 18), according to the authors, has 198,905 words.

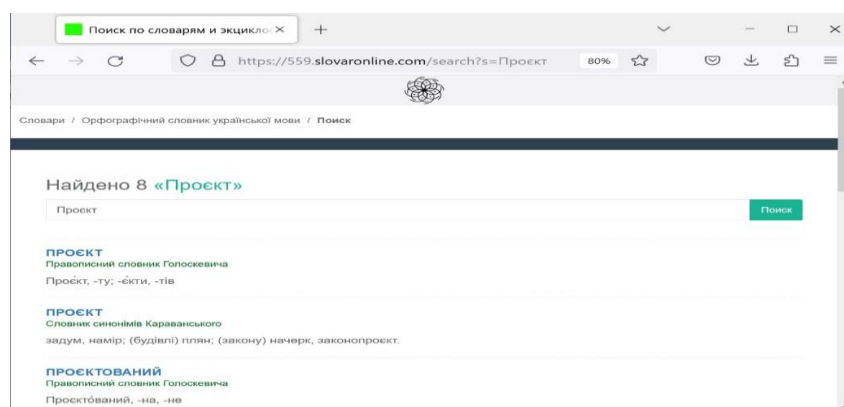


Figure 18: "OSUM" in compliance with spelling changes

Mandatory changes in the dictionary are recorded: the use of **u** at the beginning of the word: *урод* [yrod], *упію* [yrii] is given in the dictionary with an explanation of the meaning and examples from the literature. Complex numeral words (*двоосновний* [dvoosnovnyi]), the spelling of complex nouns (*вебсторінка* [vebstorinka], *тоннокілометр* [tonnokilometr], *віцеадмірал* [vitseadmiral]), the spelling of **je** (*проект* [proiekt], *проекція* [proiektiia]) is written according to the standard of current spelling. The spelling of words with **niv** [piv] does not correspond to the current norm, a *ніваркуша* [pivarkusha], *нівола* [pivkola] is recorded; doubling of consonants in the lexeme *святишченик* [sviashchenyk] is not recorded, that is, 1n and 5n criteria are ignored. The authors present alternative changes: the letter combination **au**, **ou** to indicate the sound combinations [au], [ou]: *авдиторія* [avdytoriia] / *аудиторія* [audytoriia]; letter combination **th** in words of ancient Greek origin: *катодро* [katedra] / *кафедро* [kafedra]. However, the dictionary does not record the variant endings **-i/-u** in the genitive singular: *радошти* [radosti] / *радощи* [radosty], *любови* [liubovi] / *любви* [liubovy].

Schematically, compliance with spelling changes in this source is shown in Fig. 19.

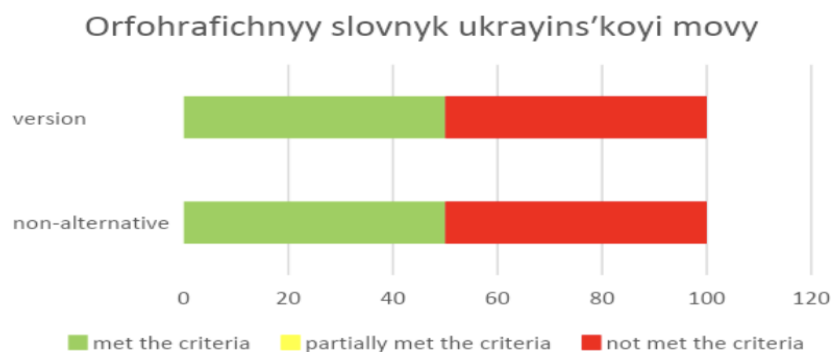


Figure 19: Display of spelling changes in "OSUM".

5. Experimental results of the discussion

The analysis of electronic lexicographical works makes it possible to state that these publications fulfill the relevant task in the current conditions - to introduce modern means of automation to the process of lexicography. In general, research sources meet the following criteria: access to language units in electronic form, which contributes to the constant enrichment of electronic dictionary resources, the ability to make corrections, and improve the lexicographic description of registry words; active use of concepts of traditional lexicons; characterization of lexemes taking into account their function and usage in the modern Ukrainian language.

As for compliance with spelling norms according to the criteria chosen for the study, the dictionaries included in the analysis show considerable heterogeneity. Based on the analysis of the most popular electronic lexicographic works, which became the sources of this study, we trace the following pattern of codification or lack of codification of orthographic norms following the current spelling of 2019, which is reflected in Table 3.

Table 3

Implementation of spelling changes in analyzed electronic dictionaries

Criterion	1 Slovnyk.u a	2 SUO	3 Glos- be	4 Horokh	5 Slovo- pedia	6 ATS 1970- 1980	7 SUMO	8 SUM- 20	9 OSUM
1n.	+	–	+	+	–	–	–	+	–
2n.	+	+	+-	+	–	–	–	+	+
3n.	+	+	–	+	–	–	–	–	+
4n.	+	+	+-	+	+-	–	–	+	+
5n.	+	+	+	+	+	–	–	–	–
6n.	+	+	–	+	–	–	–	–	–
7n.	+	–	–	–	–	–	–	–	–
8n.	+	+	+	+	+	+	+	+	+
1v.	+	+	–	+	–	–	–	+	+
2v.	+	+	–	+	+	+	+	+	+
3v.	–	+-	–	+	–	–	–	–	–
4v.	+	+-	–	–	–	–	–	–	–

As our research demonstrates, none of the electronic dictionaries taken for analysis has fully introduced the innovation of the current Ukrainian spelling. Several electronic dictionaries – "Slovnyk.ua", "SUO", "Horokh" – adhere to the norms of modern Ukrainian spelling according to most of the studied criteria. However, many regulatory innovations were not observed in almost all the studied sources, in particular, according to criteria 4v (version ending in the genitive singular *-y/-ю* і *-а/-я*: *Парижа* [Paryzha] і *Парижу* [Paryzhu]), 7n (writing website names *твітер* (twitter), *мережа «Фейсбук»* [meresha «Feisbuk»]), 6n (reproduction of loanwords from English, German, Swedish and some other languages *ck* with ukrainian letter *к*: *Дікенс* [Dikens]). This may be due to the low frequency of the corresponding lexemes. However, we state that ignoring the prescriptions of modern Ukrainian spelling requires immediate correction.

It is expedient to draw the attention of the authors of electronic dictionaries to the fact that they adequately and competently reproduce the spelling of tokens entered into their composition. Separately, we focus on the Academic Explanatory Dictionary (1970–1980), noting that it preserves the old spelling version. We believe it would be correct to display in this dictionary also the spelling following the current norms, which would contribute to the elevation of the linguistic culture of the users.

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