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INNOVATIVE DIGITAL TERMINOLOGY, TEACHING ENGLISH FOR SPECIFIC PURPOSES AND ACTIVATING NEURO-COGNITION *

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Abstract

Contemporary scientific terminology is most extensively developing in computer sciences and text processing domains: digital technologies at present are mostly innovative, extremely quickly developing and producing their own new sophisticated terminology and their own new complicated patterns. Thus, the paper is devoted to the crosslinguistic problems in translating innovative extended terminological language-specific “digital” collocations from English into Russian. Particular attention is paid to their crosslinguistic asymmetry and how to overcome it in their translation, as they have not yet their dictionary counterparts in Russian (and in any other language), and cannot be translated word by word (either by humans or automatically). Translating them demands special professional knowledge and linguistic competence (which almost equals to that of a native speaker) to make their translation sound “contextually”, idiomatically, and pragmatically correct. That is why their translation presupposes teaching and using special mental professional operations: explication, implication, and normalization (in representing their meaning), and implies creativity. This (once more) testifies to the asymmetry of the human mind which generates human’s language asymmetry. The latter is becoming the most important stimulus in cognitively activating of both human brain’s hemispheres and the

whole of human's neurological systems. Special attention is attracted to the deviations and errors made by the gen-AI-translations of extended "digital" terminological units from English into Russian and the need to correct them. The corresponding procedures can be used in improving not only innovative digital "Natural Language Processors", but teaching English and English-Russian technical translation as well. As a result, human language and its dynamic characteristics generate and direct human cognitive distinctions and behavior, as well as neurological reactions, testifying to the effect that language plays a central role in the evolution of human life and mind, as well as in the evolution of his cognitive and neurological systems by activating and developing both of them.

Keywords: innovative extended terminological language-specific digital collocations in English; asymmetry in cross-linguistic correspondences; English-Russian translation; human creativity, language as an activator of cognitive and neurological systems.

1. Introduction

The academic writing, especially English for academic purposes, has been attracting scientific attention from the very moment of its appearance (cf. Cristal, 2001; 2006, etc.). Particular attention is attracted by its cross-linguistic asymmetry with other languages, as it includes mostly complex syntactic constructions of terminological character that are similar to collocations and are language-specific word combinations that cannot be translated word by word into any other language and thus need specific subject-matter knowledge and many other linguistic and extralinguistic competences (cf. Swales, & Feak, 1994; Lakić, Živković, & Vuković, 2019; Jomaa, & Alia, 2019, pp. 361–382; Wua, et al., 2020, pp. 1–13; Albakry, & Bryan, 2025; Abaalkhail, 2026, etc.).

At present most scholars consent that language as a mental faculty is a part of human cognitive and neurological processes. As an innate mental faculty with the unique capacity to produce endless combinations of sentences (as well as various expressions, collocations, etc.) from a finite set of elements (Berwick, & Chomsky, 2015; Chomsky, 2016; Baggio, 2022), language is thus functioning at multiple interconnected levels. This provokes to converge language as an intricate blend of externalized behavior, cognition, and neurological processes: language serves not only as a modulator within human cognitive and neurological systems (Cui, Ren, Zhou, 2025), but as their activator as well. It helps find and generate innovative and creative decisions,

words and word meanings, and their new combinations, as well as “to do many (other) things with words” (Lakoff, Johnson, 1980; Austin, 1962): to write novels, poetry, to produce jokes, etc.

At present one of the most urgent problems in contemporary professional digital communication is provoked by its active introduction of new digital extensive terminology in English, which is permanently developing, renewed, and supplemented by a vast variety of newly introduced technical notions. Such English extended terminological language-specific collocations-neologisms are too complex to be processed by digital instruments, including generative Artificial Intelligence (gen-AI) ones.

The paper is organized in the following way. Paragraph 1 (Introduction) shows the problem of translating the innovative language-specific terminological patterns of digital technologies. Paragraph 2 is devoted to describing theoretical and applied background of contemporary digital terminology in English: its language specific patterns, complex linguistic distinctions and problems of its translation. Paragraph 3 is devoted to linguistic materials of the present research and the ways of translating innovative terminology from English into Russian. Paragraph 4 focuses on the asymmetry in language, mind and speech. Paragraph 5 is discussing neurological mechanisms, connecting human mind and linguistic competence in translating new terminology. Paragraph 6 (Conclusion) supposes that connecting the modulatory and stimulating the role of language in cognitive and neurological systems, one can open new directions for research with significant implications for understanding human development, neuroplasticity, and the treatment of cognitive problems.

2. THEORETICAL AND APPLIED BACKGROUND. CONTEMPORARY DIGITAL TERMINOLOGY IN ENGLISH: ITS LANGUAGE SPECIFIC PATTERNS, COMPLEX LINGUISTIC DISTINCTIONS AND PROBLEMS OF ITS TRANSLATION

Contemporary digital technologies, including generative Artificial Intelligence – gen-AI, produce an unprecedented volume of professional terminology which is (English) language specific and exposes human creativity, its cognitive and prospective character, as well as language potentialities and its extensive and intensive character. As the main volume of digital terminology is introduced in English, it makes it obligatory for other language speakers and professionals to study and learn it, as well as (mostly) translate it into their native languages.

Professional digital terminology, particularly in English, has very important inherent characteristics that are cognitively, communicatively, pragmatically, stylistically and grammatically language-specific.

The English Grammar provides a very compact noun plus noun (plus noun, etc.) core grammatical construction, which can be almost infinitely extended by similar elements (nouns), as well as by other types of constructions with adjectives, adverbs, gerunds, etc. components, thus compressing professional information and making it communicatively concise and complex, pragmatically compact (and make it possible to insert it into other terminological constructions), stylistically transparent (for native speakers), and cognitively charged; e. g. *an informative critique generation model for evaluation of large language model generation; step-wise preference optimization for long-chain reasoning of llms; the largest public dataset in ai4maths with 860k pairs of competition math problems and solutions*, etc. Cf. paper titles: “*Solving math word problems with process- and outcome-based feedback*” (arXiv preprint arXiv:2211.14275, 2022); “*Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks*” (Amsel, etc. 2026a; cf. Salager-Meyer et al., 2013).

Extended terminology in English has a large number of individual language-specific characteristics: it is compact, more informative (in comparison with “descriptive constructions”), can include further precisising components – is attracting potentially “supplementary information”, and thus can transmit quite exact, precise and important detailed new information and compressed knowledge, e. g. “*Learning Transferable Visual Models from Natural Language Supervision*” (Radford et al. 2021); “*The Polar Express: Optimal Matrix Sign Methods and their Application to the Muon Algorithm*” (Amsel et al., ICLR–2026). (For further details, see Appendix “Linguistic Resources”: Authentic Linguistic Information and Terminology in English).

Thus, (most) contemporary digital terminology in English consists of multiword constructions, generated according to extended combinatory terminological patterns and units in English (for their detailed description, see for example, [Riabtseva, 2024], and in most cases is **automatically** (including gen-AI) **translated** into Russian **incorrectly**, with failures and deviations. This fact testifies that understanding texts, particularly professional ones and their production is quite a cognitively charged procedure. “Compiling” (introducing) new digital terminology is, in its turn, quite a creative activity: terminology should be readable, understandable, usable and promise further extension. Most of such extended terminological units are used not only in the text’s body, but in its title as well; e. g. new paper titles:

(1) “**Omni-math**: *A universal Olympiad level mathematic benchmark for large language models*” (arXiv preprint arXiv:2410.07985, 2024);

(2) “**Meta-rewarding language models: Self-improving alignment with llm-as-a-meta-judge**” (arXiv preprint arXiv:2407.19594, 2024);

Cf. *their gen-AI translation* with the wrong choice for the first component in example (1a), as well as for other components given in **bold** (and *- marked) in example (2a):

(1a) “?Omni- Math: универсальный математический бенчмарк олимпиадного уровня для больших языковых моделей”;

(2a) “*Метанаграждение языковых моделей: *самосовершенствующаяся *согласованность *с использованием большой языковой модели в качестве мета- судьи”.

3. MATERIALS: WAYS OF TRANSLATING INNOVATIVE TERMINOLOGY

Translating innovative terminological units from English into Russian, particularly concerning automatic Natural Language Processing (NLP) presents considerable difficulties (for both humans and gen-AI) for a number of reasons: 1) they cannot be translated word by word as their patterns are language specific; 2) the corresponding terminology is actively and permanently developing (e. g. including new elements in its structure); 3) it develops more quickly than (professional / online) dictionaries are able to fix it and introduce; 4) inability of automatic text processing systems to be updated as quickly as the newly introduced and activated text processing innovative terminology develops; 5) inability of automatic text processing systems to promptly and correctly process (translate) innovative terminology due to its complex nature and complicated structure.

As a whole, (innovative multi-word) digital terminology in English is thus language specific and demonstrates cross-linguistic asymmetry between most languages. This fact makes it word by word translation impossible (in most cases). In studying the principles of its translation from English, one should have knowledge in the corresponding (technical) field, its (already) existing English terminology (as well as English itself) and be ready to creative linguistic activity. The latter, in its turn, addresses not only cognitive human abilities (and mind), but neurological systems as well [Cui et al., 2025]. Language becomes their stimulator and thus is able to generate contextually, idiomatically and pragmatically valid correspondences in its native

language by using such creative translational operations, as explication (adding a logically valid word), implication (implying it), and normalization – using one’s own language-specific formulas, clichés, formulary patterns, grammatical rules, stylistics, etc., in their translation, cf. [Riabtseva 2026]:

1. explication – adding some communicatively “natural” and logical component to the expression in Russian when translating some terminological expression from English into Russian, which has no word by word equivalent to the English expression, cf. *meaning-oriented classification of collocations* – «классификация словосочетаний **по их** значению». Thus, most often English compact terminological collocations-neologisms should be translated into Russian by adding some explicating and “language-specific” elements to make them sound natural in Russian, cf. *up-market reference tools (online resources)* – ‘**конкурентоспособные лексикографические справочники (онлайн ресурсы) нового поколения**’. Often the context presupposes most explicit expression of the corresponding meaning in Russian, cf. *data-driven economy* – ‘**ориентация на информационные потребности (самых разных) специалистов**’. The situation is quite natural as most linguists state that Russian in general and in its terminology in particular gives its users the opportunity to express themselves and their ideas explicitly and “extensively” in comparison to English, while the latter is trying to be most concise and “compressing” them, cf. [Cristal, 2006]. That is why when translating new innovative multi-word digital terminology from English into Russian demands not only background professional and encyclopedic knowledge in the field, but as well “feeling” the communicative differences between the languages and use one’s creative abilities in transforming innovative terminological expressions from “economic” English to more “liberal”, “wordy” and “explicating” Russian.

2. implication (omitting some superfluous element), cf. **-based** in “*corpus-based approach (to teaching a foreign language)*” vs. «корпусный подход к обучению иностранному языку»; “*web-based lexicographic management system for multilingual data bases*” – «система лексикографического веб-управления для многоязычных баз данных»; - **driven**: “*in a (basically) technology-driven way*” – «(преимущественно) **технологичным** образом» и т. д.

3. normalization (making the translation sound correctly in one’s native language); cf. “*domain*” vs. “**предметная область**” in the terminological expression in English vs. in its translation: “*domain-independent transdisciplinary computer terminology*” — «**независимая от предметной области междисциплинарная компьютерная терминология**». For example,

when “normalizing” a foreign language equivalent to that of one’s native language, the translator should make a number of mental and communicative operations. He should stick to a great number of his native language’s norms and rules, such as the necessity of correctly using prepositions, cases, number, gender, word order and word combinations, and many others, cf. the “normalization” of the rather usual (complex) English expression *computer-supported collaborative writing* with its valid Russian translation: “корпоративное письмо **при поддержке** компьютера”. It is obvious that such “encyclopedic” procedures presuppose professional knowledge, translational education and experience, that is, background knowledge, as well as “professional intuition”. More often, translation presupposes even “re-organizing” the whole construction, e. g. *web-based lexicographic tool* – «лексикографический **веб-инструмент**»; *web-based lexicographic management system for multilingual data bases* – ‘**система** лексикографического **веб-управления** для многоязычных баз данных’.

Such mental, logical, normative, communicative and discourse operations – **explication**, **implication**, and **normalization** in general are called “translation universals” (Van Oost et al., 2016, p. 7; DePalma, 2017). Thus, the translator should have enough knowledge in English, enough encyclopedic / extralinguistic, background, subject-matter and professional knowledge in the corresponding subject field, as well as professional linguistic competence in both languages to trigger the need to use the patterns that should be used correctly. Neither of opportunities to find the right (and “natural”) correspondence for an English extended (digital) terminological construction in one’s own language is accessible for most computer translators yet (Fuertes-Olivera, 2023, p. 22).

That is why neurologists propose that language, due to its profound, accessible, and widespread neurological activation, “serves as a leading modulator of cognitive and neurological systems” (Cui, Ren, Zhou, 2025). This perspective provides new insights into the interconnection between language, cognition, and brain function.

4. STUDY AND RESULTS: ASYMMETRY IN LANGUAGE, MIND AND SPEECH

Human linguistic competence is mostly subconscious, complex, cognitively charged and creative [Chomsky, 2002]. It provides the native speaker with language knowledge how to speak and understand speech, how to combine words idiomatically, contextually correctly and in a pragmatically valid way. Human linguistic competence is language specific and thus

asymmetric in nature (one word can have several meanings, and the same meaning can be expressed by different words), and is determined by the *asymmetry* of the human mind (“intelligence”) in general. That is why all languages differ from one another and imply translation.

Digital terminology in English is native, authentic, and original (not translated from another language), is mostly language specific and consists predominantly of new extended terminological collocations-neologisms (most of) which have not yet their dictionary counterparts in other native languages, particularly in Russian. The fact that scientific language is still (and always) develops can be once more confirmed by the “unpredicted” appearance of quite new types of scientific paper titles given in (3) and (4), which are not yet translatable (at least) into Russian. Their leading component is a kind of fusion of two rather autonomous components, which are question marked in their AI-translations, being “alien” to a native Russian speaker, cf. (3a) and (4a):

(3) “**Olympiadbench**: A challenging benchmark for promoting AGI with Olympiad-level bilingual multimodal scientific problems” (Proceedings of the 62nd Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers), pages 3828–3850, 2024).

Vs. *gen-AI translation*:

(3a) “**?Olympiadbench**: сложный бенчмарк для продвижения общего искусственного интеллекта (AGI) с двуязычными мультимодальными научными задачами олимпиадного уровня”.

(4) “**SWE-bench**: Can language models resolve real-world ?github issues?” (The Twelfth International Conference on Learning Representations, 2024).

Vs. *gen-AI translation*:

(4a) “**?SWE-bench**: Могут ли языковые модели решать реальные проблемы (задачи) на ?github?” (Двенадцатая международная конференция по представлениям обучения, 2024).

As a whole, the extensive, innovative character of current digital terminology in English provides its **cognitive function of compressing** information by using traditional and innovative **transparent** combinatory patterns in generating new digital terminology. (For more details, see Riabtseva, 2024). The main problem in translating texts, terminologies (and many other linguistic artifacts, such as poetry, humor, etc.) is that they **cannot be translated word by word**,

literally, as they are “asymmetric” in nature. That is the main problem for “digital” translation, including gen-AI translation into Russian; cf. (5a) – incorrect gen-AI translation of the “digital” term, which cannot be used in a connected text, and in which the mark (*) means incorrect correspondences:

(5) *process-oriented writing help with the digital writing support*

vs. *gen-AI translation*:

(5a) “поддержка *письма, *ориентированная *на процесс, *с помощью *цифрового помощника *для письма”.

The inherent feature of such English complex expressions (“contextual terminological collocations”) is that they can be generated ad hoc: within this particular paper and context, and thus they are mostly not supposed to be at all included (and found) in (professional) dictionaries.

Digital terminology develops more quickly than even digital dictionaries can trace and spot it in time, thus demanding its “pre-dictionary” translation by its reader (and user). Its translation implies not only English language knowledge, but the present state of professional knowledge in this particular domain as well. Human cognitive processing of such extended (digital) terminology starts with finding its core noun plus noun combination, then their defining dependents, besides, their particular place before their “host” and thus their arrangement, etc. That is why this particular subject becomes quite urgent and demands introducing into higher school education, not last, but not least, because of its idiomatic character.

The human language asymmetry exposes the human mind’s asymmetry and activates it in various cognitive situations and thus stimulates human neurological systems. As a result, human language and its dynamic properties try to actively and correctly combine words, speech, creative acts and deeds as well as one’s various neurological and cognitive reactions to the reality, speech and behavior. This testifies to the fact that language played and still plays the central role in human evolution, his life, mind and neurology as being their activator and “promoter”.

One of the (still) intriguing linguistic question in this domain is that how one should correctly “arrange” the order of components within a complex (foreign) construction or pattern (when translating it). For example, can different words in various extended patterns and expressions, one of which being *innovative extended terminological language-specific digital collocations in English* (and many various other) exchange their places with each other within it, or is their arrangement (should be) fixed by some language “instructions” (and feelings)?

5. DISCUSSION. NEUROLOGICAL MECHANISMS, HUMAN MIND AND LINGUISTIC COMPETENCE

Neurology being quite specific field of knowledge close to humanities research, now is extending over its discipline's boundaries and helps to more profoundly explain human extraordinary and defining ability to speak and think with the help of words. Instead of interpreting Noam Chomsky's language's dual functions in sensorimotor externalization and conceptual-intentional thought [Chomsky, 2002], neurology now detects its broader role as a modulator of cognitive and neurological systems, which still remain underexplored, but promise new perspectives in various directions. In particular, neurologists propose that language, due to its profound, accessible, and widespread neurological activation, serves as the main modulator of these systems. This perspective provides new insights into the interconnection between language, cognition, human mind and brain function. Moreover, this concept positions language and linguistic ability as a dynamic force shaping cognitive functions, behavioral responses, and neurological pathways, highlighting its central role in the human experience, cf. (Cui, Ren, Zhou, 2025].

Thus, neurology emphasizes that language plays the main role not only in communication but in shaping the very systems that underlie cognition and brain function, particularly that language is tightly integrated with cognitive processes like reasoning, conceptualization, etc. By exploring the modulatory and stimulating the role of language in cognitive and neurological systems, one can open new directions for research with significant implications for understanding human development, neuroplasticity, and the treatment of cognitive problems. That is why three key “human language features: its infinite power to build on a finite structure, the linking of sound to ideas, and the intrinsic connection between language and thought ... make human language an innate mental faculty with the unique capacity to produce endless combinations of sentences from a finite set of elements” (Cui, Ren, Zhou, 2025, p. 1).

6. CONCLUSION. LANGUAGE AS AN ACTIVATOR OF HUMAN COGNITIVE AND NEUROLOGICAL SYSTEMS

Neurolinguistics' fundamentals traditionally focus predominantly on studying language processing, language acquisition, literacy, speech and language disorders, etc. (Baggio, 2022). One of the most urgent contemporary problems in the neurolinguistic field now is language creativity, the linguistic creativity being one of the most important of them. How humans

introduce new words and word meanings, new word collocations, particularly new terminology, its new extensions, etc.

The fact is that contemporary digital terminology is extensively and intensively developing (as digital studies themselves), thus becoming more complex, many-componential, is permanently and constantly renewed. It cannot be automatically translated (in many cases) from English (as its source language) into another (foreign) languages word by word. As previous and latest analyses of the problem show (Riabtseva, 2023–2026), extended terminological units are under-translated, “over-translated”, or incorrectly translated into foreign languages (particularly into Russian).

Thus, human language as the most deep, dynamic, active and accessible property of the human mind, is becoming the main connector between his cognitive abilities and his neurological distinctions, and becomes their activator and developer. Human linguistic activity is creative in nature and is permanently developing and enhancing (human) cognitive functions, and thus, in its turn, is not only activating cognitive human abilities (and mind), but even re-arranging neurological connections and systems as well. Particularly important is that “language is not merely a tool for communication, but a powerful influence on brain organization and its cognitive functions, as the neural systems supporting language processing “underpin a range of higher-order cognitive functions, including memory, attention, executive functions, and social cognition”, cf. [Cui et al., 2025, p. 6]. That is why specialists state that “language is promoting human evolution and child development” (Ibid.) in general.

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Appendix. “Linguistic Resources”

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