Lexical Innovation in Business Colour Idioms: Evidence from Large Language Models in Five Languages

Giedre Valunaite Oleskevicienė[1], Ágnes Abuczki[2], Ganit Richter[3], Berat Ujkani[4], Vera Moitinho de Almeida[5], Pedro Madeira[6]

[1]Faculty of Human and Social Studies of Mykolas Romeris University; [2]Károli Gáspár University of the Reformed Church in Hungary; [3]Management Information Systems, School of Business Administration, The College of Management Academic Studies; [4]Faculty of Mechanical and Computer Engineering of University "Isa Boletini" in Mitrovica; [5]Faculty of Arts and Humanities of the University of Porto; [6] Independent Researcher

[1]Ateities 20, Vilnius, Lithuania; [2]Reviczky u. 4. 1088 Budapest, Hungary; [3]Elie Wiesel 2, Rishon LeTsiyon, Israel; [4]Ukshin Kovacica, 40000 Mitrovica, Kosovo; [5]Via Panorâmica, s/n, 4150-564 Porto, Portugal

[1]gvalunaite@mruni.eu, [2]abuczki.agnes@kre.hu, [3]ganitri@colman.ac.il, [4]berat.ujkani@umib.net, [5]vmoitinho@letras.up.pt, [6]pedromadeira1@gmail.com

Abstract

Lexical innovation refers to the process of creating new lexical items, enabling languages to adapt to evolving socio-cultural and material realities. The domains of business, economics, and finance are among the most productive ones of lexical innovation. The present research study lies at the intersection of lexical innovation, idiomaticity, and large language model (henceforth, LLM) research and investigates lexical productivity, semantic shift, and globalisation (Anglocentric changes) in business-related colour idioms by comparing human translation and annotation with the output of LLMs. The current experiment involves an initial study carried out for five languages: English (the pivotal one), Albanian (AL), Hebrew (HE), Hungarian (HU), Lithuanian (LT), and Standard European Portuguese (PT). The research results reveal that LLMs show high mutual agreement, but the agreement with humans is lower. The internal consistency of LLMs reflects shared Anglocentric metaphor encoding rather than convergence toward human idiomatic usage. It demonstrates that human expertise remains essential for high-quality idiomatic translation, particularly for culture-specific expressions.

Keywords: lexical innovation, LLMs, idioms

1. Related Research

Lexical innovation is a process of creation or adaptation of words or terms that allows languages to adapt to constantly changing technological and scientific contexts, as well as to the global influence of the multiplicity of cultural and social contexts. The lexical innovation process involves the introduction of new words and meanings into the lexicon of a language and promotes linguistic evolution, allowing languages to dynamically adapt to changes by introducing new concepts representing new technologies and integrating social and cultural shifts (Armstrong, 2016). Frequently, lexical innovation is related to the emerging new technological domains and developing technical domains that are characteristic of the emergence of new concepts, which demand precise designators. However, lexical innovations are also inherent in informal and literary language. Grieve et al. (2018) distinguish three main types of lexical innovations: formal neologisms, which comprise completely new words in the language; neo-semantic innovations, which make the process of new meanings assigned to existing words; and borrowings and calques, which are imported units from other languages or morphological translations.

The contexts like business, finances, and economics are considered among the most productive of lexical innovation, leading to the introduction of new technical words (Llopis and Sánchez-Lafuente, 2012). The authors observe that lexical innovation in the field is mostly related to the English language, which has an impactful influence as a lingua franca and also introduces the main lexical innovations in the different fields of science, technology, and the world of business and finance. It is related to the dynamism of the business area, which traditionally introduces new forms of investment and innovative financial mechanisms in the major world financial hubs, accumulating wealth and implementing cutting-edge ways to make money. Economic and capital diversification processes lead to the need for lexical innovation to define new business practices. In short, lexical innovation in the field of business comprises both the introduction of new terms and the adaptation of existing ones to innovative business and social contexts.

Neology detection studies are closely related to the domain of semantic change, which has recently been researched through computational approaches. Traditionally, neology detection involves corpus-based frequency analysis, lexicon comparison, and rule-based morphological processing (Kerremans & Prokić, 2018). Tahmasebi and Borin (2018) discuss

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computational techniques to tackle lexical semantic change by providing the semantic change types from the computational perspective, including lexical replacement, named entity change, role changes, and temporal changes. The authors discuss distributional and embedding-based methods to identify semantic change by applying semantic vectors, topic distributions, and contextualized neural embeddings.

2. Research Experiment and Methodology

The current study involves an experiment carried out for five languages: English (the pivotal one), Albanian (AL), Hebrew (HE), Hungarian (HU), Lithuanian (LT), and Standard European Portuguese (PT) (following the Portuguese Language Orthographic Agreement of 1990 - CPLP, 1990), aligning idiomatic business and finance terms and multiword expressions related to black colour. Colour idioms were chosen to be the subject of the study because colour terms particularly enable fast lexical innovation as they are cognitively salient and culturally shared. Colour idioms in business often emerge from socio-economic, political, and technological change or regulation (Prusak and Valūnaitė-Oleškevičienė, 2024; Malyuga and Aleksandrova, 2020), and they undergo semantic shift or domain re-specialisation (Alousque, 2011)—e.g., the meaning of the idiom "black swan" shifted from “rare-event theory” to “business risk." For these reasons, they are excellent targets for testing the management of idiomatic lexical innovations by large language models (LLMs).

First, data was collected. English colour idioms with black were selected using term bases and dictionaries, such as the Financial Times Lexicon and the Investopedia dictionary, among others. (For further references, see section 9. Language Resource References). The English colour idioms were saved in a shared spreadsheet and were manually complemented with their (most commonly used) counterparts in five languages by native speakers (of Albanian, Hebrew, Hungarian, Lithuanian, and Standard European Portuguese). As a consequence, a multilingual language resource of business colour idioms was created, which provided the human baseline in our research.

In the subsequent stage of the experiment, LLM-based generative AI chatbots were prompted to give the equivalents of the selected English idioms in the five languages under scrutiny. Three advanced LLMs (Claude 4.5 Sonnet, Gemini Pro, and GPT-5.2 Auto[1]) were used in the experiment to investigate their effectiveness and accuracy in multilingual term search in the context of business and finance.

The following prompt was given to each LLM: “Provide the equivalents of the English idiomatic expressions in LT, HU, HE, AL, and PT, and provide each of their direct, literal translations to English in the given table. Provide one equivalent for each idiom in each language (and one literal translation to English). Provide it in a downloadable, editable Excel file.” The English idioms were attached in a table format (without equivalents in other languages). Model responses were elicited via API calls, using the default decoding parameters of the models. The files generated in reply included the English idiom (original), LT equivalent and its literal translation to English; HU equivalent and its literal translation to English; HE equivalent and its literal translation to English; AL equivalent and its literal translation to English; and PT equivalent and its literal translation to English. Afterwards, the resulting three files were merged into a single master spreadsheet, where the columns were grouped by language so that GPT, Gemini, and Claude outputs could be read side-by-side for every language. Ultimately, a heatmap of consensus was generated by Claude that visualises the level of agreement (full, partial, no agreement) between the three LLMs (GPT, Gemini, and Claude) for (the equivalents of) each idiom across all five languages.

In the closing, interpretive phase, the output of the models was compared to human annotation, and the comparative evaluation of the outputs of the three models was performed by the authors on the task of providing equivalents of business idioms in several languages. It poses a great challenge for evaluation that there is no universally accepted framework to evaluate large language models.

3. Research Questions

3.1. Do LLMs provide the same equivalents as native speakers?

3.2. How do LLMs absorb, generate, and disseminate new lexical items? Do LLMs tend to keep the English term or translate it? (loanwords vs. translations; globalisation vs. localisation)

3.3. Which LLM provides the most colloquial equivalents and prefers loanwords?

3.4. Which LLM tends to translate the terms?

3.5. Are recent innovative colour idioms (such as Black Friday) more globalised (i.e., more direct loans from English) than older, traditional colour

[1] Claude 4.5 Sonnet was released in September, 2025, and it is advertised as the strongest model for building complex agents, with a very high level of reasoning. Similarly, Gemini 3 Pro was released in November 2025, described by Google as its most intelligent AI model yet, featuring enhanced reasoning and coding capabilities. The third model under evaluation, GPT-5.2, was released in December, 2025, and brings adaptive reasoning into everyday use by solving harder work tasks more effectively and with more polish, particularly in spreadsheet formatting.

idioms that are rooted in universal concepts (such as black hole)?

3.6. Do LLMs reinforce Anglocentric colour metaphors and lead to cultural imperialism across languages?

The biases and uneven coverage by LLMs may privilege neologisms in high-resource languages while under-representing or distorting innovation in smaller linguistic communities (Gallegos et al. 2024).

3.7. Does any model invent a phrase (hallucination) that does not exist?

In fact, LLMs not only absorb neologisms from their training data but also have the capacity to generate novel lexical items, metaphors, or hybrid forms in response to prompts (Iwamoto and Kanayama, 2024). When LLMs produce unattested lexical items, the question is under what conditions can these be classified as errors, creative neologisms, or emergent lexical proposals?

3.8. Are the LLMs consistent in terms of grammatical accuracy (definiteness of nouns, definite articles, capitalization)? Which LLM is the most consistent and grammatically rigid?

4. Research Results

When reviewing the multilingual side-by-side data in the master spreadsheet, several interesting patterns were identified that highlight the different features of the models and may distinguish them in terms of rendering business colour idioms across languages.

4.1. Globalisation vs. localisation (Loanword vs. translation)

The idiom “Black Friday” is one of the clearest differentiators among the different models.

Both GPT and Gemini showed a tendency to keep "Black Friday" as a loanword - e.g., in Portuguese (Black Friday), which reflects current colour idiom usage where the English term is dominant.
In contrast, Claude suggested the translation of “Sexta-feira Negra” in Portuguese. While literally correct, it relates to a disastrous day and not to the big shopping discounts day after Thanksgiving Day, suggesting Claude might prioritise linguistic purity over cultural usage.
In Hebrew, GPT used the transliteration (בלאק פרייידי - "Black Friday"), while Gemini and Claude used the translation (יום שישי השחור - “The Black Friday”).
LLMs often opted for literal translations—e.g., Gemini provided very precise literal translations in Hebrew, such as translating “squeezing” for “blackmail”. Similarly, GPT often defaulted to repeating the English idiom in the Literal Translation column—e.g., translating the literal meaning of Black Friday just as "Black Friday."

4.2. Grammatical nuance (definiteness, capitalisation, and case)

Gemini consistently used the definite form for days in Albanian (e.g., “E Premtja e Zezë”—"The Black Friday"). However, GPT and Claude sometimes toggled between definite and indefinite (“e premtja” vs. “e premtë”), or varied capitalisation in Albanian (“E Premtja” vs. “Premte”) and similarly Lithuanian. The research reveals Gemini's notable consistency.
As for “black box," GPT correctly employed hyphenation in the Portuguese translation "caixa-preta," whereas Claude and Gemini produced a spaced compound (“caixa preta”). None of the three LLMs conformed to the orthographic conventions stipulated by the 1990 Portuguese Language Orthographic Agreement (CPLP, 1990), specifically the requirement that days of the week in Portuguese be written in lowercase.

4.3. Idiom interpretations

In Lithuanian, Gemini provided a literal translation for “in the black": “Dirbti pelningai” (literally: "Work profitably"). The same was observed in Hebrew, בפלוס (literally: "In plus"), as well as in Hungarian, “nyereséges” (literally: “profitable"), and Claude opted for “nyereségesen” (literally: “profitably").
Concerning Portuguese, all three models correctly identified the unique Portuguese idiom “no azul” ("in the blue"), which is a strong indicator of cultural awareness because this is a unique colour idiom distinct from the English "black." However, these results refer to Brazilian Portuguese and not to standard European Portuguese, where one would expect translations such as “com saldo positivo” or “com lucro” (literally, "with positive balance” or “with profit," respectively).

Moreover, we have found several examples of semantic drift (Hamilton and Jurafsky, 2016) and metaphor extension (Lakoff and Johnson, 1980) in colour idioms, namely:

- Black → illegality (black market) → systemic risk of negative consequences (black swan)
- Green → meaning linked to ecology → ESG (Environmental, Social, Governance) → finance → branding ethics
- Blue → meaning linked to sustainable ocean resources (blue economy) → ESG (Environmental, Social, Governance) → finance → branding ethics

4.4. Vocabulary choice

For the "Blackleg" in Lithuanian, LLMs provided “Streiklaužys” (literally: "Strike-breaker") and similarly in Hungarian - “Sztrájktörő” (literally: "strike-breaker").

There was a slight difference in Portuguese for "blackleg," which included a minor grammatical difference between LLMs:

- Gemini: fura-greve (singular: strike-breaker).

- Claude, GPT: fura-greves (plural: strike-breakers).

A similar situation was observed in Albanian:

- Gemini: Thyerës i grevës (Breaker of the strike).
- GPT: Thyes Grevash (breaker of strikes—plural, indefinite).
- Claude: Thyesës i grevës (Breaker of the strike).

Concerning "Black economy" vs. "Black market economy," most languages use terms equivalent to "Shadow economy" (e.g., “šešėlinė ekonomika" in Lithuanian) or "Parallel economy" (e.g., “economia paralela" in Portuguese) to distinguish the broader economic concept from the specific "black market" (“mercado negro" in Portuguese).

All three LLMs provided distinct but correct translations for "black market economy" in Portuguese: "economia de mercado negro," "economia informal," and "economia subterrânea" (literally, "black market economy," "informal economy," and "underground economy," respectively).

As to "Black-Scholes," all three LLMs provided the Brazilian Portuguese translation “modelo Black-Scholes" instead of the standard European Portuguese “modelo de Black-Scholes” (literally, "Black-Scholes model” and “model of Black-Scholes," respectively).

Regarding “black money," GPT provided “dinheiro negro," while Claude and Gemini provided “dinheiro sujo” (literally, "black money” and “dirty money”). Both idioms are correct in Portuguese, although some authors (e.g., Silva, 2009; Hortelão Lopes, 2015) distinguish between "dinheiro negro" (i.e., money applied in illegal activities) and "dinheiro sujo" (i.e., money acquired from illegal activities).

4.5. Visualisation of the output of LLMs

The generated agreement heatmap is basically a visual overview with colour coding:

- Green (3) = All 3 systems agree
- Amber (2) = Two systems agree
- Red (1) = All systems differ

Agreement by language is represented by vertical ranking. The breakdown presents the distribution of agreement levels for each language, with separate bars for equivalent vs. literal translations. It shows that HU and LT perform best, while AL and HE have the most disagreement. The reason for this might be that HU and LT have larger training datasets, enhancing reasoning capabilities than AL, which is a low-resource language in the context of LLM training.

Agreement by idiom is represented in a horizontal bar chart ranking all 19 idioms by overall agreement score. The highest agreement is visible in terms like "black box," "Black Friday," and "black hole" (universal, technical, and cultural terms).

Most disagreement is related to terms requiring cultural adaptation, like "in the black," "blackleg," and "blackmail." The agreement scores range from ~1.8 to ~3.0 (perfect agreement).
The visualisations clearly show that the three AI systems agree most on:

- Technical financial terms like "Black-Scholes," “Black Monday," and “Black Tuesday," among others.
- Universal concepts and more common terms, such as "black box" and "black hole," show strong consensus across almost all languages.

Concerning languages, Hungarian and Lithuanian expressions show the most agreement, with Hungarian demonstrating 73.7% equivalent agreement, 78.9% literal agreement, and Lithuanian demonstrating 68.4% agreement on both.

The visualisation reveals most disagreement on culturally specific idioms requiring local adaptation, such as “in the black," "blackleg," and "blackmail."

Languages with supposedly limited training data, such as Albanian and Hebrew, show less agreement; for Albanian, only 42.1% full agreement, and for Hebrew, 47.4% full agreement on equivalents. Albanian shows more red/yellow areas, indicating that the models struggle to agree on the definitive grammatical form (definite vs. indefinite articles, e.g., “e premtja” vs. “premtë”).

The models partially agree on several Portuguese idioms, where the heatmap shows yellow, as GPT and Gemini prefer the English loanword, e.g., "Black Friday," while Claude prefers the literal translation "Sexta-feira Negra."

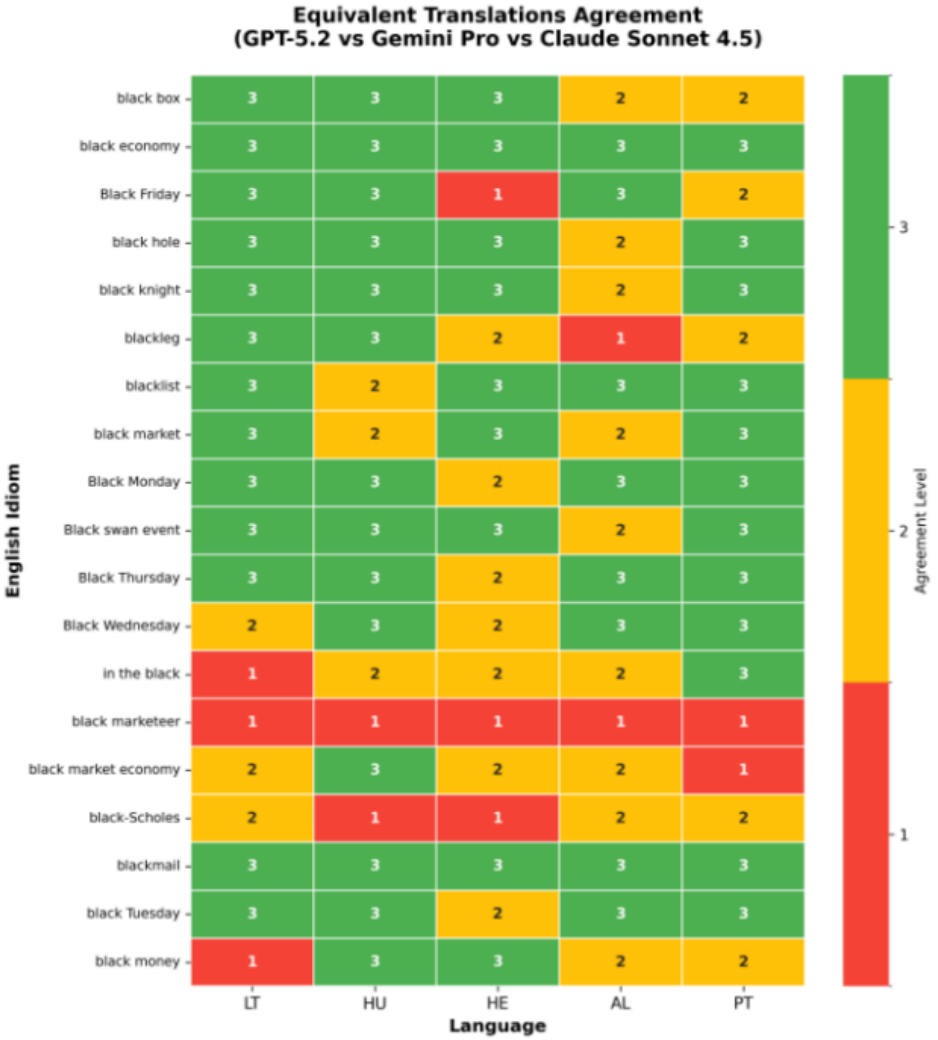


Figure 1: LLM consensus heatmap

4.5. Comparing Human Baseline with LLM Output

The results of the experiment demonstrate strong agreement among LLMs but less consistent agreement with human interpretation of colour idioms. The heatmap below compares the human-provided idioms against the collective output of the three LLMs (GPT, Gemini, Claude).

Green colour indicates high consensus, which indicates that all three LLMs produced the same translation as the human annotator. This indicates the idiom is well-established and standard in that language.

Yellow and orange slots indicate partial agreement, showing that some LLMs matched human choices, while others differed (e.g., using a loanword like "Black Friday" instead of the translated term).

The red color demonstrates disagreement where none of the LLMs matched the human translation. This frequently occurs when the human baseline states "No equivalent," but the LLM attempts to force a literal translation.

Human–LLM agreement clusters around partial agreement (yellow) rather than green.

The human choices demonstrate the use of nuanced local idioms (e.g., “no azul” in Brazilian Portuguese, but not in Standard European Portuguese), and the LLMs may fail to capture such cases, though in this specific case, the LLMs actually performed well.

High agreement is registered in cases of technical or globally standardised idioms like "black hole," "black market," and "blacklist." Stable idiomatic expressions guide high human and LLMs alignment.

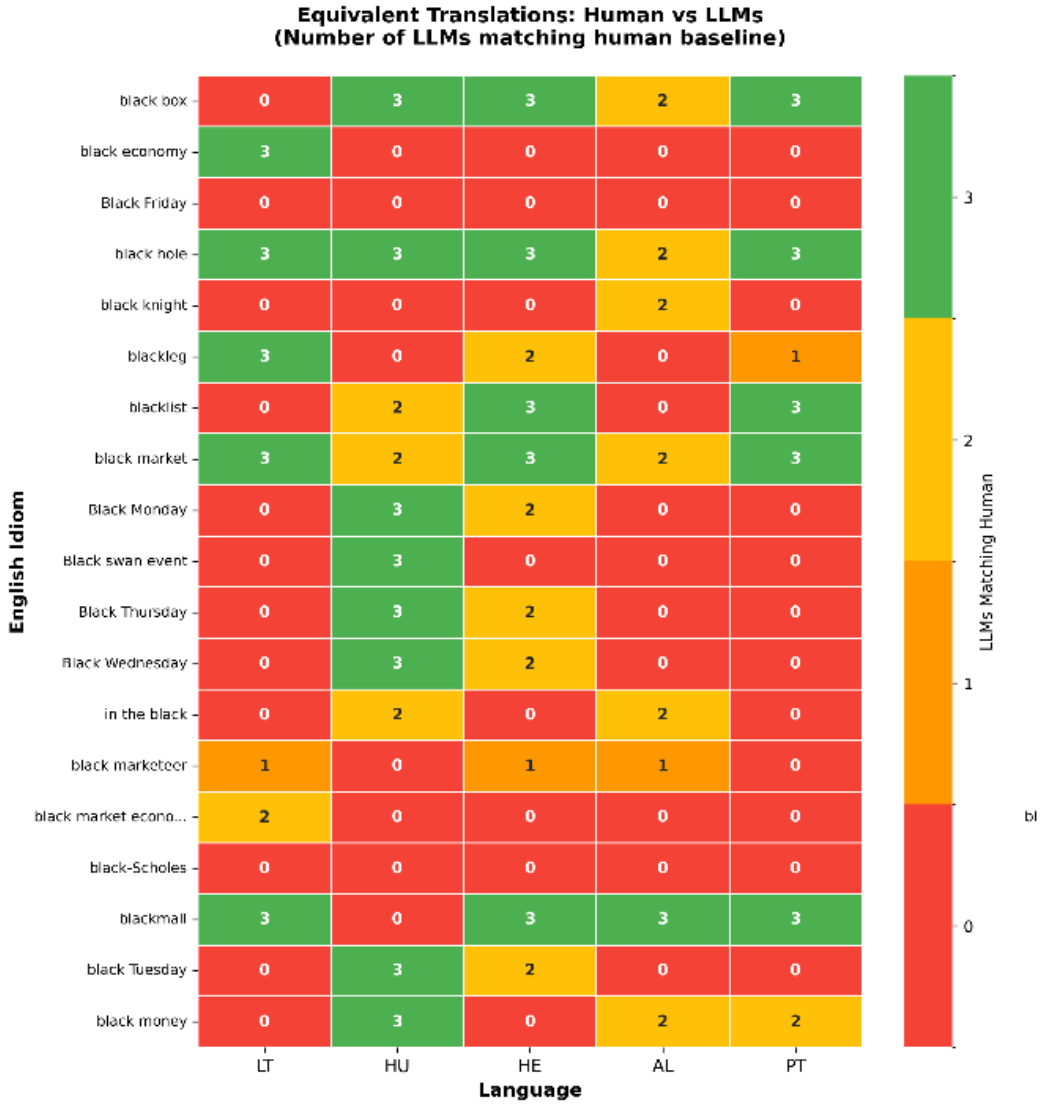


Figure 2: Human vs. LLM consensus heatmap

Human and LLMs' agreement breaks down in the case of idioms involving metaphor shifts, for example, in the case of *in the black, black economy, blackmail*, and *Black Friday*. In such cases, humans prefer functional or localised equivalents, while LLMs over-preserve English variants or loanwords.

Concerning languages in the dataset, Hungarian and Hebrew show higher human–LLM agreement. Portuguese and Lithuanian show more divergence, reflecting a stronger human preference for idiom substitution or localisation

High LLM–LLM consensus and less alignment of human-LLMs might mean that high cross-model agreement can coexist with systematic deviation from human idiomatic norms.

5. Conclusion

As a result of the comparative evaluation of the three models, it is claimed that, based on our small multilingual dataset, Gemini appears to be the most grammatically rigid (with a high level of consistency in terms of capitalisation and the use of definite articles). GPT seems to be the most colloquial out of the three models (preferring loanwords such as Black Friday in Hebrew and Portuguese). Claude leans towards academic translation (translating terms that might often be left in English). The visual heatmap shows that HU and LT perform best, while AL and HE have the most disagreement.

None of the three models invented a phrase that does not exist (no hallucinations).
These LLMs show higher mutual agreement than agreement with humans. In fact, LLMs are internally consistent, but that consistency reflects shared Anglocentric metaphor encoding rather than convergence toward

human idiomatic usage. The heatmaps clearly show that human expertise remains crucial for high-quality idiomatic translation, particularly for culture-specific expressions and less common language pairs.

6. Limitations

This is an ongoing research project first tested on a small dataset to carry out a pilot study, which inherently has a limitation of small-scale data. Another limitation is due to the deficient information on the technical specifications of the three examined models, because information such as model size is not publicly available. This presents a universal issue and an ongoing challenge when evaluating the performance of large language models.

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Barbara Lewandowska-Tomaszczyk (University of Applied Sciences in Konin)

Chaya Liebeskind (Jerusalem College of Technology, Israel)

Elpida Loupaki (Aristotle University of Thessaloniki, Greece)

Barbara McGillivray (King's College London)

Liudmila Mockiene (Mykolas Romeris University, Lithuania)

Maciej Ogrodniczuk (Institute of Computer Science, Polish Academy of Sciences, Poland)

Atul Kr. Ojha (University of Galway, Ireland)

Ana Ostroški Anić (Institute of Croatian Language and Linguistics, Croatia)

Marko Robnik-Šikonja (University of Ljubljana, Slovenia)

Purificação Silvano (University of Porto, Portugal)

Enriketa Sogutlu (Beder University, Albania)

Ranka Stankovic (University of Belgrade, Serbia)

Giovanni Luca Tallarico (University of Verona, Italy)

Giedre Valunaite Oleskeviciene (Mykolas Romeris University, Lithuania)

Andrius Utka (Vytautas Magnus University)

Federica Vezzani (University of Padua, Italy)

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