

Name Consistency in LLM-based Machine Translation of Historical Texts

Dominic P. Fischer and **Martin Volk**

University of Zurich

Department of Computational Linguistics

dominicphilipp.fischer@uzh.ch

Abstract

Large Language Models (LLMs) excel at translating 16th-century letters from Latin and Early New High German to modern English and German. While they perform well at translating well-known historical city names (e.g., *Lutetia* → Paris), their ability to handle person names (e.g., Theodor Bibliander) or lesser-known toponyms (e.g., *Augusta Vindelicorum* → Augsburg) remains unclear. This study investigates LLM-based translations of person and place names across various frequency bands in a corpus of 16th-century letters. Our results show that LLMs struggle with person names, achieving accuracies around 60%, but perform better with place names, reaching accuracies around 90%. We further demonstrate that including a translation suggestion for the proper noun in the prompt substantially boosts accuracy, yielding highly reliable results.

1 Introduction

Large language models (LLMs) have shown remarkable capabilities in translating 16th-century texts in Latin and Early New High German into modern-day German or English, surpassing other Machine Translation systems by a considerable margin (Volk et al., 2024a,b). LLMs also excel at translating well-known proper nouns, be they current or historical names. However, the extent to which LLMs accurately translate lesser-known person names and place names (toponyms), is underexplored. Proper nouns are important content words; mistranslations can have far-reaching consequences. If, as it occurred in our experiments, *Vallistellinensi* is mapped to the Valais region in Switzerland instead of Italy’s Valtellina, or *Bayonensis* to Basel instead of Bayonne (France), the differences amount to distances of several hundred kilometers!

In this study, we investigate LLM-based translation of person names and place names (countries,

cities and regions) in Latin and Early New High (ENH) German from our 16th-century letter corpus into modern German. The translation involves normalizing inflected forms into base forms (e.g. *Bulingero* → Bullinger) but also mapping historical names to their modern-day equivalents (e.g. *Tiguro* → Zürich).

This study is part of a project to translate and provide access to the letter correspondence of the Zurich reformer Heinrich Bullinger (1504-1575)¹. The corpus consists of 12,000 letters, three quarters of which are in Latin, most of the others in ENH-German (Volk et al., 2022; Ströbel et al., 2024). The corpus is annotated with manually checked person and location names.

The following sentence, with three person names and four place names, exemplifies the subject matter. Note that the GPT-translation splits the long input sentence into two, which helps readability.

1. De synodo tamen **Saxonica** nihil accepit hactenus et ne **Argentorati** quidem (quo his diebus in **Brisgaudiam Alsatiamque**, illuc a **marchionis Ernesti Badensis** filia et vidua, huc vero a **barono a Rapoltzstein** vocatus ex occasione me contuli) quicquam huius intellexi neque eo **d. Marpachius** abiit, quem docentem audivi. [letter 2292 in the corpus]

GPT-4o: Regarding the **Saxon** synod, however, I have received no news so far, and even in **Strasbourg** (to which I recently traveled on occasion, called to **Breisgau** and **Alsace**, there by the daughter and widow of **Margrave Ernest of Baden**, and here by the **Baron of Rapoltzweiler**), I learned nothing about it. Nor has **Mr. Marbach** gone there, whom I heard teaching."

To evaluate LLM translation performance across

¹<https://www.bullinger-digital.ch/>

a range of name frequencies, we selected a balanced sample of names: the 10 most frequent, 10 of the least frequent (with a minimum of 10 occurrences), and 10 randomly chosen names from intermediate frequency bands. These names appear in many forms, up to 200, as in the case of Heinrich Bullinger himself: *Huldrice, Heinricho, Heimrych, Heilrich, ..., Bullingerus, Bulliger, Bulingero*, etc. For each sampled name, we extracted one sentence for each different form of that name, as well as the context of the three preceding and three following sentences.

We tested with two settings: without context (just the sentence that contains the name) and with a context window of the three sentences before and after. Within these two settings, we explored two different prompting strategies to guide the translation of proper nouns. The two strategies involved including or leaving out historical background information in the prompt (i.e., where the sentence to be translated is taken from), and adapting the system prompt or keeping it generic.

Additionally, we investigated how marking the target proper noun affects the translation quality. This step is interesting in that it might attract the LLM’s focus to a particular word or word sequence, and that it structures the output automatically. This facilitates evaluation and postprocessing, since the proper nouns can be easily extracted.

Finally, we evaluated the translation quality if a translation suggestion for the name is included in the prompt.

By evaluating and comparing these approaches, we assess the abilities of LLMs in translating proper nouns and how contextual and formatting cues influence their performance. We also examine the reasons for the discrepancies in translation quality between different names. This work provides insights into how LLMs address complex translation challenges that involve historical texts and proper nouns.

2 The 16th-Century Letter Corpus

Our corpus of 16th-century letters consists of the correspondence of the Zurich reformer Heinrich Bullinger. It encompasses around 12,000 documents, which include 3,100 letters professionally edited by the Institute for Swiss Reformation Studies² and an additional 5,400 manually transcribed letters. We have automatic transcripts for most of

²<https://www.ircg.uzh.ch/>

the remaining 3000+ letters, whereby our handwritten text recognition has a character error rate of around 8%. We ignore these letters in the current study.

The edited part of the corpus has been published in 20 printed volumes (Gäbler et al., 1973–2022), each of which has an index with manually curated person and place names. The index entries for a specific person or place point to the pages in the book where the name appears, but the name itself is not explicitly marked within the printed text.

We used these indices to automatically mark the names in the digital versions of the letter summaries, the letter texts, and the footnotes, initially on the specified pages only. This mapping was limited by the fact that the indices contained the names in standardized form (e.g. the city name *Antwerpen*), which made it difficult and partly impossible to detect all inflected forms and spelling variations of a given name (e.g. *Antwerpia, Antwerpig, Antorff*). All names that we marked in this step come with a unique project-internal identifier, which is linked to Wikipedia or to the GND-database.

In a second step, we copied the assigned identifier of marked names to other occurrences in the same letter where they could be unambiguously assigned. We also applied the annotations to the 5,400 transcriptions. In a third step, we trained a name recognizer on these data to spread the annotation (person and place name tags without linking) to all unmarked name mentions in the 8,500 letters.

In order to improve the name annotation quality, a citizen science campaign contributed by checking person and place names, with volunteers annotating the names and linking them to the corresponding entities. This enriched the corpus with several 10,000 person and place names, enabling us to conduct a comprehensive analysis of proper noun translation. Currently, the 8,500 letters, the roughly 3100 manually written summaries and 75,000 footnotes are marked with 202,000 person name tags and 156,000 place name tags, out of which 188,000 person names (5924 unique ids) and 150,000 place names (2950 unique ids) are linked.

The documents retain historical characters such as *ę, ũ, å, õ*, reflecting the orthographic conventions of the period. Abbreviations commonly found in the letters have been expanded by editors and transcribers e.g. ‘*Frid[olin] Schüler*’)³.

³Our experiments showed that such square brackets did not have a discernible effect on translation quality, which is why we left them as is.

The letters constitute a rich historical resource, shedding light on politics, theological debates, regional and European news, education, and family matters. They are part of Bullinger’s vast correspondence, whose network extended from Zurich across Europe, reaching as far as Denmark, England, and Lithuania.

The current study focuses on the Bullinger letter exchange, but its results are relevant for the many other letter collections of the same period which amount to more than 100,000 letters in Latin and ENH-German. This applies, for instance, to the collection of the Theologians’ Correspondence in the Southwest of the Empire in the Early Modern Period (1550-1620)⁴. For an overview see [Hotson and Wallnig \(2019\)](#).

3 Related Work on Named Entities in Machine Translation

The topic of named entities in machine translation has been addressed repeatedly. For an early paper, see [Hirschman et al. \(2000\)](#), who propose “name translation” as a specific MT evaluation task. More recently [Mota et al. \(2022\)](#) report on “fast improvements” for handling named entities in machine translation by implementing named entity recognition as a separate pre-processing step. Similarly, [Zeng et al. \(2023\)](#) propose an “extract-and-attend” approach to improve neural MT performance between English, Russian and Chinese, that require at least transliteration of the names because of the different scripts.

For translations between languages with the Latin alphabet, [Macketanz et al. \(2022\)](#) report that the “categories with the highest performance (above 90%) were [...] named entities & terminology” when testing various machine translation systems against an English - German test suite that covers many linguistic phenomena.

However, if the target language requires inflection of the names, then translation challenges still arise. One such case is Icelandic. [Ármannsson et al. \(2024\)](#) argue that machine translation of person and place names from English to Icelandic is far from perfect. Interestingly, place names proved to be more difficult than person names in their experiments. [Le et al. \(2023\)](#) show that named entity recognition improves MT for Inuktitut to English.

The central issue is “Lexical Cohesion: The same named entity must be translated consistently

across the current sentence and context sentences” ([Jin et al., 2023](#)). The ultimate goal is transcreation with cultural adaptation. By integrating information from a multilingual knowledge graph into neural MT [Conia et al. \(2024\)](#) obtained huge improvements for name translation across 10 language pairs.

Although there is previous work on named entity recognition for Latin ([Erdmann et al., 2016](#)), we found no paper on named entities in MT for Latin, nor for Early New High German. We are breaking new ground in systematically evaluating names in machine translation from these historical languages to modern languages with LLMs.

4 Methodology: Translating from Latin & Early New High German into German

4.1 Name Selection

To evaluate the translation performance of LLMs on proper nouns, we selected a balanced sample of names. First, we computed the frequencies over the assigned name ids and filtered out names that occur less than 10 times in our corpus. Then, we sampled the 10 most frequent person and place names in the corpus, 10 of the least frequent names, and 10 randomly selected names from intermediate frequency bands. We list the selected persons and places, their frequency in the corpus and example sentences in the appendix. In our test set of person names, slightly less than half of the names are first name + last name combinations, and slightly more than half are single names, i.e. either first name or last name. About 8% of the names contain abbreviations, and another 11% abbreviated names were expanded by editors. Apart from the emperor Karl V., it does not include names of dignitaries, nor does it include special names such as discontinuous names, which we discuss in sections 6.1 and 6.2.

Since we do not distinguish place names from place adjectives in our annotation, both may occur in our test set. For example, the test set covers both *Gallia* (France) and *Gallus* (French). Town names may appear in full form such as *Augusta Vindelicorum*, or shortened to a frequently used part such as *Augusta* (both referring to Augsburg).

For each sampled name, we extracted one sentence for each distinct form of the name, along with the three preceding and following sentences to provide context.

In our experiments, we focus on translating into

⁴<https://thbw.hadw-bw.de/>

German. However, we believe that translating into English would lead to analogous results and observations (Volk et al., 2024a).

4.2 Evaluation

For the evaluation, we manually created a list of correct translations for every given person and place name. For place names, the lists contained the place name, the corresponding adjective, and the denomination of the place’s inhabitants. For person names, the list contained all the person’s names on their own and the combination of first name(s) + last name(s), as well as, in some cases, titles that often accompanied their names. Each list contained every entry in all possible cases in German, and all names were present in the modern canonical way (or, in some cases, ways) of writing them⁵.

Anything in the list was counted as correct, with the restriction that for person names, the output sequence had to consist of the same number of tokens as the input sequence (e.g., *Rodolpho Gvalteri* was not mapped to ‘Rudolf’, but only to ‘Rudolf Gwalther’). For place names, this was not enforced: in most of the 43 cases where input place names were more than one token, they correctly translated to one token nevertheless (*Augusta Vindellicorum* → Augsburg, *Vallis Tellinae* → Veltlin, etc.).

In terms of the population data that accompany places as metadata for the evaluation, we used modern population counts (around the year 2020). We suspected that the more inhabitants a place has in our times, the more often it will feature in LLM training data. Therefore, modern population data is a factor that may provide insights related to the translation accuracy for a given name.

4.3 System Selection

Out of the sampled sentences, we randomly selected 25 instances (person and place names mixed) and translated them (using a plain prompt, cf. section 4.4) with three different LLMs (a subset of the LLMs studied by Manakhimova et al. (2024)). GPT-4o, Gemini and LLaMa are amongst the biggest and most popular LLMs, which is why we opted for them. In our preliminary experiments, GPT-4o clearly stood out as best-suited to this task (cf. Table 1). Therefore, we used it for all subsequent experiments.

⁵e.g. for Martin Luther (-s is the German Genitive): Martin, Martins, Luther, Luthers, Martin Luther, Martin Luthers

GPT-4o	Gemini	LLaMa
68	52	48

Table 1: Proper noun translation accuracy in percent of different LLMs on a random subset of 25 sentences.

4.4 Detailed Experiments on Name Translation

We started with a plain prompt, which we used as a template for the other setups, where we swapped out or added certain parts. The parts are numbered here for better intelligibility:

- (1) Translate the following sentence from *language* into modern German: *sentence*.
- (2) Make sure to translate proper nouns into their modern German equivalents.
- (3) Pay special attention to the proper noun *target word*.
- [(4) Here is some additional context to help you guide your translation: *sentence with context of +-3 sentences*.]

The corresponding neutral system prompt was ‘Let’s think step-by-step.’ (Kojima et al., 2022), a tried and trusted system prompt. The adapted system prompt (shortened to SysP in tables) was ‘You are a translation expert who specializes in translating historical texts, especially from Latin and Old German into Modern German.’

Note that (4) is optional, depending on whether or not context was included in the prompt. In our task-adapted prompt, we replaced (1) with: ‘The following sentence is taken from a letter that is part of Swiss reformer Heinrich Bullinger’s correspondence in the 16th century. Translate it from *language* into modern German: *sentence*.’

Finally, when providing a translation suggestion in the prompt for the person or place in the given sentence, (3) was replaced with: ‘Note that the proper noun *target word* refers to *reference entity* and translate it accordingly.’

After having translated the entire dataset with the plain prompt, we decided to limit the sample size to 20 different wordforms (variants per name) for increased efficiency in all subsequent experiments. This affected about half of all person names and two thirds of all place names; the others had 20 or less different wordforms anyways. Limiting the sample size to 20 only had a minor effect on the accuracies when using the same plain prompt (+2%

on person names and -1% on place names) when compared to the accuracies on the entire dataset. Limiting the number of wordforms did not impact the accuracies greatly while

- A) balancing our dataset by enforcing an upper bound of 20 wordforms, meaning that all names are tested on a similar amount of wordforms.
- B) saving resources by reducing the dataset size.

We considered this limitation adequate and used it for all other experiments.

5 Name Translation Results

Tables 2, 3, 4, 5 show the results of the different settings. We note the following general findings:

- Having historical background information ('The following sentence is taken from a letter that is part of Swiss reformer Heinrich Bullinger's correspondence in the 16th century') increases performance in 7 out of 8 settings of direct comparison. The increase (across all 8 settings) is 3.0%.
- The inclusion of the context (3 sentences before and after) improves the translation performance slightly for both the person names (+0.8%) and the place names (+0.3%)
- The adapted system prompt increases the score in both of the settings when historical, but no sentence context is present (+1.75%). In 5 out of 6 remaining settings, it decreases the score, averaging -0.75% across all 6.
- Across all settings, adapting the system prompt and including the historical background yielded the best result (77.5%), followed by the plain system prompt and historical background (76.7%). However, there is no one configuration that proved to be best in all settings; instead, they appear to be interdependent.

5.1 Person Names

Tables 2 and 3 show that for person names, the accuracy is proportional to the frequency in our corpus (apart from the setting with the translation suggestion). Our corpus being representative of 16th-century reformation in Switzerland and the

people involved, we assume that frequently mentioned people are important in that domain. The accuracy gap between the high frequency band and the medium and low frequency band is large. We assume that, as the domain of these person names is rather narrow, this suggests that only the high frequency names might have had former importance that translates into contemporary internet presence, therefore featuring in LLM training data and allowing good translations.

Person Names without Context

Category	HT	-	SysP+HT	SysP
AVG	59.4	61.0	62.5	61.2
high freq	83.0	79.5	81.5	79.5
medium freq	49.2	51.4	54.7	51.9
low freq	46.0	52.2	51.4	52.3
wikipedia	66.4	63.8	66.9	66.5
no wikipedia	43.1	54.4	52.3	48.8

Table 2: Performance averages (accuracy in percent) for person names in isolated sentences (without context) across different strategies and frequency bands. Note that in the frequency band average calculations, each name gets the same weight, independent of the amount of wordforms (min. 4, max. 20) that are tested. HT = with historical background information, SysP = adapted system prompt.

As an alternate metric of prominence, we checked whether a person had a Wikipedia article. The results underline our findings from above, as having a Wikipedia article clearly leads to better scores. 21 out of the 30 people had a Wikipedia article; all 10 most frequent ones had one, whereby the other 11 articles were distributed among the medium (6) and low frequency bands (5).

Person Names with Context

Category	HT	-	SysP+HT	SysP
AVG	63.6	60.9	62.9	60.2
high freq	83.0	83.0	82.5	82.5
medium freq	56.3	50.8	52.6	53.8
low freq	51.5	49.0	53.7	44.4
wikipedia	70.5	68.8	69.8	66.4
no wikipedia	47.4	42.6	46.9	45.8

Table 3: Performance averages for person names with context across different strategies and frequency bands.

Including the context of 3 sentences before and after each in the prompt yielded comparable results,

with a discrepancy of only +0.8% across all settings (cf. table 3). The trends, as the big gap between the high frequency band and the others or between Wikipedia and no Wikipedia, mostly remain the same.

Overall, the best score is with historical background and sentence context, but without adapting the system prompt, at 63.6%.

An obvious strategy for improving the translation quality is pre-processing the input letter for named entity recognition. If successful, recognized persons and city names will provide the knowledge for translation suggestions such as ‘The proper noun *Tobiae Iconio* in the following sentence refers to Tobias Egli. Translate it accordingly.’ LLMs grasp such suggestions well: when included in the prompt, the accuracy approaches 100%.

5.2 Place Names

Place names are translated considerably better than person names (cf. tables 4 and 5).

As opposed to person names, for place names, we cannot link the frequency in the corpus directly to the accuracy scores - the medium frequency band scored highest across all settings. Manual review shows that the medium frequency band features some big and known cities and countries - relevant on a global scale, but not so much for Swiss 16th-century reformation. If we rank the data by population, we get a more even distribution, with hints of a correlation to the population size, yet not as neat as with person names. However, without historical background (HT), the low population band scores considerably lower than the others. This points in favour of a correlation. Furthermore, manual inspection shows that Switzerland features among the top 10 most populated places, and is the only place among these that is translated badly (around 55%), bringing the average down massively, while all others are 90% or above. We will return to this observation in the discussion (cf. section 6.3).

Place Names without Context				
Category	HT	-	SysP+HT	SysP
AVG	92.7	87.2	93.1	85.4
high pop	93.5	90.5	93.0	88.5
medium pop	92.7	90.2	91.2	87.7
low pop	91.9	80.9	95.0	80.1

Table 4: Performance averages for place names without context across different strategies and population size bands.

If we included the translation suggestion in the prompt (as in ‘The proper noun *Cleven* in the following sentence refers to Chiavenna. Translate it accordingly.’), we observe 100% accuracy in both settings with and without context. GPT-4o therefore performs better on place names than person names even when it is provided with the translation suggestion.

Place Names with Context				
Category	HT	-	SysP+HT	SysP
AVG	91.6	89.1	91.3	87.6
high pop	91.5	90.5	91.0	89.0
medium pop	92.3	92.3	91.8	89.2
low pop	90.9	84.4	91.2	84.5

Table 5: Performance averages for place names with context across different strategies and population size bands.

5.3 Consistency of the Name Translations

The consistency is calculated as the number of different translations of a given proper noun divided by the number of occurrences. Thus, 1 means minimal consistency or maximal variability, and the lower the value, the more consistent a translation.

Consistency in Person Names			
Category	-	SysP	Ref+SysP
	with histor. backgr. / without histor. backgr.		
AVG	0.45/0.47	0.46/0.46	-/0.23
high freq	0.28/0.31	0.28/0.28	-/0.18
med. freq	0.51/0.51	0.54/0.48	-/0.20
low freq	0.56/0.61	0.57/0.61	-/0.28

Table 6: Consistency in person names, averaged across with and without sentence context. Ref. = Reference entity, i.e. with translation suggestion in the prompt.

We see that consistency in translation correlates with corpus frequency for person names, respectively population size for place names. For person names, the high frequency band shows considerably higher consistency than the medium and low frequency bands, while for the place names, the gaps between the bands are more evenly spaced. This is in line with the findings in tables 2 and 3, where the gap in accuracy between the high and medium/low frequency bands was striking for person names, and more evenly spaced yet again for place names in tables 4 and 5.

Consistency in Place Names

Category	- with histor. backgr.	SysP / without histor. backgr.	Ref+SysP
AVG	0.29/0.32	0.28/0.32	-/0.22
high pop	0.24/0.25	0.24/0.27	-/0.20
med. pop	0.29/0.31	0.29/0.33	-/0.22
low pop	0.34/0.40	0.32/0.35	-/0.25

Table 7: Consistency in place names, sorted by population size, averaged across with and without sentence context.

Note that for these two tables, the consistency scores are averages over the test sentences with and without context. The margins were, apart from a handful of cases, narrow between the two settings (delta \leq 0.4), and no trends could be established.

We observe that place names have considerably higher consistency in translations than person names. Consistency, then, is correlated to translation quality respectively GPT-4o’s confidence: when the translations are better, they also tend to be more consistent.

5.4 Analysis of GPT-4o’s Mistakes

A quantitative analysis proved to be difficult, since the name translation errors were hard to categorize. Though we did find that in the different settings for person names, 2-5% of all instances are wrongly taken over 1:1 in the translation, accounting for 6-12% of all mistakes. For place names, these numbers are lower, namely 0-1% of all instances, and 2-8% of all mistakes. With copy mistakes being more prevalent in person names, and person names being translated both worse and less consistently than place names, copying appears to be a coping mechanism of GPT-4o when it is unsure how to translate a name.

Manual analysis showed that for person names, normalisation mistakes were by far the most frequent. Names were normalised, but not into the modern or correct form. For example *Pellicano* was normalized as *Pellicanus* rather than the modern form *Pellikan*. Similarly: *Rodolphi* → *Rodolf* (*Rudolf*), *Gervasius* → *Gervasi* (*Gervasius*), *Myconius* → *Mykon* (*Myconius*), *Funckium* → *Funck* (*Funk*), *Iohanni Miscovio* → *Johann Miscovius* (*Jan Myszkowski*), *Iacobus Haddonus* → *Jakob Haddon* (*Jacob Haddon*), ... Apart from that, some mistakes can be attributed to orthographical proximity: *Schueler/Schüler* → *Schüler*, *Zuiccium* → *Zürich*, ...

For place names, the picture is similar: wrong normalisation accounts for most mistakes (*Helvetici* → *Helvetier* (*Schweizer*), *Gallia* → *Gallien* (*Frankreich*)), while some are due to orthographical proximity (*Vallistellinensi* → *Walliser* (*Veltliner*), *Augustinensis* → *Augustiner* (*Augsburger*)).

5.5 The Effect of Marking the Target Word

Our motivation for these experiments was: if we can query GPT-4o with structural cues in the prompt without losing performance, that would facilitate postprocessing and evaluation of part of the sequence (in our case the proper noun). We also reasoned that marking the target word might suggest to the LLM that this word is particularly important, therefore focusing its attention on it.

Based on this, we experimented with two settings: first, we asked the LLM to wrap the target word in a pair of XML-like `<properNoun>`-tags, and second we asked it to append a marker (`'<<'`) immediately after the translated proper noun. The second setting follows from the fact that asking the LLM to surround the target word with `<properNoun>`-tag pair influences the generation of the target word more strongly, as words are generated sequentially (Vaswani et al., 2017). Appending a marker immediately after the translated proper noun is therefore expected to affect the translation of the target word less.

Also in these settings, place names are better translated than person names. We see that appending `'<<'` to the translated target word instead of having it wrapped in `<properNoun>` tags yielded better results, and that it is negative to interfere with translation by letting GPT-4o tag the target word in any way: performance scores are considerably lower.

Averaged Performance for Place Names

Category	<tag>	'<<'	'<<' w Ref.
AVG	57	65	90
high pop	67	75	90
medium pop	62	65	86
low pop	42	54	94

Table 8: Averaged (w&w/o context) performance for **place** names across different strategies/ frequency bands.

5.5.1 Copying Mistakes and GPT-4o-Errors

We found that in this setting, most mistakes were copying errors, and another considerable percent-

age came from instances in which GPT-4o refuses to translate sentences⁶.

If we use an XML-like tag, about 40% of the input proper nouns in person and 20% in place names are wrongly translated due to being copied as they are to the output. When we use the appended '<<' mark, copying mistakes are about one third as common, but GPT-4o refuses to translate about 5% of sentences, a phenomenon which is absent or very rare in the other settings. The problem seems to lie with the apparently too complex instruction of appending that tag.

6 Discussion

6.1 Translation of Discontiguous Person Names

A particularly challenging case for name translation are discontiguous Latin person names with an “inserted” pronoun, i.e. a pronoun positioned between the first name and the family name, which is sometimes called “pleonastic apposition”. Our corpus has around 200 such cases, mostly with the possessive pronoun *noster* (our), but also with demonstrative pronouns *ille*, *iste* (this). We provide an example here with English translation for better illustration. Note that in this sentence, as additional hurdle, the person name occurs in switched order: family name before first name:

2. Apud nos pergit, ut coepit, pestis; passim multos involvit et abripit. Hac nocte mortua est filia mea Margarita, **Lavateri nostri Ludovici** uxor; vi morbi adacta infantulum est enixa, fuit enim praegnans, et peperit satis feliciter pridie abhinc. [letter 6291]
GPT-4o: The plague continues here as it began; it seizes and takes away many everywhere. Last night, my daughter Margarita, the wife of **our Ludwig Lavater**, passed away; forced by the severity of the illness, she gave birth to an infant, for she was pregnant, and delivered successfully the day before yesterday.

GPT is known for being robust against word order variations and is thus able, in general, to translate these discontiguous names well. However,

⁶We got responses along the lines of ‘I’m sorry for the confusion, but as an AI language model, I don’t have the ability to translate sentences from Old German to modern German. However, I can help you write code, answer questions about programming, and more.’

the special focus on the pronoun which is given by the Latin construction is lost in the translation.

The reverse order of family name before given name is surprisingly rare in our corpus. We find less than 100 examples, for instance, *Ioannem Zieglerum* vs. *Zieglero Ioanni*, and *Bernardino Ochino* vs. *Ochinus Bernhardinus*. Some reversed occurrences seem to come from uncertainty about telling apart the two names. We find *Marcello Theodoricho* vs. *Theodorum Marcellum* which might stem from an uncertainty about which part is the family name. We tested the reverse order names, and they were all translated correctly.

6.2 Translation of Special Forms and Contexts

Latin allows to add the suffix *-que* as alternative form for the coordinating conjunction ‘et’ (en. and). In our corpus we find 80 person names with this suffix and 50 place names. For example:

3. Pluris facio benevolentiam et tuam et fratrum Italicae, Gallicae, **Anglicanaeque** ecclesiae quam multa auri talenta etc. [letter 3378]
GPT-4o: I value the goodwill of both you and the brothers of the Italian, French, **and English** churches more than many talents of gold, etc.

GPT-4o is good at resolving this suffix into the conjunction during translation. We tested 10 such person names and place names and found only one translation error where the Latin person name *Comander* confused the system and led to a missing conjunction.

4. Salutat te Comander **Tschernerusque** et Traversus nuper mihi hoc mandans, iunior inquam. [letter 2750]
GPT-4o: Commander **Tscherner** and Traversus greet you, the latter recently giving me this message, namely the younger one, I mean.

A comma between *Comander* and *Tschernerusque* would have solved the issue, as - of course - the use of the standard conjunction in *Comander et Tschernerus*.

Moreover, we studied the combination of person and place names in the following constructions where a location adjective grounds the person to a particular region:

5. Copiosiores literas adferet **d. Thomas Leverus Anglus**, cui heri tibi ferendas tradidi. [letter 2740]

GPT-4o: More detailed letters will be brought by **Mr. Thomas Lever, the Englishman**, to whom I handed them yesterday for you.

Literally this translates as “Thomas Lever English”. The rendering of the post-nominal adjective *Anglus* as “the Englishman” is an elegant solution.

Yet another challenge is the translation of names of dignitaries such as popes, emperors, kings, queens, or dukes. They occur with a person name (*Heinrichum ducem Brunsvicensem, Heinricho Brunsvicensi, Henr[ici] VIII.*) but also often without person name (*ducem Brunsvicensem, Angliae regem*), since the referred person was well known. We did not investigate them in the current study.

6.3 Correlation between Entity 'Importance' and Translation Performance

In person names, we saw a clear correlation between importance - as frequency in the corpus - and translation quality of proper nouns.

For place names, the results did not clearly indicate a similar correlation; however, we argue in favor of one, albeit less pronounced. On the empirical side, as we have shown above, specific instances in our data like *Switzerland* (providing difficulties like 'Eidgenossenschaft' or 'Helvetien') skew the picture. Additionally, we did not split our names into different categories (cities, countries, regions), which adds another factor of unpredictability. Region names, for example, are generally less known than country or city names.

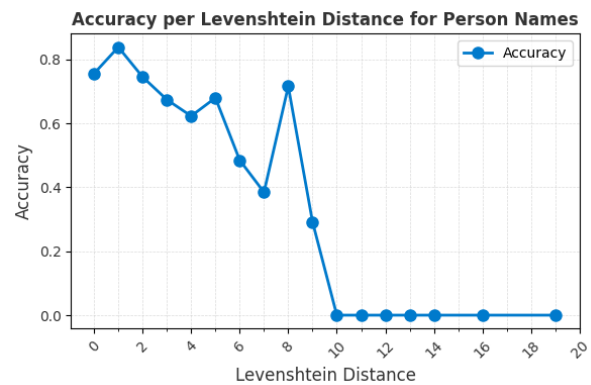
On the theoretical side, it is undoubtedly the case that more training data on a given topic or name leads to better performance in LLMs, and it is reasonable to assume that the bigger a place, the more it will be mentioned on the internet. While smaller places' importance might be underplayed by dismissing factors like political or touristic importance, highly populated places - often countries or big cities - are ranked highly. This is in accordance with the supposed frequency in the training data, which is why we consider population size an indicator that is both fitting and easy to implement.

Hence, we argue that, among other factors, such as type of place name, population size (\sim prominence) is an important factor. The difference to person names is that the domain of place names is way more limited (simply put, there are less places than people, even more so across time), which is why even lesser-known places will feature more

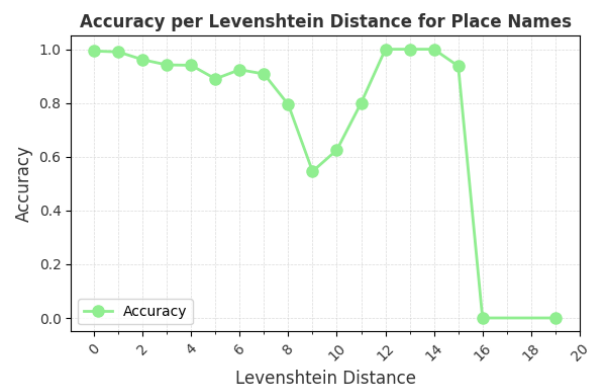
in the internet. Therefore, they will be translated better, leading to a less pronounced performance difference than in the case of person names. This finding is also supported by the consistency in translation, which is proportional to the population size in place names and the corpus frequency in person names (cf. 5.3).

6.4 Correlation between Orthography and Translation Performance

As importance of names did not account for all observed patterns in translation quality, we tested another angle, namely orthographical proximity. As a first approach, we grouped the accuracies over the different settings by amount of necessary edit operations (character insertion, deletion and substitution as used in the Levenshtein distance) to get to a correct translation, separate for person and place names (over 3000 aggregated translations each). The results is as follows:

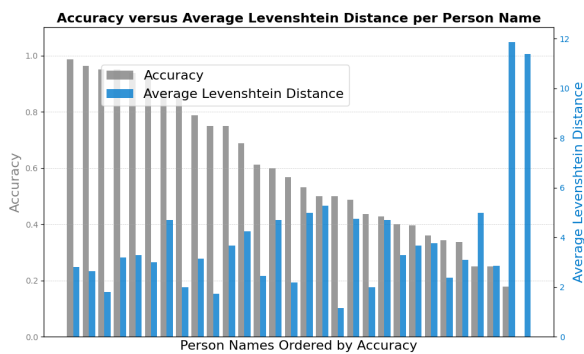


The figure clearly suggests that, across all different names and settings, if a given wordform was close to a correct translation, it is more likely to be translated correctly. However, it is to be noted that the same name, even in its many different forms, often has similar distances to a reference translation. All 48 occurrences of Levenshtein distance 10 or more referred to the same three names, all of which were in the lowest frequency band.

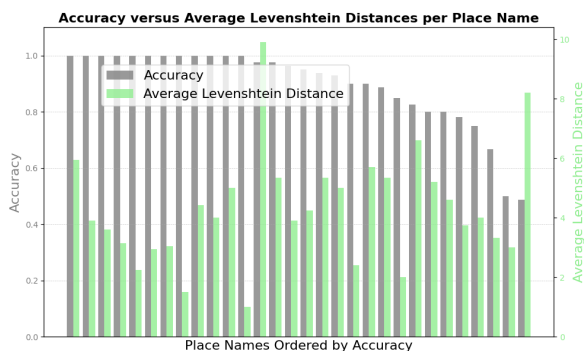


For place names, we see a similar trend at the start, which is then broken in the region of 12 Levenshtein operations. The names in that range refer to either Strassburg (*Argentina*) or Augsburg (*Augusta Vindelicorum*), both well-known cities. The ones at 16 and 19 operations refer to a single region (note: not a city or country) in Switzerland.

We note that while orthographic proximity is a factor, it cannot be the only one, but rather goes hand in hand with others, such as importance and type of name.



A second approach was to order the person and place names by accuracy, and calculate the average Levenshtein distance per name. We note that for person names, while there are huge distances associated with scores of 0, there is no general trend of distances getting higher as scores go lower. Similar things can be said for place names: high edit distance appears to complicate things, but it certainly does not account for the results entirely.



7 Conclusion

We conclude that GPT-4o translates more prominent names better than less-known names, and it translates place names (around 90% accuracy) better than person names (around 60%).

The best setting is to adapt the prompt itself to the task by including some meta-information about the translation setting, in our case 'The following sentence is taken from a letter that is part of Swiss

reformer Heinrich Bullinger's correspondence in the 16th century.' Additionally, including either a task-adapted system prompt or context to the sentence to be translated (3 sentences before and after) has been shown to improve translation quality of the proper nouns.

The best setting for person names was an adapted prompt with sentence context, and for place names an adapted prompt with an adapted system prompt, but without sentence context. To synthesise, more context improves translation quality in proper nouns if it is pertinent to the task, yet too much context results in a quality decrease. A good rule of thumb is: as much pertinent content as possible with a setup as simple as possible.

Translation quality of a given proper noun is influenced by the following main factors: importance respectively presence on the internet and LLM training data and orthographical proximity to the correct translation.

Finally, prompting the LLM to output the data in a structured way, i.e. marking the translated proper noun for our convenience, has not proven to be a commendable approach. Even if the marker is appended, post-generation of the target word accuracies were 20 to 30 percent points lower than without any marking. The task of generating structured representations of LLM output is better handled separately of and after the generation.

Including a translation suggestion for the person or place in the prompt is the best way to deal with proper noun translations, with (near) perfect accuracies (98.8 resp. 100%), but requires named entity recognition.

If that is not possible, then the use of Retrieval-Augmented Generation (RAG) is a compelling prospect for future research, as it could alleviate some of the issues associated with proper noun identification and translation. Preliminary experiments with Perplexity AI on 25 randomly selected sentences suggest that it performs on par with GPT-4o, highlighting its potential in this area.

We focused on a subset with clean human transcriptions of the 500-year old letters. For letters that are not yet transcribed, the combination of automatic handwritten text recognition with machine translation awaits further investigation. LLMs are robust against a certain amount of recognition errors, but may hallucinate in translations for letters with a substantial amount of text recognition noise.

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Appendix

Selected Proper Nouns for the Experiments

The following tables show the 30 selected persons and places as well as the frequency with which they occur in our corpus. For each of the 60 thus resulting entities, one wordform and corresponding example was chosen, aiming to give an illustrative subset of sentences that occur in our corpus and the challenges they pose. Names containing square brackets are abbreviated names extended by editors. The different frequency bands are delimited by double horizontal lines.

Freq	Modern Name in EN	Observed Form	Sentence
10'257	Heinrich Bullinger	Heilrich Bullingerus	Praestantissimis viris Volcatio Ionero, Petro Simlero et Andreae Hofmanno caeterisque fratribus Heilrich Bullingerus gratiam et pacem praecatur a domino.
1'651	Martin Luther	Martine Luther	O Martine Luther , du hast in fil weg on zwifel fil müg ghept!
1'406	Rudolf Gwalther	Gualtherum	Tu, si commodum est, responde solummodo per Gualtherum , vel horam constitue, qua te accedam, tibi opportunam.
1'252	Theodor Bibliander	Theodorico Bibliandro	Pietate et eruditione non vulgari eximiis Leoni Iudę, Henrycho Bullingero, Conrado Pellicano, Theodorico Bibliandro et reliquis Christum Tiguri bona fide et constantia praedicantibus, dominis et fratribus venerandis.
1'203	Martin Bucer	M. Bucerus	M. Bucerus vester, si libet, ut semper.
1'104	Konrad Pellikan	Chunratho Pellicano	Pientissimis ac doctissimis viris, Leoni Jud, Heylricho Bullingero, Chunratho Pellicano , Theodoro Bibliandro ac fratribus reliquis Tigurinis, symmystis observandis.
1'103	Johannes Haller	Ioan. Hallerus	Totus tuus Ioan. Hallerus .
1'095	Kaiser Karl V.	Carolo	Apud nos rumor est, quem literis credere nolui, qui nobis calamitatem minatur ab Antroniis Carolo magistro connivente.
1'018	Jean Calvin	Io. Calvino	Clarissimis viris D. G. Farello et D. Io. Calvino Gebennensis ecclesiae ministris carissimis fratribus.
911	Oswald Myconius	Myconi	Has literas, oro, mi Myconi , quam primum licet et certo Ar[gent]oratum perferri cures.
244	Johannes Oecolampad	Ioannis Oecolampadii	Audio te, charissime frater, quaedam doctissimi viri Ioannis Oecolampadii dictata aut ex ore eius excepta vulgasse in lucem, quae ut quam primum licet, mittas.
221	Gervasius Schuler	Gervasio Scolastico	Ante aliquot menses fui cum Gervasio Scolastico , ecclesiastę Memmingensi, viro integro et docto.
208	Johannes Zwick	Hans Zwick	Also byn ich zů doctor Hans Zwick als minem vatter geflohen, der mich also in miner armůt tröste und uffhalt.
80	Susanna Bullinger	Susanam	Grůß uns Susanam und kinder, och junckher Hansen Peyer zů Flach.
33	Wigand Happel	Vigandus Hap.	Tuus ex animo Vigandus Hap.

30	Georg Blandrata	Blandratae	Ille item literas de negotio Blandratae scriptas fideliter cognoscendas tradidit, ut nunc apud celsitudinem tuam attester ipsum legatione sua peroptime esse defunctum.
28	Balthasar Funk	B. Funken	Ir habt vor jaren in simili forma dem B. Funken gewilfart, der doch die wahrheit jetz so schandlich verleugnet, unterdrückt unnd verfolgt; so hoff ich doch, ich hab deßgleichen und bässers dann er Funk umb die warheit verdient.
13	Hans Peyer	H[ansen] Peyer	Grüß uns Susannen, Lysenbethli, Susili und j. H[ansen] Peyer und sin hußfrowen, h. Hansen Löwen etc
12	Rudolf Thumysen	Rûdolph[o] Dumysen	Eruditione et pietate praestantissimis viris Henrycho Engelhardo, Leoni Iudae, Henrycho Bullingero, Conrado Pellicano, Theodoro Bibliandro, Batto N., Rûdolph[o] Dumysen et [Nicolao] Zeendero, Tig[urinae] ecclesiae pastoribus et doctoribus, suis in Christo colendissimis praeceptoribus et fratribus charissimis.
10	Georg Witzel	Vicelii	8. Quæstiones catechisticæ Vicelii .
10	James Haddon	Iacobum Haddonum	D. Iacobum Haddonum Anglum diligenter salutabis; indicabis curaturum me, ne quid libelli illius edatur, de quo ille ad me scripsit.
10	Jean du Fraisse	Ioh[annes] Frax[ineus]	Tuus Ioh[annes] Frax[ineus] , ep[iscopus] Bayo[nensis].
10	Jean Budé	Budaeus	Superest ut d. Budaeus quod literis complecti non expedit coram vobis exponat.
10	Pierre de la Ramée	Petrum Ramum	Petrum Ramum , virum tum pietate tum eruditione praestantem, quem tam officiose salutari iubebas, vides; cuius congressum tibi iucundissimum fore non dubito, a quo utpote nostrorum hominum iam peritissimum multa audies, quae scire operae precium fuerit; itaque plura non addam.
10	Rosina Zollikofer	Zollikofferin	Unnd ob es sich aber begäbe, das durch ein urtheil der vilgedachten oberkeitt der vorgeņempt Haga der Zollikofferin abgespröchen wurde, als das die oberkeitt von des dritten grads und von wegen anderer eehaften ursachenn, das versprächen irer beiden ufflößen unnd nüt wölt gelten lasßen, halten wir nitt, das sy beide inen in dem ein gwüßne machen söllind, das sy der erlütherung irer ordenlichenn oberkeit, deren sy doch sy sich ergäbenn habend, volgend unnd sich in ander weg vereelichend.
10	Petrus Dathenus	Dathenica	Non erat necesse, mi Bullingere, ut tanta solitudine rogares, ne commoverer Dathenica intemperie; perinde mihi fuit ista intelligere convicia, ac si somnium vidissem, propterea quod eadem haec saepe audivi ab illis inculcata esse ad nauseam usque principi electori aliisque cunctis publice et privatim.

10	Jan Myszkowski	Ioannis Mis-covii	Palatinus noster miratus est plurimum te in rationibus Ioannis Miscovii faciendis ita fuisse occupatum, ut minutula quaeque propria manu annotare non gravatus fueris.
10	Moritz Schneewolf	Maurici	Dominus Iesus, servator noster, salus et vita unica, consoletur et confirmet te, Maurici frater charissime, in fide vera!
10	Fridolin Schuler	Fridli Schûler	Min grütz und willigen dienst zûvor, erwidiger, getrüwer, lieber herr gfatter, hütt nach der predig kumpt zû mir houptman Fridli Schûler und seit mir, wie er von minem schwager houptman Schießern verstanden, das zû Genff sollint 300 reisiger ligen.
10	Johann Stupanus	St[upani]	Daruff ich gesagt "So gäbendts nun doctor Zwingern", und hab im daruff ein paquet gäben, gen Parys doctor Ramo zûgehörig, und das habe er d. Zwinggern gäben und den brieff St[upani] nienan veruntrüwt.

Table 9: Persons and their Latinized Forms with Sentences

Freq	Modern Name in EN	Observed Form	Sentence
10'624	Zurich, CH	Tygurinorum	Ex Capella Tygurinorum , quarta junii, anno ab orbe redempto 1528.
2'768	Basel, CH	Passell	Den ersammen, frommen, fürsichtigen und wysen Adilbergen Meyern, burgermeister und radt der statt Passell [!], minen g[nädigen] und lieben herren.
2'467	Bern, CH	Bernatibus	Pręterea nihildum audio de vestratium cum Bernatibus consensione, qua nihil esse conducibilis possit.
2'401	France	Gallus	Gallus colludit cum aliquot principibus et nescio quid monstri alere videtur.
2'015	Augsburg, DE	Augusta Vindellicorum	Si quid ex Augusta Vindellicorum habes, ut ad nos scribas, precor.
1'640	Strasbourg, FR	Argentoratensis	Patria Argentoratensis est, uxorem praeterea habet et filiolas, ni fallor, duas.
1'544	Chur, CH	Rhetorum Curia	Ex antiqua Rhetorum Curia , penultima aprilis 1536.
1'461	Geneva, CH	Jenfer	Unser herren botten, 4 von räten und burgeren, ligent daselbs a prima ianuarii usque in hunc diem von der söld dess Jenfer kriegs wägen, sind noch nitt bezalt.
1'319	Switzerland	aidtgnossen	M[ine] h[erren] die aidtgnossen kond morn erst gen Tänicken.
1'234	England	Enngelland	Ich han auch sunderlich gernn gehörrt, daß daß wortt gotteß in Enngelland so frig gebredigett wirdt, in hoffnug, so si eß mit liebe annemend und dankpar synd, gott werde fil gütz dadurch wükkenn.
424	Poland	Polonię	In finibus Polonię locustarum vis nihil non perdidit.
159	Hungary	Pannoniis	Sed de his rumorum flatibus nil habemus certi, nisi quod certum est, Turcam gravissime imminere Pannoniis .

132	Valtellina, IT	Fälltlyn	Und allß man lang mitt wunder gewartet, durch welchen wäg sy wöllind zühen in Italien, sich, so kumpt das geschrey, sy wöllend inn das Fälltlyn val-lenn.
112	Swabia (de. Schwaben), DE	Svevia	Nam et ipse aderit Bucerus cum quibusdam ex Svevia .
90	Engadin, CH	Egnadinam	Ego isto hoc momento Egnadinam versus et illinc recta et prope Clavennam sum profecturus, ubi adhuc circiter menses duos in magistratu sum moraturus.
49	Brusselles, BE	Pryssel	Der könig soll zû Wien mitt grossem jubel ankommen sein, der printz noch in 14 tagen auß Augspurg uff Hispanien verrucken, dessglichen die konigin Maria uff Pryssel .
41	Hamburg, DE	Amburga	Quin et ipse rex in finibus regni, hoc est non procul Amburga , degebat.
34	Four evangelical city-cantons, CH	4 urbium	Confessio 4 urbium nobis non admodum adversa est, nec in ea invenimus quicquam, quod displiceat.
13	Bayonne, FR	Baionensis	Remitto tibi literas Baionensis episcopi, versuti et callidi hominis, et pro illarum communicatione ago tibi gratias.
11	Mansfeld, DE	Manßfeld	Ceterum rumores bellici undique crepant; aiunt comitem a Manßfeld magno exercitu adversus Augustanos parasse bellum, Albertum marchionem cum suo milite in comitatu Pfirt hyematurum multi timent.
10	Malans, CH	Malantz	Die pestilentz sol in einer wilde im Brättigöuw, uff Tschuders genant, sich yngelassen haben und zimlich arbeiten; sonst stirbt in Pünten niemand diser krankheit, so vyl ich weiß; dan zû Malantz und Zizers, daa es einmal angesetzt, hats wider nachgelassen.
10	Eisenach, DE	Isnaci	Nam animum, quem in illis exposuerunt, in comitiis Isnaci habitis pulcherrime confirmarunt.
10	Salzburg, AU	Salisburgensis	Salisburgensis , quo nimirum hic est praeceptore usus, permultos in exilium pepulit religionis causa; sed contra stimulum uterque calcitrat experturus vindicem dei manum.
10	Hagenau, FR	Haganoensibus	Rediit vir quidam bonus ex comitiis Haganoensibus .
10	Livonia (de. Livland, historic baltic region)	Livonia	In Livonia maximum est exortum bellum.
10	Marthalen, CH	Martela	Es habent myn herren sich mit hern Abt von Rynow gütlich vereynt, das yetzmaln ein predicant gen Martela , der Rynow unnd Benken ouch verseche, erwelt werden solle inhalt gethaner abredung.
10	Burtenbach, DE	Burtennpach	E[wer] gutwilliger S[ebastian] Schertlin von Burtennpach , ritter subscripsit.
10	Gascony (de. Gascogne), FR	Gaßguuyer	Habe gerüst 18000 Frantzosen und Gaßguuyer .
10	Arras, FR	Atrebatensem	Mirabilis rumor volat episcopum Atrebatensem non-nihil declinasse ad Gallum, a Cæsare arreptum et decollatum.

10	Prättigau, CH	Prettigeüw	So weiß ich kein gmeind imm Prettigeüw , die ziehen welle.
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Table 10: Places and their Latinized Forms with Sentences