The MT Priming Effect - Paper

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1) Introduction

Nowadays, using MT (machine translation) systems such as DeepL seems indispensable. Not only is it free and fast, but it also delivers great output. At least, that's what you'd probably think if you didn't look deeper into the subject.

MT in general means that a computer system translates a text automatically by using artificial intelligence (AI) and without any human involvement. DeepL is a neural machine translation (NMT) system, which means that neural networks are trained with a large set of translation data, containing both source and target texts. They can refer to what they've "learned" to generate an output.

Before analysing how MT influences the translation process, let's have a look at the following illustration:

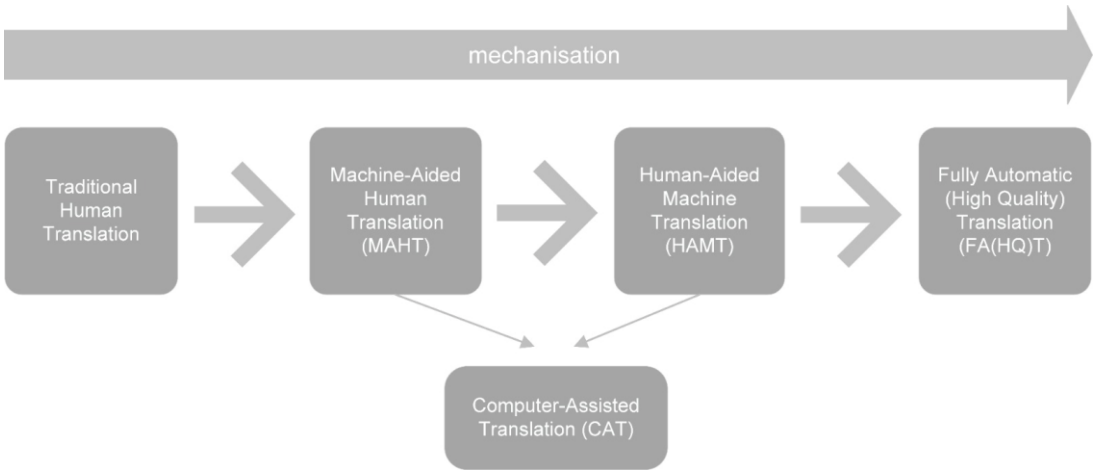

Figure 1: own illustration adapted from Hutchins/Somers 1992

This scale of translation automation shows 2 extremes. On the left, in the scenario of traditional human translation, translators translated a printed version of the source text only using printed dictionaries and pen and paper. Due to mechanisation and advancement of technology, different types of machine translation have developed. In the current level of development, we are situated in computer-assisted translation (CAT), which includes human-aided machine translation (HAMT) and machine-aided human translation (MAHT). In MAHT the translator translates independently but uses tools like terminology databases and spell-check. In HAMT the translator runs the text in an MT system and edits and corrects it afterwards. As you'll probably know by now, NMT has become state-of-the-art in recent years. Consequently, NMT systems are increasingly employed in the professional translation process to increase translation productivity. Translations produced by NMT systems are often grammatically acceptable and sound idiomatic, which

makes it harder for us (future professional translators) to discover mistakes such as critical shifts in content (e.g. omissions, additions or inverted negations) or expressions and terms that might be inappropriate for the text type or incomprehensible to our target audience. NMT systems, more so than systems relying on previous MT architectures, therefore often tempt us to adopt their suggestions when post-editing their output.

2) Post-editing

Correcting and editing a raw machine-translated output as a human translator is called post-editing (PE). Following specific quality criteria, the MT output is checked for understandability and accuracy, readability is enhanced and mistakes are corrected. This results in a certain amount of work needed to carry out PE. This work covers 3 dimensions:

1. **Temporal dimension**: the duration required to fix a machine-translated text's flaws

2. **Cognitive dimension**: the type and degree of cognitive processes that need to be engaged to fix a specific machine translation flaw

3. **Technical dimension**: the amount of deletion, insertion, reordering, or a combination of these actions

There are two types of PE—light post-editing (LPE) and full post-editing (FPE). On the one hand, light post-editing (LPE) is supposed to make the MT output understandable. Although style, terminology, grammar, and/or syntax may not be flawless, it should express the same meaning as the source text. In full post-editing (FPE), on the other hand, the post-editor aims to edit the MT output to make it coherent and accurate without any grammar or syntax flaws. This means that FPE should bring the quality of the MT output close to that of a human translation.

Depending on the desired level of quality, the post-editor is responsible, among other things, for checking grammar, spelling and punctuation, ensuring correct and consistent use of terminology, and standardizing the language style and register. There are four key problem areas that, while rarely a problem in human translation, are regularly present in MT outputs and hence require special attention during post-editing.

1. **Unidiomatic expressions:** As MT systems are not trained frequently enough with adequate adaptations, they often translate typical source language expressions word by word.

2. **Lexical disambiguation**: Due to their lack of contextual awareness and world knowledge, MT system fail to appropriately distinguish between multiple meanings of a word, which often results in the incorrect translation of polysemes.

3. **Semantic disambiguation**: MT systems refer to the most frequently used translation in the training material, which might not be the correct one in the respective context.

4. **Syntactic disambiguation**: Syntactic rules of the target language are not followed.

3) MT priming

Priming can be understood as an unconscious mechanism that influences the way we perform a task based on something we've experienced before. In the context of MT, priming occurs when a post-editor is unconsciously influenced by an MT output, which means that the reception of the MT output affects their translation behaviour. In particular, the linguistic quality of an MT output frequently affects their choice of post-editing strategies.

MT-induced priming effects have been identified in various studies and are closely related to the concepts *translationese*, *machine translationese* and *post-editese*.

Translationese means that human translations tend to show linguistic features that differentiate them from a target language original. These linguistic features are also referred to as *laws of translation* or *Translation Universals*, which include the following tendencies: *simplification*, *normalisation/homogenisation*, *explicitation* and *interference*.

Simplification

Three types of *simplification* have been identified in human translations: lexical, syntactic, and stylistic. *Lexical simplification* derives from the individual's semantic competence in their native language and comprises six principles:

1. Use of superordinate terms: when no equivalent subordinate term can be found in the target language
2. Approximation of the concepts in the source language text
3. Use of 'common level' or 'familiar' synonyms
4. Transfer of the functions of a word in a source-language to its target-language equivalent
5. Use of circumlocutions: instead of finding conceptual matches for high-level words or expressions

6. Use of paraphrase: in the cases of cultural gaps between the source and the target languages

Syntactic simplification takes place when complex syntax is simplified by human translators to make the text easier to understand. In a nutshell, the tendency consists in breaking up long sentences and includes a variety of strategies, such as the following:

1. Replacing of non-finite clauses with finite ones
2. Substitution of elaborate phraseology with shorter collocations
3. Reduction or omission of repetitions and redundant words
4. Exclusion of modifying phrases and words

The reduction and exclusion of repetitions found in the source text can also be seen as *stylistic simplification*.

Normalisation

Normalisation, also referred to as *homogeneisation***,** consists of adjusting the target text to the expectations of the target audience. This includes changes in word choice, syntactic structure, or style with the aim of making the text more accessible and more familiar to the intended readership.

Explicitation

Explicitation takes place when the translator applies own interpretation of the source text and inserts additional words, such as cohesion markers. Explicitation techniques encompass the following ones:

1. Use of interjections: to better express the characters‘ thoughts or to put emphasis on a given interpretation
2. Addition of modifiers, qualifiers, and conjunctions: to achieve greater transparency
3. Addition of extra information and explanations and repetition of previously mentioned details: to achieve more clarity.
4. Use of precise renderings of implicit or vague data
5. Provision of more accurate descriptions
6. Addition of names to geographical locations
7. Disambiguation of pronouns: to clarify forms of identification

Interference

Interference is the tendency to translate the source text literally instead of employing the linguistic knowledge of the target language. The extent of interference depends on the

professional experience of the translator and on the sociocultural conditions. For example, influenced by interference, translators can adopt language patterns from the source text (e.g. adopting verbal style when translating from English into German).

Machine translationese and post-editese

Interestingly, MT output often displays features of translationese, which could be described as *Machine Translation Universals* or *machine translationese*. Here's why: like all corpus-based MT systems, NMT systems are trained with large corpora containing translation data in both the source and target languages. These translation data are often created by professional translators and may to some extent display the Translation Universals described earlier. Therefore, NMT output may contain the features of transla-tionese and post-editese. For example, if the translation data frequently displays explic-itation strategies, the NMT system is likely to reproduce this.

It is important to note that priming has a stronger effect in post-editing than in human translation. Due to the MT priming effect, it is often more difficult for the post-editor to produce translations that offer alternatives. Post-editors are less likely to change the MT output since it's already written in the target language. As a result, a post-edited output offers a lower variance than a human translation text**.** This difference could be described as *post-editese*.

4) Data Collection and Evaluation

Putting theory into practice, we're now moving on to analysing different translation scenarios to identify the differences between an NMT output, post-edited NMT outputs (MTPE) and human translations from scratch (HT)[1]. To analyse the different target texts produced in these scenarios, we use basic tools that help us collect and evaluate data as well as draw conclusions from our findings.

In the accompanying video, we explain relevant concepts and guide you step by step through the analysis. If you like, you can follow the individual steps and gain your first experience with the analysis of different types of translation data. For this, you need the following (freeware) tools:

- Microsoft Excel
- AntConC (http://www.laurenceanthony.net/software/antconc/ (13 July 2022))
- TagAnt (http://www.laurenceanthony.net/software/tagant/ (13 July 2022))

[1] Please note that these texts are the ones presented in Rupcic (2021).

In the video, we cover each tool and explain how to best use them for analysing the different target texts. However, if you are unfamiliar with AntConc, we recommend that you watch the following tutorials before watching the video.

1. AntConc 4 – Tutorial 1 Getting started https://www.youtube.com/watch?v=br3v9rQKpyo (13 July 2022)
2. AntConc 4 – Tutorial 4 File tool basics https://www.youtube.com/watch?v=kreOmM49z3c&list=PLiR-IDpYmiC0R3Vv5NncOuIqaUcyLLW7Ae&index=4 (13 July 2022)
3. AntConc 4 – Tutorial 8 Word list tool basics https://www.youtube.com/watch?v=MSl4WjM9Mw4&t=99s (13 July 2022)

5) Analysis results – examples

In this chapter, we'd like to show you some examples of where the target texts, produced in the different translation scenarios (NMT, MTPE, HT), differ. We'll explain the differences and add interpretations to make our analysis results more tangible.

5.1) Differences in part of speech and style – part one

Example 1:

Source text	NMT	HT_B7	MTPE_A3
By using this website you are agreeing to be bound by these terms and conditions **('these Conditions')** and [...] subject to any additional terms and conditions that are **applicable** to that service.	**Durch die Nutzung** dieser Website erklären Sie sich damit einverstanden, an diese Geschäftsbedingungen **(„diese Bedingungen")** und [...] unterliegen Sie den zusätzlichen Bedingungen, die auf diese Dienstleistung **anwendbar** sind.	**Mit der Nutzung** dieser Website stimmen Sie den folgenden allgemeinen Geschäftsbedingungen **(folgend „Bedingungen" genannt)** sowie [...] stimmen Sie allen zusätzlichen Bedingungen zu, die für diese Dienste **Anwendung finden**.	**Durch die Nutzung** dieser Website akzeptieren Sie diese Geschäftsbedingungen **(„diese Bedingungen")** und [...] unterliegen Sie den zusätzlichen Bedingungen, die auf diese Dienstleistung **anwendbar** sind.

In this example we can see several peculiarities. We can see that the sentence starts with "By using" and the NMT output as well as the MTPE show the probably most obvious

translation (“Durch die Nutzung”) whereas the HT shows the – at least in this context – actual translation (“Mit der Nutzung”). The human translator probably wanted to consider the text conventions of legal German here. But in all translation scenarios we can find the transformation of the gerund into a nominal construction which is the common construction in legal texts.

The phenomenon of a more literal translation with the NMT and the MTPE can be found at the end of the sentence as well. The word “applicable” was translated literally (“anwendbar”) by maintaining the adjective. However, in the HT, this construction was transformed into a nominal one (“Anwendung finden”), which again is the more appropriate one in a legal context and has a higher register as well.

We can also find another literal translation in this sentence. In the parenthesis, the source text reads “these Conditions”, which was translated literally by all translation scenarios but the HT. The HT added two words so that the translation reads “folgend „Bedingungen“ genannt”. This is also an example for increasing lexical density because in the MTPE the determiner and noun were just maintained whereas in the HT two content words were added (“folgend”, “genannt”).

These three examples show that the HT used the most common and most appropriate translations whereas the NMT and the MTPE stuck very closely to the source text and consequently text conventions weren’t considered.

Example 2:

Source text	NMT	HT_B6	MTPE_A3
You are **to abide** by the following **rules**:	Sie **müssen** sich an die folgenden **Regeln** halten:	Sie **sind zur Einhaltung** der folgenden **Vorschriften verpflichtet**:	Sie **müssen** die folgenden **Regeln** einhalten:

In the second example, there are two peculiarities showing how closely the NMT and MTPE stuck to the source text. Firstly, the NMT and MTPE translated “to abide” with “müssen”, so the verbal construction was maintained whereas in the HT we can find a nominal and more appropriate translation (“sind zur Einhaltung verpflichtet”), which has a higher register as well. By adding the content words “Einhaltung” and “verpflichtet”, the lexical density is increased again.

Secondly, NMT and MTPE used the probably most obvious translation for “rules” (“Regeln”). But in this context, it’s not appropriate. In the HT, however, we can find the more appropriate translation in this kind of context which is “Vorschriften”.

Again, we can see that the human translator is the only one that doesn’t stick to the source text but tries to find the most appropriate translation by translating more freely.

Example 3:

Source text	NMT	HT_B7	MTPE_A5
[…] not to **promote** or **advertise**, or engage in any other form of marketing, [...].	[…] nicht für andere Formen des Marketings zu **werben** oder zu **werben**, [...].	**Werbeaktivitäten** [...] sind nicht zulässig, [...].	**keine Reklame, Werbung** oder andere Formen des Marketings zu **veröffentlichen**, [...].

This is a clear example of the human translator translating more freely. Instead of maintaining the verbal construction and translating literally (which would also lead to a quite long and complicated sentence), the human translator used only one noun (“Werbeaktivitäten”) that describes exactly the content of the source text sentence. It leads to a shorter sentence and a nominal construction.

This is an example where the MTPE shows that the post-editor tried to translate slightly more freely but at the same time to maintain the meaning of “promote” and “advertise” (“Reklame, Werbung”).

Example 4:

Source text	NMT	HT_B7	MTPE_A5
We do not endorse, and we are not responsible for [...].	**Wir befürworten nicht** [...] **und sind nicht** dafür **verantwortlich**.	**Macmillan Publishing Limited übernimmt keine Haftung** für [...].	**Wir sind nicht** für [...] **verantwortlich und befürworten** diese **nicht**.

In this example, we can again see that the NMT and MTPE stuck closely to the source text by translating “we” literally whereas the human translator changed the personal pronoun into the name of the company (“Macmillan Publishing Limited”). This is not only more appropriate in legal texts but also more formal.

This phenomenon can also be seen in the other marked part of the sentence ("do not endorse, and we are not responsible for") where the NMT and MTPE stuck closely to the source text by translating literally, maintaining the verbal construction, and only slightly changing the sentence order. In the HT, we can see that the translator tried to use a more appropriate and shorter expression ("übernimmt keine Haftung"), which again is a nominal construction.

5.2) Differences in part of speech and style – part two

On average, human translations in our examples show slightly higher values for lexical density (the difference ranges from 0,52 to 0,58) than post-edited texts (0,51 to 0,54), and the NMT output has the lowest lexical density (0,49).

Now, we can take a look at lexical density in relation to the usage of specific parts of speech, for example, nouns and verbs.

Nouns and nominal style in German

The following example shows the difference between the lexical density for nouns of a post edited text (MTPE_A5, 77 nouns) and a human translation (HT_B9, 92 nouns). In comparison with MTPE_A5, HT_B9 prefers the nominal style, which is also characteristic for legal German and thus adheres to the text conventions.

MTPE_A5	HT_B9
erklären Sie sich **damit einverstanden**, […].	stimmen Sie der **Anerkennung** […]
wenn Sie eine bestimmte **Dienstleistung** […] **nutzen**	**im Falle einer Nutzung** unserer Dienstleistungen
Bitte lesen Sie diese Bedingungen; **sie sind wichtig**.	sie sind **von großer Wichtigkeit**
wenn wir von einem Gericht […] dazu **aufgefordert oder angeordnet werden**	**im Falle einer Aufforderung** oder Anweisung
Sie **müssen sich** an die folgenden Regeln **halten**	Sie sind **zur Einhaltung** der folgenden Regeln verpflichtet

Verbs

Similarly, the lower number of verbs (19) in HT_B7, compared to the machine-translated text (MTPE_A5, 30) is also worth examining further:

Source text	HT_B7	NMT	MTPE_A5
If you purchase or acquire goods or services from any third parties	Beim Kauf oder bei der Nutzung von Waren oder Diensten von Drittanbietern bestehen jegliche Verträge	Wenn Sie Waren oder Dienstleistungen von Dritten kaufen oder erwerben	Wenn Sie Waren oder Dienstleistungen von Dritten kaufen oder erwerben

One of the reasons for the lower number of verbs in human translation can often be a preference for nominal constructions, which can be related to the use of impersonal style (outlined below).

Further differences: impersonal style in HT

With the insights derived from the brief analysis of lexical density, we can explore further instances of impersonal style in human translations compared with the NMT output and post-edited text:

HT_B7	NMT	MTPE_A5
Beim Kauf oder bei Nutzung	Wenn Sie Waren oder Dienstleistungen von Dritten kaufen oder erwerben	Wenn Sie Waren oder Dienstleistungen von Dritten kaufen oder erwerben/
Angriffe sind untersagt	Sie dürfen niemanden persönlich angreifen	niemanden persönlich anzugreifen
Folgende Regeln müssen eingehalten werden	Sie müssen sich an die folgenden Regeln halten	Sie müssen sich an die folgenden Regeln halten
es dürfen keine beleidigenden oder obszöne Inhalte veröffentlicht werden	Sie dürfen keine Schimpfwörter oder Obszönitäten vorbringen	keine Schimpfwörter oder Obszönitäten zu veröffentlichen

Interestingly, the NMT output and the post-edited texts are relatively similar. This is one example on how post-editors leave the NMT output unchanged or add minimal corrections because they rate it acceptable. On the contrary, we can observe that the human translator, not primed by the MT output, prefers to use impersonal constructions (e.g., “es dürfen” instead of “Sie dürfen”, or “Angriffe sind untersagt” instead of “Sie dürfen niemanden angreifen”), which is also characteristic for legal German.

5.3) Normalisation/Explicitation

We also would like to show you how human translation can add value to the final translation result. The following two examples illustrate how HT adheres to the text conventions of legal German by translating more freely, i.e. more independently of the source text.

Example 1:

Source text	HT_B6
We want to encourage visitors to this website **to contribute to this website**, but we want you to use this website responsibly.	Wir möchten die Besucher unserer Website **zu Beiträgen zu dieser Website** ermutigen, bitten jedoch um eine verantwortungsvolle Nutzung der Website.

This is a case of **normalisation**. The source text was written in verbal style, but the HT decided to shift to nominal style in the translation due to the conventions of German legal language.

Example 2:

Source text	HT_B6
If you purchase or acquire goods or services from any **third parties**, even if you have been directed from this website to **them**, any contract you enter into with those **third parties** and any use you make of **their website** is a matter between you and **them**.	Im Falle eines Kaufs oder Erwerbs von Waren oder Dienstleistungen von **Drittparteien** erfolgt jeglicher Vertrag, den Sie mit **der Drittpartei** schließen, und jegliche Nutzung **der Website der Drittpartei** zwischen Ihnen und der Drittpartei, selbst wenn Sie von dieser Website an die jeweilige **Drittpartei** weitergeleitet wurden.

In this translation, we can see an example of both **normalisation** and **explicitation**. On the one hand, repeating the noun “Drittpartei” instead of using pronouns (“them”, “their”) makes the translation more explicit and precise, on the other hand, it also adjusts the text to the characteristics of legal German, which require the phrasing to be as unambiguous as possible.

6) Conclusion

In conclusion, our data analysis and the discussion of various examples from the different translations scenarios mostly verified the claims and tendencies we covered in chapter 3 and in the beginning of our video.

In human translations, lexical variety tends to be higher than in NMT outputs and post-edited texts. This seems logical: it's easier for human translators to translate more freely and use a wider variety of words because they are not primed by the target language suggestions of the NMT output. They therefore automatically draw on a larger vocabulary.

Post-editors do work with an NMT output and tend to stick to it. In addition, the NMT output tends to stick more closely to the source text and does not consider context information such as language standards and text conventions.

However, this is characteristic of human translation: professional translators tend to follow the respective language standards, e.g. German often tends to the nominal style whereas English tends to use verbal constructions. Translators also follow the respective text conventions, e.g. legal text conventions (nominal and formal style). The NMT doesn't follow these text conventions or language standards, but imitates the source text, which can be generally categorised as interference. Since post-editors are less likely to change the NMT output, tendencies of interference and simplification are increased.

Additionally, the values for lexical density we discussed in our video were verified by the examples. On average, lexical density tends to be lower in raw NMT output and post-edited texts than in human translations. However, it remains unclear whether this is a systematic difference between the different translation scenarios.

Consequently, the NMT output tends to reproduce the structure of the source text and to reduce the lexical variety and density compared to human translations. Machine translationese therefore tends toward interference and simplification, which might originate from tendencies in the training data, showing evidence of translationese. Post-editing counteracts these tendencies to some degree, but not completely since evidence for interference and simplification can also be detected in the post-edited texts. We can therefore say that there seems to be a close interdependence between the concepts *translationese*, *machine translationese* and *post-editese*.

But what does that mean for future translators? Since post-editing is increasingly implemented in the professional translation process, professional translators will probably have to get used to a new way of working. They have to improve MT outputs, but not necessarily make them perfect (depending on the assignment). Since post-editing usually comes with a discount or similar methods to decrease the costs, the result must be made usable or understandable with as little effort as possible. To ensure this, professional translators should keep in mind that machine translationese often shows tendencies toward interference and simplification. With this knowledge, the respective errors can be spotted and corrected more efficiently.

In addition, NMT systems are not yet capable of adequately and reliably considering all context information and situational factors in a communication scenario (expectations and level of knowledge of the audience, text function, text convention, client requirements regarding terminology, style and addressing the reader). In contrast, it takes professional translators only a few minutes to access this knowledge by looking at the assignment or asking the client. For the foreseeable future, it will therefore be primarily up to professional translators to take these factors into account when working with NMT systems.

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