

# Brazilian short prose in German: A study of literary post-editing

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## Abstract

This article investigates the post-editing workflow and types of edits made in the context of a real-life literary translation project. The source text is a short narrative by Brazilian author Lima Barreto. The text was first machine-translated into German by DeepL and subsequently postedited by a literary translator, using a keylogger to capture edits and intermediate versions.

**Keywords:** Literary post-editing; post-editing workflow; edit distance; typology of edits; intermediate versions.

## Resumen

Este artículo investiga el flujo de trabajo de posesición y los tipos de edición realizados en el contexto de un proyecto real de traducción literaria. El texto original es una narración breve del autor brasileño Lima Barreto. El texto fue traducido automáticamente al alemán por DeepL y posteriormente poseditado por una traductora literaria, que utilizó un keylogger para capturar las ediciones y las versiones intermedias.

**Palabras clave:** Posedición literaria; flujo de trabajo de posesición; distancia de edición; tipología de ediciones; versiones intermedias.

## Resum

Aquest article investiga el flux de treball de postedició i els tipus d'edició realitzats en el context d'un projecte real de traducció literària. El text original és una narració breu de l'autor brasiler Lima Barreto. El text ha estat traduït automàticament a l'alemany per DeepL i posteriorment posteditat per una traductora literària, que ha fet servir un keylogger per capturar les edicions i les versions intermèdies.

**Paraules clau:** Postedició literària; flux de treball de postedició; distància d'edició; tipologia d'edicions; versions intermèdies.

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## 1. Introduction

For the occasion of the 200-year anniversary of Brazilian independence on 7 September 2022, the Brazilian embassy in Austria published a two-volume bilingual collection of Brazilian short fiction and essayistic prose written over the past two centuries and translated into German (Borges et al., 2022).<sup>1</sup> This article investigates one of the translations included in the anthology, which was not translated from scratch but via post-editing (PE) of a machine-translated draft generated by DeepL<sup>2</sup>. The translator whose work will be explored is a literary translator and co-editor of the anthology. She post-edited the draft in an MS Word window, with a keylogger running in the background (Inputlog; Leijten and Van Waes, 2013). By making her work available for research, she created a rare opportunity for investigating the use of machine translation (MT) and literary PE in a real-life context.<sup>3</sup>

The source text is a short autobiographical narrative by the Brazilian journalist and novelist Lima Barreto (1881–1922). Barreto was the son of first- and second-generation freed slaves and born at a time of great social instability. His writings include scathing chronicles of Brazilian society at the turn of the century, and he is nowadays counted among Brazil's most important writers. The source text is 1,652 words long and entitled *O Pavilhão e a Pinel* ("The pavilion and the [crazy] ward"); it is the first chapter of his *Diário do Hospício* ("Journal from the mental hospital"), written in 1919/1920 and published posthumously in 1956. In this diary-like narrative, Barreto reflects on his mental health and life in the psychiatric hospital where he was treated. In style, it is not as ornamental as the work of some of his contemporaries but rather matter-of-fact, with a preference for everyday language, straightforward syntax, and ample use of irony (Aidoo and Silva, 2014).

The focus of this article is twofold, i.e., on the workflow involved in producing the German translation of Barreto's text, and on the amount and types of edits made by the translator-as-post-editor. The data for analysis include the keylogs generated by Inputlog, the source text, the machine-translated output, intermediate post-edited versions, and the published translation. Together, the successive German versions that lead up to the final target text and attest to intermediate states of the translation in progress constitute what can be described as the translation's *avant-texte* – a portmanteau term coined by Jean Bellemin-Noël for the "sketches, manuscripts, proofs and 'variants'" of a literary work (1972: 15, quoted in Davis, 2002: 92; see also Feinauer and Lourens, 2020).

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<sup>1</sup> See also <https://centroaustriaco.com/2022/11/11/embaixada-do-brasil-na-austria-lanca-antologia-de-contos-brasileiros-com-traducao-em-alemao/>. [Accessed: 20231211].

<sup>2</sup> <https://www.deepl.com/translator>. [Accessed: 20231211].

<sup>3</sup> I am very grateful to the translator and the editors of the anthology for their consent and support.

## 2. Related research

So far, the use of MT and PE is still a marginal phenomenon in literary translation practice, which has also emerged from surveys on MT use by professional literary translators that were carried out a few years ago (Daems, 2022; Ruffo, 2022). Even though MT use can be expected to have somewhat increased since, most data and findings on literary PE that are available at this point come from research settings (e.g., Moorkens et al., 2018; Guerberof-Arenas and Toral, 2020; Şahin and Gürses, 2021; Guerberof-Arenas and Toral, 2022; Kolb, 2023; Vieira et al., 2023). Studies of real-life cases like the one under consideration here are still extremely rare.

One of them is a study by Macken et al. (2022), in which the researchers collaborated with a company specialized in book translation based in Belgium and Sweden which uses an "MT-enhanced workflow" (101) and provided them with an English novel as the source text (ST), a Dutch MT version (DeepL), a post-edited version and the final version, i.e., a revision of the post-edited text. Both the post-editor and the reviser were professional translators, with the reviser having more experience in the literary domain than the post-editor; the reviser worked mostly monolingually, but could access the ST when necessary. Linguistic features of the three target versions were compared and the (dis)similarity between the successive texts was measured with automatic metrics, among them CHARCUT (Lardilleux and Lepage, 2017), which has also been used in the present study. In addition, types of edits performed at each stage were identified manually. Results show that the post-edited version was more similar to the MT than to the revised version and more edits were made during revising than during PE, with most revisions aiming at rendering the final target text more acceptable for readers.

In another recent study of a real-life literary PE task (Winters and Kenny, 2023), a renowned German translator, Hans-Christian Oeser, agreed to use DeepL to translate a novel by Christopher Isherwood, *The World in the Evening*, and post-edit it for publication. The focus of this study was on edits which introduce the translator's own personal style into the post-edited text. For example, the authors analysed the translator's use of certain keywords which are not contained in the MT output; they found that these keywords are indeed characteristic of his personal style, based on a comparison of their frequency with the frequency of the same words in previous translations of his and a reference corpus of 57 contemporaneous literary works originally written in German. In an earlier study, Kenny and Winters (2020) asked the same translator to post-edit an MT version of a chapter from a novel by F. Scott Fitzgerald that he had translated two decades earlier; in this case, their analysis of his edits showed that the post-edited version contained less of his personal style than his translation from scratch. The translator himself described his two PE experiences as "painstaking retranslation", adding that "more often than not your creative energy is channelled along predefined paths which you might not even have known to exist and which might not at all correspond to your own writing style as it has developed over time" (Oeser, 2020: 22).

Castilho and Resende (2022) compared post-edited versions produced by nine professional translators of two English novels translated by Google Translate into Brazilian

Portuguese (Paula Hawkins' *The Girl on the Train* and Lewis Carroll's *Alice's Adventures in Wonderland*) and compared them with the published human translations. All translators but one had previously used PE professionally, a few translators had some experience with translating novels, while others had translated short literary texts during their training. The study did not aim to investigate a real-life scenario but to identify unique linguistic features that set the post-edited versions apart from the human-translated texts. Analysed features include lexical density, sentence length, use of pronouns, and convergence, among others, with results varying between the two novels. (Dis)similarity between the PE versions and the MT as well as the HT was measured automatically by (h)TER (Snover et al., 2006), showing high distance scores between the PE versions and the HT but very low scores for PE compared to MT output. From the low number of edits that were made, Castilho and Resende conclude that priming effects could play an important role in literary PE.

### 3. Study design

The study's design was developed against the background of the specific real-life context of the anthology translation project. The project was initiated by the Brazilian embassy in Austria in 2020, and the anthology was co-edited by four editors. At the time of the project, all of them were associated with the University of Vienna as lecturers in translation studies and/or Romance languages, some of them are also practicing literary translators and two of them had previously collaborated on translation projects with the embassy. The anthology's 81 texts (by 25 authors) were translated by a diverse group of 40 translators, including professional literary translators, teachers of translation, and (former) translation students from Austria, Germany, and Brazil. They were recruited through the editors' personal networks and a public call for collaboration, involving anonymous reviews of translation samples. In some cases, native speakers of German and Brazilian Portuguese collaborated on translations. The anthology was published by the embassy itself rather than a commercial publisher, and the translators were not paid for their work. The participating translators were free to propose authors and works to be included in the anthology; they were also free to follow their preferred translation strategies, the only guideline set by the editors was that translations should not be overly domesticating but preserve the text's idiosyncrasies and foreignness, and the use of footnotes was encouraged (Borges et al., 2022: 12-13). Each translation was revised by one or several of the other translators who contributed to the anthology. What is highly unusual is the visibility given to the translators in this project. The anthology contains biographical notes on the translators, and below each text's title the translator's name appears together with the respective reviser's name, thus highlighting not just the translators' dual role but also the fact that multiple agents were involved in the production of the translations and the translations contain multiple voices: the author's, the translator's, the reviser's (see, e.g., Alvstad et al., 2017; Kolb, 2019). My own role in the project was not only that of researcher, but I also participated as a translator of five

pieces by Lima Barreto and reviser of a number of texts, including the post-edited version investigated here.

At an early stage of the project, I approached the translators by email to ask whether they would consider working with a machine-translated draft for at least one of the texts they intended to translate rather than translate it from scratch and – if that was the case – whether they would be willing to work with a keylogger and make their work available for research. After some initial interest from several translators, three eventually committed to be part of the envisioned study. One of them was Melanie Strasser, a professional literary translator, German native speaker and co-editor of the anthology, and it is her work that will be investigated in this article. The other two collaborated on four texts for the anthology: one of the team a Brazilian Portuguese native speaker and a recent graduate from a translation program in Brazil at the time of the project, the other a German native speaker who teaches German and translation at a Brazilian university.<sup>4</sup> Exploring the collaboration of a native speaker of the source language with a native speaker of the target language can be expected to yield valuable insights into the role of MT and PE in such a scenario, but it is not the object of the present article.

Melanie Strasser holds a master's degree in translation studies and a PhD in Romance studies, both from the University of Vienna, and has translated other Brazilian authors such as, for instance, Machado de Assis (with Marianne Gareis). She is also a translation scholar and the author of a book on the concept of cannibalism in Brazilian translation theory (Strasser, 2023). At the time of the project she lived in Vienna, where she taught translation and literary theory at the University of Vienna. She also worked as an editor for a publishing house based there. Given her multiple roles as translator, reviser and co-editor, it can be assumed that she was firmly invested in the general orientation of the project and the guidelines described above. At the time of the project, she had five years of experience as a literary translator and no prior PE experience.

The study was designed with the aim of intruding as little as possible upon the post-editor's working routine, which is why keylogging was chosen as the sole tool and the use of additional tools such as think-aloud protocols was ruled out. The post-editor worked at home (her usual working environment for freelance translation work); she used the freely accessible version of DeepL to generate the MT draft and Inputlog as a keylogger. Inputlog has the advantage of allowing users to work in a familiar MS Word window, with the logging software running unobtrusively in the background. She therefore copied the DeepL draft into the MS Word window integrated into Inputlog rather than working directly in the DeepL interface. In her workflow, she also followed her usual translatorial routine of going through the text several times (in this case, doing several rounds of PE) and obtaining feedback from colleagues on an intermediate version before submitting her text for revision. As I had translated other texts by Barreto for the anthology and was familiar with his work and style, I was assigned the task of revising this translation by the editors. My revisions were made in MS Word, using the comments

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<sup>4</sup> I thank both translators for their participation.

and track changes functions (the standard procedure in the anthology project). As a last step, also standard procedure for all texts, two of the co-editors re-read the translation and finalized it for publication. After completion of the translation, the post-editor filled out a questionnaire on her background and perception of the PE task.

Given the limited space of a journal article, not all aspects of the making of this translation can be covered and a selection had to be made. The following aspects were chosen for analysis: the workflow for producing the German version of *O Pavilhão e a Pinel* (Section 4.1); the amount of edits made by the post-editor (Section 4.2); linguistic features that characterize the ST, the MT, intermediate PE versions, and the final target text (Section 4.3); for a subset of 508 words, the types of edits that were performed (Section 4.4); and for a sample passage, the role of intermediate versions (Section 4.5).

The aspects chosen for analysis throw light on the PE effort (Krings 2001) involved in crafting a publishable target text from the raw MT output. Based on the keylogs generated in the course of the task, the temporal PE effort can be determined, i.e., the time spent by the post-editor on the task, and an insight can be gained into the number and duration of successive PE rounds. MS Word files in which colleagues and the reviser gave feedback on intermediate versions attest to the role played by agents other than the post-editor (Section 4.1). Another indicator of PE effort is the amount of edits made by the post-editor. This can be determined by automatic metrics that measure the difference/similarity of texts. For this study, CHARCUT (Lardilleux and Lepage, 2017) was used, a character-based metric which has been developed to evaluate MT output by comparing it to a human reference translation in terms of insertions, deletions and shifts, i.e., calculating the number of such operations required to transform one text into the other. Here, CHARCUT is used to determine the edit distance or dissimilarity between successive target versions of the text (see also Macken et al., 2022; Section 4.2). In Section 4.3, successive versions are compared with a view to linguistic features such as lexical diversity, lexical density and sentence length (see also Castilho and Resende, 2022), which were extracted with Sketch Engine<sup>5</sup>. To gain an understanding of the types of edits made by the post-editor, a subset of 508 words (approximately the first third of Barreto's narrative) was annotated manually by me. One aim was to determine the role played by preferential edits, which reflect personal preferences of the post-editor and were carried out in addition to essential edits made to correct MT errors. For reasons of time constraints, a subset rather than the whole narrative was analysed, as it was large enough to elicit clear tendencies (Section 4.4). Section 4.5 uses the opening paragraph of the narrative as a sample passage to discuss the role of intermediate solutions.

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<sup>5</sup> <https://www.sketchengine.eu/>. [Accessed: 20231211].

## 4. Results and discussion

### 4.1 Workflow

The workflow for producing a German version of *O Pavilhão e a Pinel* to be published in the anthology involved a number of different agents and comprised a number of successive stages. The primary agent was the post-editor, while other agents were several colleagues who provided feedback on an intermediate version, and – at later stages – the reviser and two of the co-editors. Terminology regarding editing and revising activities in the literary field is far from uniform (Scocchera, 2013; Feinauer and Lourens, 2020), and work on a literary translation that is done after the production of a first draft is often referred to as (self-)revision. For the sake of clarity, the term revision is reserved here for other-revision, and all editing work done by the post-editor, regardless of the stage at which it was performed, is labelled as PE. Table 1 gives an overview of the workflow, including information on the type of activity, the agent(s) performing an activity, the software used, the date of work sessions, the duration of PE sessions<sup>6</sup>, the segments worked on or edited during a specific session and the (intermediate) target version produced during a specific session. As Table 1 shows, four workflow stages can be clearly distinguished: 1) a very work-intensive first PE stage, followed by 2) feedback and 3) revision stages, during which the translator received feedback from colleagues and the reviser, respectively, and used some of the input in subsequent PE rounds, and 4) a finalizing stage of mostly editorial tasks. Target versions are numbered consecutively, with the target versions achieved at the end of each stage labelled as PE 1, PE 2, PE 3, and the final version labelled as FV. All stages except the first also involved agents other than the post-editor.

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<sup>6</sup> An exception is the very last PE session in Stage 3, when the post-editor did not use the keylogger; no information is available for the duration of activities other than PE.

Activity	Agent	Software	Date (2021/22)	Duration (hrs:min:sec)	Edited segments (total: 32)	Target version
Stage 1						
PE	Post-editor	Inputlog	01 Mar	00:05:44	1	1
PE	Post-editor	Inputlog	12 April	01:07:16	1-11 <sup>7</sup>	2
PE	Post-editor	Inputlog	18 April	01:43:24	1-17	3
PE	Post-editor	Inputlog	18 April	01:20:33	12-23 <sup>8</sup>	4
PE	Post-editor	Inputlog	19 April	01:05:41	21-32	5
PE	Post-editor	Inputlog	20 April	01:05:45	1-17	6
PE	Post-editor	Inputlog	02 May	01:55:46	1-32	7
PE	Post-editor	Inputlog	02 May	01:07:11	1-32	8=PE 1
Stage 2						
Feedb.	Colleague	MS Word	03 May		1-32	
Feedb.	Colleagues	MS Word	05 May		1-17	
PE	Post-editor	Inputlog	06 May	00:59:17	1-32	9=PE 2
Stage 3						
Rev.	Reviser	MS Word	08 July		1-32	
PE	Post-editor	MS Word	08 July		1-32	10=PE 3
Stage 4						
Final.	Co-editors	MS Word	03-27 Jan		1-32	
Final.	Post-editor	MS Word	31 Jan		1-32	11=FV

Table 1: Workflow for producing the German version of *O Pavilhão e a Pinel*

<sup>7</sup> The MS Word file generated by Inputlog indicates that she worked on segments 1-23 that day. Due to a bug in the Inputlog software that was discovered only recently, long after the fact (my thanks go to Luuk van Waes for this information), Inputlog only logged her work on segments 1-11 (including duration).

<sup>8</sup> Again, the MS Word file indicates that she worked on segments 1-32, but only segments 12-23 were logged.



After an initial short session of just under six minutes on 1 March 2021, during which the post-editor worked on the first segment (segments correspond to ST paragraphs), she resumed work six weeks later, from then on working on it regularly over three and a half weeks. Due to a bug in the Inputlog software (see footnotes 7 and 8), we cannot be entirely sure whether she completed a first full-text work-through over four or five sessions; in any case, this first phase was followed by one more partial round and two more full-text PE rounds, resulting in target version 8/PE 1 (end of Stage 1). At this point, she submitted her target version (PE 1) to two external sources for feedback (external in the sense that they were not part of the pre-established workflow). Based on PE 1, a colleague sent her suggestions for edits in an MS Word file (comments function), and two days later, she spent an evening with six or seven colleagues from the Austrian Association of Literary Translators who meet from time to time to discuss a group member's work in progress (on this occasion, they discussed approximately half of her text). During the meeting, the post-editor noted suggestions coming from the group in an MS Word file (comments function). Some (but not all) of the suggestions from those two external sources were then used in another full-text PE round, resulting in target version 9/PE 2, a semi-final version she considered ready to be sent off for revision (end of Stage 2).

Approximately two months later, PE 2 was revised by me. I also made edits and suggestions in an MS Word file, some (but not all) of which were accepted by the post-editor in a final PE round, resulting in target version 10/PE 3 (end of Stage 3). After another six months, PE 3 was read by two of the co-editors when finalizing the text for publication (formatting, layout, adding the translator's and reviser's names). At this point, no further edits were made except deleting a stray full stop in a footnote. In a finalizing round of her own, the post-editor added a footnote with information on a cultural reference (end of Stage 4; resulting in target version 11, the final version). The fact that she performed multiple PE rounds, honing and re-honing her text, and also integrated feedback from external sources goes a long way towards explaining why only minimal edits were required in the revision stage (see Section 4.4). With one exception (or possibly two, see footnote 8), she started at the very beginning of the text each time she resumed work.

PE 1 was produced over at least 9 hrs 31 min, and possibly even longer, if we allow some additional time for edits that were not logged by Inputlog. As no comparative data on the post-editor's working speed when she translates from scratch are available, it is impossible to know whether her temporal effort was lower or higher than it would have been for a traditional translation. However, a comparison with data from a similar study could be of interest (Kolb, 2023), which took place in a research setting and in which five translators translated a short story by Ernest Hemingway from scratch and five different translators (all of them professional literary translators) post-edited a DeepL version of the same story. The present post-editor's working speed producing PE 1 was considerably lower than that of the slowest of the five Hemingway post-editors (2.9 vs.

3.6 words/min) – or, in other words, she put in more time.<sup>9</sup> Even though the two studies are both limited in scope, what these findings indicate is that translatorial behaviour in research settings might well differ from real-life contexts, in which translators-as-post-editors might feel a greater responsibility for the final product (in the present case, maybe even compounded by the post-editor's concurrent role as co-editor). Other factors, however, will also have played a role, such as differences between source texts, MT quality, and intersubject variability when it comes to working speed and working style.

The MS Word files containing the suggestions made by the post-editor's colleague and the comments she recorded during the peer-group session are a valuable part of the translation's *avant-texte*, as they not only reflect decision-making processes but also show how multiple voices may find their way into a translation, also in a PE scenario. Multiple translatorship (Jansen and Wegener, 2013) thus not only comprises revisers and editors, but also arises from the translator's or the post-editor's social interaction with colleagues, friends, or partners.<sup>10</sup> To quote the post-editor, "When I am faced with a problem, I like to ask all kinds of people what they think, and this often yields surprising insights." (Personal e-mail communication, 17 March 2023; my translation.) These voices are, as a rule, invisible and unacknowledged, but attest to what has been described as the distributed nature of translatorial cognition (Risku and Rogl, 2021).

#### 4.2 Edit distances

As shown in Section 4.1, the workflow comprised an extensive first PE stage, followed by two much shorter stages in which feedback from other sources was integrated into the target text by the post-editor. This temporal profile is in line with the scope or amount of edits performed in each stage. The amount of edits was measured by determining the edit distances or degrees of dissimilarity between the MT output and the target texts that were produced at each stage as well as the distances between individual target versions. Edit distances were calculated with CHARCUT. For Stage 1, the distance score for an additional intermediate target version (number 5) was calculated, as this target version stands at the end of the first complete work-through of the text (but see footnote 8). Table 2 shows CHARCUT scores for the specified target versions compared to the MT output, followed by scores comparing target versions with each other. The higher a CHARCUT score is, the more different two texts are from each other; in other words, higher scores stand for higher numbers of edits. Even though distance scores do not tell us what exactly was done to arrive at those versions, they can still serve as a rough indicator of the amount of PE effort that was expended at a particular point of the PE workflow (see also Section 4.5).

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<sup>9</sup> In the Hemingway study, think-aloud protocols were used. Allowing for a slow-down effect that has been associated with the think-aloud condition (Krings 2001; Jakobsen 2003), this difference would probably be even more pronounced.

<sup>10</sup> While keylogs do not contain any information on such interactions, think-aloud protocols sometimes yield valuable insights (Kolb, 2019).

As Table 2 indicates, the bulk of edits were made during Stage 1 leading up to PE 1 (with a CHARCUT score of 0.3808 compared to the MT), a point in the workflow when the post-editor decided to submit her text for external peer feedback. Within this first stage, two distinct phases can be discerned: a first and more edit-intensive phase resulting in target version 5 (with a distance score of 0.3325 compared to the MT), and a second – less intensive – phase of additional PE rounds, with a score of 0.1312 between target version 5 and PE 1.

Candidate text	Reference text	CHARCUT
MT	target version 5	0.3325
target version 5	PE 1	0.1312
MT	PE 1	0.3808
MT	PE 2	0.3946
MT	PE 3/FV	0.3952
PE 1	PE 2	0.0833
PE 2	PE 3/FV	0.0136
PE 1	PE 3/FV	0.0941

Table 2: Edit distances between selected target versions (CHARCUT)

During Stage 2, edits amount to a score of 0.0833 (PE 1 vs. PE 2), approximately 22% of the score reached in Stage 1, and include (but are not limited to) suggestions from colleagues. During Stage 3, the revision stage, very little happened, and PE 3 does not greatly differ from PE 2 (0.0136). As mentioned above, only two edits were made in the finalizing Stage 4, both relating to footnotes. As there is no easy way to take footnotes into account in CHARCUT, they have been excluded from this quantitative analysis so that, for the purpose of this article, PE 3 and the final version (FV) are identical. The final edit distance between the MT and PE 3/FV is 0.3952. As edits were sometimes reversed at later points (see Section 4.5 for examples), interim edit scores do not add up to the final score. (CHARCUT results from the aforementioned Hemingway study are slightly lower: 0.3076 on average, with 0.3656 as the highest score; Kolb, 2023).

The fact that these findings are very different from those reported in Macken et al. (2022; see also Section 4.4), where the post-edited version was more similar to the MT than to the revision and most edits were made during revising, points to the significance of work contexts. While results in the present study indicate that the translator-as-post-editor (possibly compounded by her role as co-editor) felt the main responsibility also

for the stylistic side of things lying with her (see also Section 4.4 for the role of preferential edits), in the workflow described by Macken et al. more responsibility for the final text seemed to have been with the reviser, the post-editor in all probability seeing their role mainly in providing an error-free version of the MT output.

### 4.3 Linguistic features

In their study of linguistic features that might distinguish traditional human translations from post-edited texts, Castilho and Resende (2022) consider lower scores for lexical diversity, lexical density, and sentence length as potential indicators of simplification or post-editese. As no human translation of Barreto's text is available, no such conclusions can be drawn here. However, comparing these features across German versions available in this study can provide some indication of the impact of edits on the texts' linguistic complexity. Table 3 shows the results for the following features: lexical diversity (type/token ratio), lexical density (content words/total number of tokens), and average sentence length (see also Macken et al., 2022) – all extracted with Sketch Engine, for the ST, the MT output and the PE versions which mark the end of each workflow stage.

Feature	ST	MT	PE 1	PE 2	PE 3/FV
Number of tokens	1652	1786	1855	1815	1814
Number of unique tokens	742	754	825	827	825
Lexical diversity	0.45	0.42	0.45	0.46	0.46
Lexical density	0.55	0.47	0.49	0.50	0.50
Number of sentences	90	90	89	90	90
Average sentence length in words	18.36	19.86	20.84	20.17	20.16

Table 3: Linguistic features of ST and selected target versions (Sketch Engine)

Not unexpectedly, lexical diversity is lower in the MT than the ST. That the range of vocabulary tends to be smaller in machine-generated texts than in texts written by humans has been shown in numerous studies, such as Vanmassenhove et al. (2019) or Lee (2022), who have also shown that MT tends to overgeneralize and favour more frequently used words over less frequent ones. In this case, for instance, two verbs from the same semantic field (“incomodar-se, aborrecer” [to trouble, to annoy]) were translated by DeepL with the same high-frequency German verb “stören” (to bother). The post-edited versions take lexical diversity back to the ST level, with PE 2 and PE 3/FV ranging even slightly higher (all post-edited versions avoid “stören” altogether, rendering the first verb by a paraphrase and the second by the much more unusual verb “verdrießen” [to irritate, to distress]). Similarly, lexical density is also lower in the MT than in the original

and then increases in subsequent versions, though it eventually remains below the ST level.<sup>11</sup>

PE 1 contains both the highest number of tokens and the highest average number of words per sentence. Both measures are slightly lower for PE 2 and PE 3/FV. While the higher number of tokens and longer sentence length in the MT compared to the ST will also have to do with differences between the languages (e.g., the frequent use of gerunds in Brazilian Portuguese, modal particles in German), differences between the MT and subsequent versions were largely caused by structural changes, mostly related to deliteralisation (see also Popovic et al., 2023, and Section 4.5).

#### 4.4 Typology of edits

For the purpose of this article, a 508-word subset of Barreto's ST was chosen to gain some insight into the types of edits that were made. The analysis is limited to a comparison of the MT output with the final version (identical with PE 3). The texts were manually annotated by me. For developing a suitable scheme of classification, inspiration has been drawn from typologies put forward for the analysis of MT errors and PE edits (de Almeida and O'Brien, 2010; Tezcan et al., 2019; Nitzke and Gros, 2020; Desmet, 2021; Macken et al., 2022). Edits were classified as either essential or preferential (Table 4), and for each group, edits were assigned to one of five categories (Table 5). Essential edits comprise changes made to correct MT errors, while preferential ones comprise interventions that go beyond achieving correctness regarding content, grammar, and orthography, but reflect the post-editor's personal preferences and her efforts to achieve a high-quality *literary* translation. The typology that has been developed to categorize edits (Table 5) deviates from others in one important respect – the treatment of style. It proceeds from a broad view of style as the very fabric of a literary text, the aggregate of its linguistic features, comprising "every sound, word, syntactic structure, co-referential link and overall shape of the text" (Mullany and Stockwell, 2010: 43) – and the view that those features reflect choices made by the author and, in this case, the post-editor. "Style consists in *choices* made from the repertoire of the language", is how Leech and Short phrased it in their classic *Style in Fiction* (2007: 31, italics in original).<sup>12</sup> These choices happen on various levels, be it on the level of semantics, syntax or, let's say, punctuation, and have specific effects. Style is therefore not treated as a category separate from semantics, syntax, or orthography.

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<sup>11</sup> Auxiliary verbs were excluded in both languages.

<sup>12</sup> In literary studies, style has been approached from different angles, style as choice being one of them; others include style as deviation from some norm or style as a person's individual way of expression.

Edits	Number	%
Essential edits	54	31.4
Preferential edits	118	68.6
<b>Total</b>	<b>172</b>	<b>100</b>

Table 4: Essential and preferential edits in PE 3/FV of 508-word subset

As Table 4 shows, approximately 70% of edits were of a preferential nature, and approximately 30% were made to correct MT errors (for edits in intermediate versions of a sample passage, see Section 4.5). Only eight edits were made in the revising stage: four essential edits, including orthography (two missing commas), morphology (agreement), and a case of "cleaning up", i.e., deleting a word that had been unintentionally left over from erased MT output (categorized as "Addition/deletion", see Table 5), and four preferential edits, including a lexical choice (register), a structural change, the substitution of a plural pronoun by a singular one to align the target text semantically more closely with the ST, and a case of optional punctuation. Macken et al. (2022) reported approximately 44% for both essential and preferential edits for the PE stage in their study, and 86% preferential edits for the revision stage, with the reviser making slightly more edits in total than the post-editor. Of the 27 sentences that make up this subset, only two very short and straightforward sentences were accepted by the post-editor without any edits: "Diesmal nicht." (Not this time.) – "Alípio und Jorge begleiteten mich." (Alípio and Jorge accompanied me.) Unedited sequences of words (disregarding punctuation) are for the most part short, which has been found to be the case not just for this subset but for the entire text. While the FV of the complete narrative still contains as many as 43 unedited 5-grams, numbers then drop dramatically to single digits for 6-grams and higher n-grams, a single 17-gram being the longest unedited sequence in the entire text. This is also broadly in line with findings in the above-mentioned Hemingway study (Kolb, 2023), in which participants edited between 87.5% and 95% of the total of 40 sentences (with not a single sentence accepted without edits by all five post-editors; comparable results are reported in Vieira et al., 2023).

The largest category of essential edits is semantics (77.8%), with lexical change the primary group (in her post-task questionnaire, the post-editor also named lexical choice as DeepL's main weakness). If a wrong term occurred more than once, the edit was counted each time: e.g., the MT contains three instances of "Hospiz" (for "hospício", which is a false friend, as the German term – like the English "hospice" – does not refer to an institution that cares for mentally ill patients but rather one for the terminally ill) and was edited/counted each time; interestingly, in two other instances of "hospício",

Essential edits	Number	%	Preferential edits	Number	%
Semantics	42	77.8	Semantics	74	62.7
Syntax	6	11.1	Syntax	38	32.2
Morphology	2	3.7	Morphology	0	0
Orthography	2	3.7	Orthography	6	5.1
Addition/deletion <sup>13</sup>	2	3.7	Addition/deletion	0	0
<b>Total</b>	<b>54</b>	<b>100</b>	<b>Total</b>	<b>118</b>	<b>100</b>

Table 5: Categories of essential and preferential edits in PE 3/FV of 508-word subset

DeepL translated it correctly as “Irrenhaus” (perceived as pejorative today, but common usage at the time). Most MT errors in the semantics category relate to verbs. Verbs, like adjectives, frequently have a broad spectrum of meanings with only partial overlap between languages, and to select the right one in a given context is a challenge for MT systems. For example, the semantic field of “dar” (to give) also contains the meaning “to give as a present”, “schenken” in German; this is the term DeepL used in a scene in which the inmates are given shoes to wear inside the compound, certainly not intended as a present. Another well-documented problem in MT is the omission of ST material; in the present subset, DeepL omitted part of a sentence that is relevant for coherence (I woke up). Syntactical errors were mostly due to literal translation. Worth mentioning is the low number of morphology and orthography errors, even for a text of the subset's size.

Five MT errors concern cultural references. For instance, Barreto describes one of the nurses as an arrogant Portuguese “com uma fisionomia bragantina”, referring to his facial features as characteristic of someone from the House of Braganza (the Portuguese dynasty that ruled Brazil until 1889). DeepL's translation of the adjective “bragantina” as “prahlerisch” is intriguing in that the German term fits the context but is at the same time a translation of the English term “bragging”. Also, “senhor” was rendered as “Mr.”, possibly due to its frequent occurrence in Portuguese training data. Not related to cultural references are some interesting instances of gender-biased mistranslation that occur in this and in later passages and in which the selected gender in the MT version contradicts not just contextual, but explicit grammatical gender information in the ST: e.g., the masculine “o interno” is rendered as feminine “Praktikantin” (female intern) or “o enfermeiro” as “Krankenschwester” (female nurse) (on gender bias in MT see, e.g., Savoldi et al., 2021). While “nurse” and arguably “intern” are certainly skewed towards feminine, the fact that “o inspector” was also rendered as feminine seems to contradict prevailing stereotypes. Whether the dominance of English training data might have played a role in these cases must remain a matter of speculation.

<sup>13</sup> Addition of ST material omitted by DeepL or deletion of unintentionally retained MT material.

In the group of preferential edits, the majority were also related to semantics, though the percentage was lower than in the group of essential edits (62.7% vs. 77.8%). Lexico-semantic edits were also the majority of edits reported in Macken et al. (2022). Without process data such as think-aloud protocols there is no way of knowing why exactly specific edits were made in a particular way; in some cases, we can make an educated guess – for instance, that explicitations of cultural references were made for pragmatic reasons. If a lexical change introduced a note of irony, we could assume that the post-editor considered these features in line with the situational context and Barreto's intention. Regarding syntax (32.2% of all preferential edits), changes are mainly related to sentence structure, such as replacing a relative clause by a main clause/adverb/apposition etc. or vice versa, or the addition/deletion of conjunctions. In most cases, the edits aimed at deliteralisation, as the MT output, despite recent advances in the technology, still tends to closely follow the ST's syntactic structure (see also, e.g., Webster et al., 2020).

The post-editor made use of a whole range of strategies, such as de- and reliteralisation, generalisation and specification, explicitation and implicitation, amplification, focalisation shifts etc. Literary texts tend to contain more ambiguity than other text types and be more open for interpretation, so that an important role in meaning construction is assigned to the reader – in this case, the post-editor. Even more than essential edits, preferential ones reflect the post-editor's specific way of reading and interpreting the ST, her assumptions about Barreto's intention, pragmatic considerations, and personal stylistic preferences.

#### 4.5 Sample passage: intermediate versions

The opening paragraph of *O Pavilhão e a Pinel* is used as a sample passage to illustrate some of the issues raised above, in particular, the role of intermediate edits:

Estou no Hospício ou, melhor, em várias dependências dele, desde o dia 25 do mês passado. Estive no pavilhão de observações, que é a pior etapa de quem, como eu, entra para aqui pelas mãos da polícia.

[English gloss: I am/have been in the Mental Hospital or, better, in various departments of it, since the 25th of the past month. I was in the observation pavilion, which is the worst stage for someone who, like me, enters here through the hands of the police.]

Table 6 lists relevant words/phrases from this passage in the ST, the MT output, and all target versions in which edits were made. Five versions of this short passage (3, 4, 5, 10/PE 3, 11/FV) do not contain any edits. Version 9/PE 2 was completed after the post-editor had received feedback from colleagues, and the asterisk (\*) indicates which solutions were part of this feedback. In all three cases, the suggestions from colleagues are identical with earlier solutions considered by the post-editor so that they did not introduce anything new at this point; however, they will probably have served at least as confirmation of previous choices the post-editor might have felt uncertain about.



ST	MT	1	2	6	7	8 = PE 1	9 = PE 2
Estou ... desde	Ich bin seit		Ich bin ... seit		Seit ... bin ich	Ich bin ... seit	Seit ... bin ich
passado	letzten		vergangen				
hospício	Hospiz	Irrenanstalt					
ou	oder	[deleted]					
melhor	vielmehr	besser gesagt	genauer gesagt		genauer	genauer gesagt	genauer*
várias	verschiedenen	verschiedensten	unterschiedlichen	verschiedenen			
dependências	Teilen	Abteilungen					
dele	davon	[deleted]	ihren				
Estive	Ich war				Zunächst war ich		
no pavilhão de observações	auf der Beobachtungsstation		im Beobachtungspavillon				
que é	die ... ist	[deleted, restruct.]	das ist [restruct.]	[deleted, restruct.]			
a etapa	die Stufe (nomin.)	die Station (nomin.)		die Etappe (nomin.)	der Station (dative)	die Station (nomin.)	der Station (dative)*
quem	diejenigen, die	jene, die	jemanden, der		einen, der	jemanden, der	einen, der*
como	wie	so wie		wie			
entra para aqui pelas mãos da polícia	hier in die Hände der Polizei geraten	von der Polizei hierhergebracht werden	von der Polizei hierhergebracht wird		von der Polizei eingeliefert wurde	von der Polizei hierhergebracht wird	von der Polizei eingeliefert wurde

Table 6: ST, MT, intermediate and final versions of opening paragraph

The opening passage contains two MT errors: the translation of “hospício” by a false friend (see Section 4.4) and the mistranslation “hier in die Hände der Polizei geraten” (fall here into the hands of the police). Both MT errors were remedied in the very first PE session; while the first edit was not revisited at a later point, the translation of the police phrase was revisited four times (change of verb, tense, number). As Table 6 shows, other words/phrases show similar circular movements: for example, “melhor” (better), translated as “vielmehr” (rather) by DeepL, was edited into “besser gesagt” (better said) (1), followed by “genauer gesagt” (more precisely said) (2) and “genauer” (more precisely) (7), before the post-editor circled back to “genauer gesagt” (8/PE1) and, finally, “genauer” (9/PE 2). Another instance where the post-editor seemed to hesitate, moving back and forth several times between two options, is the structure of the first sentence. DeepL normalised it by starting out with “Ich bin seit ...” (I am/have been since ...), moving the

date segment forward from the end of the sentence. During her second session, the post-editor restructured the sentence to follow more closely the original, creating a somewhat unusual German rhythm (2). In version 7, she moved in the opposite direction, deliteralising her previous option by now starting out directly with the date segment “Seit dem ... bin ich” (Since the ... I am/have been), a common German structure. She revisited this decision twice (8/PE 1 and 9/PE 3), reintroducing version 2 before finally settling on version 7. In session 7, she chose to restructure also the second sentence, adding a “Zunächst” (Initially), thereby giving up the syntactic parallelism of the two ST sentences for the sake of fluency and temporal coherence. In cases where DeepL closely followed the ST’s syntax, the post-editor frequently opted for deliteralisation: for example, she replaced the relative clause “que é a pior etapa” (which is the worst stage), translated literally by DeepL, by an apposition (1); here, too, she subsequently circled back twice, going back to the relative clause in version 2, before reintroducing the apposition in version 6. While many edits aimed to deliteralise the MT for the sake of fluency, the post-editor sometimes also chose to reliteralise MT suggestions to align her text more closely with the original, such as in the case of DeepL’s normalising translation of “pavilhão de observações” (observation pavilion) as “Beobachtungsstation” (observation ward; more on deliteralisation and reliteralisation see, e.g., Chesterman, 2011).

Keylogs for the entire task suggest that within PE rounds the post-editor processed the text mostly in a linear fashion, proceeding from sentence to sentence and paragraph to paragraph. However, there are frequent instances of immediate rephrasing, when she went back and forth multiple times between options, inserting a word/phrase, then deleting it immediately after, before typing in – and deleting again – an alternative, and finally reintroducing the first option. Such routines may attest to a translator’s or post-editor’s expertise, indicating that they are able to spontaneously and fluently produce multiple alternative options (Borg, 2019); however, such instances may also be read as moments of uncertainty in the translator’s or post-editor’s decision-making process, similar to the circular movements between versions described above. Indeed, in her post-task questionnaire, the post-editor gives as one reason for preferring translating from scratch over PE that “the MT puts me off my own ideas, and especially with difficult literary texts makes me *insecure*” (my translation, emphasis added). As there is no example of immediate rephrasing in the keylogs pertaining to the opening passage, a screenshot from a revision matrix generated by Inputlog during the post-editor’s work on version 9/PE 2 is included to illustrate the point:

98 Insertion	mit-Gras-ausgestopfte-	1	13:03.056	13:03.497	00:00.441
99 Deletion	mit-Gras-ausgestopfte-	2	13:03.056	13:03.497	00:00.441
100 Insertion	grasgefüllte-	15	13:47.405	13:48.998	00:01.593
101 Deletion	grasgefüllte-	3	13:52.621	13:52.779	00:00.158
102 Insertion	mit-Gras-ausgestopfte-	1	13:52.621	13:52.779	00:00.158

Figure 1: Screenshot from revision matrix (Inputlog)

As the post-editor’s behaviour described above cannot be compared to her decision-making processes when translating from scratch, it is impossible to determine whether

certain features of her working style, such as immediate rephrasing, are engendered by the PE modality of the task or are rather part of her usual working routine; the keyboard activity itself may be serving as a kind of cognitive scaffold. The same is true for the role priming effects may have played in this particular case, be it on the level of semantics or syntax. Even though, for example, the post-editor restructured many sentences (32.2% of preferential edits being syntax-related), there are still a fair number where she closely followed DeepL's structures, and one can only guess what she would have done in a translation-from-scratch scenario.

## 5. Concluding remarks

Literary PE is still a marginal phenomenon in the life of professional literary translators, but this is bound to change, at least for some language pairs and literary genres. This article has examined the workflow of a literary translator who post-edited a machine-generated draft of a short story by Brazilian author Lima Barreto, and the number and types of edits made by the post-editor were determined. Keylogging was used as the only tool due to its largely unobtrusive nature, and while keylogging data can be used to investigate a variety of process aspects, the focus of this article was on the product rather than the process level.

Findings indicate that workflows very much depend on specific contexts, and real-life PE tasks might well differ from those in research settings. In this case, the workflow involved four distinct stages and multiple agents, from the post-editor to the reviser, the co-editors, and colleagues, whose voices found their way into the final target text. The MT engine's "mechanical voice" (Van Egdom and Daems, 2021) remains manifest in those parts of the MT output that have not been edited, the interlacing of human and algorithmic voices resulting in a synthetic text that is part human-generated and part machine-generated.

Intermediate post-edited versions and the published target text were compared with the MT output and with each other to determine how (dis)similar successive versions are. Edit distance scores are indicative of PE effort, as they reflect the amount of edits that were performed in the course of the workflow. Results show that the bulk of edits were made during a first work-intensive stage, while subsequent PE rounds showed lower editing levels. The impact of edits was traced from the ST and MT through selected intermediate versions to the final target text in terms of lexical features that convey a sense of the complexity of texts (lexical diversity, lexical density, and sentence length); all measures were lower in the MT than in the published version, with the latter even slightly surpassing the ST in lexical diversity. For the analysis of edits, a 508-word subset was annotated manually, and a new typology was developed that conceives of style as choice, and thus does not consider it as a category separate from semantics or syntax. Approximately 70% of all edits were of a preferential nature, reflecting not only the post-editor's own stylistic preferences but also pointing to the level of responsibility that fell to her in her dual role of translator and co-editor. The majority of both essential and

preferential edits were lexico-semantic, and lexical choice was also named as DeepL's main weakness by the post-editor. Despite this criticism and her preference for translation from scratch over PE, she also acknowledged in her post-task questionnaire that "sometimes the MT solutions were very good" and served as a source of inspiration (for the use of MT as a source of inspiration see Kolb et al., 2023). Finally, the opening paragraph of the narrative was used to illustrate how keylogging data can serve as a rich resource for studying certain features of PE processes, such as the role of intermediate versions, the translator's working routines, or the role of other agents. What the data clearly show is that in this case literary PE was far from a fast and straightforward editing process and closer to what Hans-Christian Oeser called "painstaking retranslation" (2020: 22).

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