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Bindels, J.; Dorst, A.G.; Pluymaekers, M.

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Joop Bindels
Zuyd University of Applied Sciences

Aletta G. Dorst
Leiden University Centre for Linguistics

Mark Pluymaekers
Zuyd University of Applied Sciences

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INTRODUCTION

Although Large Language Models (LLMs) and ChatGPT figure prominently in the media these days, one of the most widely used applications of artificial intelligence for workplace communication is still Machine Translation (MT). MT refers to the process by which a machine – usually in the form of a web interface, browser plugin or mobile phone app – translates a written or spoken text from one language into another without involvement of a human translator. Examples of commonly used MT applications include Google Translate, Bing Microsoft Translator, and Amazon Translate.

In 2016, Google claimed that over 500 million people make use of Google Translate, translating approximately 100 billion words a day, between over a hundred languages – numbers that have likely increased since (Turovsky, 2016; Wu et al., 2016). Thanks to machine learning, word embeddings and neural networks, the current generation of Neural Machine Translation engines produces output that is so accurate and so fluent that many believe machine translations have become indistinguishable from human translations and that 'human parity' has been achieved (Hassan et al., 2018). Not surprisingly, both professional and public interest in machine translation have since taken flight, as most of these systems are freely accessible online and are extremely easy to use.

However, as pointed out by scholars such as Bowker (2020), using machine translation is easy, but using it *critically* requires some thought. The notion of developing an informed and critical attitude towards the use of machine translation in order to harvest its potential and mitigate its risks is commonly referred to as Machine Translation literacy or MT literacy. While a growing number of studies has focused on MT literacy for students in translation and/or language degrees (Bindels & Pluymaekers, 2022; Dorst et al., 2022; Jolley & Maimone, 2015; Loock, 2020; Loock & Léchauguette, 2021), very little is known about the need for MT literacy among students in different fields or disciplines, with the exception of Bowker's (2020) study on international business students.

Similarly, while a steady stream of studies has appeared over the years focusing on how professional translators use MT and how the technology impacts on their working conditions (e.g., Läubli & Orrego-Carmona, 2017; Moorkens et al., 2018; Sánchez-Gijón et al., 2019), very little research has been done on whether, why and how professionals in other disciplines employ MT in their daily work (cf. Anazawa et al., 2013; Nurminen, 2019). Research on the use of MT in high-stakes contexts, especially legal or medical settings, has shown that many professionals

use AI-driven translation technologies without understanding how they work or what the risks and wider societal implications are (Vieira et al., 2020). This resonates with media reports about situations of misuse or misunderstanding of MT, such as the BBC reporting that NHS interpreting service problems contribute to patient deaths[1], and The Guardian reporting that a “growing reliance on language apps jeopardizes some asylum applications”[2] (n.p.).

This is one of the reasons why O’Brien and Ehrensberger-Dow (2020) argue in favor of training non-traditional MT users, including professionals outside the language industry but also informal or ‘lay’ users, in MT literacy. But before we can support these non-traditional users in developing their MT literacy, we first need to know what they actually do with MT in different workplace contexts. Although we realize that professionals in different disciplines use MT for a wide variety of reasons and their needs and expectations are far from uniform, it seems reasonable to assume that MT literacy involves a set of core elements that apply in all professional contexts. In this article, we aim to uncover these common core elements and incorporate them into a description of the decision-making process that can help professionals determine whether and how they can use MT responsibly in a particular professional situation.

Related Research

Bowker and Ciro (2019) were the first to offer a definition of Machine Translation literacy, specifically for the context of scholarly communication:

- comprehend the basics of how machine translation systems process texts;
- understand how machine translation systems are or can be used (by oneself or by other scholars) to find, read, and/or produce scholarly publications;
- appreciate the wider implications associated with the use of machine translation;
- evaluate how (machine) translation-friendly a scholarly text is;
- create or modify a scholarly text so that it could be translated more easily by a machine translation system; and
- modify the output of a machine translation system to improve its accuracy and readability.

(Bowker & Ciro, 2019, p. 88)

If we substitute ‘scholarly text’ for simply ‘text’, it is easy to see how this list of skills (evaluate, create, modify) and knowledge (comprehend, understand, appreciate) applies equally to other professional settings. The same is true for the more general definition offered by O'Brien and Ehrensberger-Dow (2020): “MT literacy means knowing how MT works, how it can be useful in a particular context, and what the implications are of using MT for specific communicative needs” (p. 145). Both definitions show a hierarchy of complexity that aligns with Bloom’s

[1] https://www.bbc.com/news/uk-england-bristol-66605536

[2] https://www.theguardian.com/us-news/2023/sep/07/asylum-seekers-ai-translation-apps

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taxonomy (1956) for learning objectives: Know > Understand > Apply > Analyse > Evaluate > Create.

More recently, Ehrensberger-Dow et al. (2023) explored different MT literacy training scenarios in the context of MT literacy consultancy, and their core topics also provide a useful starting point:

- overview of current MT systems
- overview of quality issues associated with MT output
- clarification of legal constraints (data privacy)
- potential, implications and good practices associated with MT for email
- MT on social media and websites; implications for reading and writing
- Limitations of MT (i.e. when professional translation is needed).
  (Ehrensberger-Dow et al. 2023, p. 406)

In today's society, the concept of Machine Translation literacy critically interacts and overlaps with information literacy (e.g. Bowker 2021a), data literacy (e.g. Krüger 2022), and AI literacy (e.g. Ng et al. 2021). Krüger demonstrates how in parallel with the "increasing relevance of MT literacy in the professional translation process, the rise in prominence of another digital literacy can be observed, i.e. *data literacy*" (2022, p. 248, italics original). The same is now true for AI literacy, as the widespread adoption of AI tools and technologies by both the industry and the general public entails that we need to define AI literacy and determine what people should know about the technologies behind AI applications and the potential risks and ethical issues in using AI-driven tools. As Ng et al. (2021) argue, "AI literacy means having the essential abilities that people need to live, learn and work in our digital world through AI-driven technologies" (p. 2), and people need to be taught explicitly "how to use AI technologies judiciously, as well as to discriminate between ethical and unethical practices" (p. 2). Similarly, Bowker (2021a) shows how Machine Translation literacy should be integrated much more extensively and systematically into general information literacy - "the ability to identify, find, evaluate, and use information effectively" (p. 127) – in order to promote linguistic diversity, given the fact that our societies are becoming increasingly multilingual and multicultural but our communication is becoming increasingly dominated by English.

The language industry has experienced an immense digitalization and datafication, as a result of which translation processes – both Neural Machine Translation (NMT) and prompt-based translation using LLMs – are now fundamentally data-driven. Krüger's (2022) detailed investigation of the points of contact and overlap between data literacy and MT literacy shows that data context (including ethics), data planning, data collection/production, data evaluation and data use are all essential to developing professional MT literacy. In Krüger's

framework, professional Machine Translation literacy encompasses five dimensions: Technical MT Literacy, Linguistic MT Literacy, Economic MT Literacy, Societal MT Literacy, and Cognitive MT Literacy (p. 250). However, these five dimensions are specifically relevant for professional *translators*. To what extent they apply to other professional users from other disciplines – e.g. journalism, marketing, business, law, medicine – who are not translators but who are using MT as part of their professional workflow remains a topic in urgent need of further investigation.

As noted before, there is a considerable lack of studies on how and why machine translation (MT) is used in different professional contexts. Two noticeable exceptions are considered here. One is the study by Anazawa et al. (2013) on how Japanese nursing professionals use online MT to read English scientific articles. They point out that being able to utilize recent developments reported in the scientific literature is critical for nurses, but reading articles in English presents them with a considerable language barrier. In order to provide quality care, nurses need to obtain this information quickly, and the use of free online translators is an obvious solution. The results of the study showed that of the 250 participants in the survey, 73.8% had used online MT and more than half of the group found the output usable. Most used online MT to "grasp the basic meaning of the original text" (p. 25), and some also "used multiple online MT systems for the same text, to identify the most useful translation" (p. 25) or used it in combination with a technical dictionary, showing that they "do not accept translations from online MT systems without question" (p. 26). However, Anazawa et al. note that use of MT was related to language proficiency, with users with lower proficiency being less likely to use MT because they felt unsure about judging the quality of the output by looking at the English source text. They conclude that more research needs to be done on the "possible linguistic support for nurses *via* advanced Internet-based technology, leading to more effective use of MT tools" (p. 27) to access information and increase their knowledge and expertise.

This is very different from the professional situation described by Nurminen (2019) for patent professionals, including patent attorneys, counsels and examiners. These professionals use machine translation "in its raw, unedited form to obtain a basic understanding, or gist, of patent documents that they need but that are in languages they do not understand" (p. 32). So unlike the Japanese nurses in Anazawa et al. (2013)'s study, these patent professionals have no access to the source texts at all. Yet both groups are working with gist translations for the purpose of gaining access to information. Nurminen focuses on the types of decisions patent professionals make on the basis of raw MT output and the risk assessment they employ to decide between relying on MT output or hiring a human translator. Like the nurses, patent professionals combine MT output with other resources, including drawings and formulas, and they compare outputs from different engines.

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Nurminen found a high level of MT literacy for the patent professionals, who "appeared to understand the basics of MT technologies, knew how to access different MT tools, and were aware of the possibility and consequences of translation errors" (p. 40). Moreover, Nurminen notes that these professionals were very aware of the limitations of the technology and showed no signs of overestimating or hyping the potential of MT.

Since the contexts described by Anazawa et al. (2013) and Nurminen (2019) are not necessarily representative for the wide variety of ways in which MT can be used in the workplace, it is important to identify common steps that professionals follow in deciding whether and how to use MT in their workflows. Doing so will allow us to highlight important considerations that professionals should take into account during the decision-making process, which will also shed more light on the critical elements of MT literacy for MT users who are not professional translators. In the next section, we will provide more information about the method we used to uncover common phases in the decision-making process.

Finding Common Ground: Helping Professionals Make Informed and Critical Decisions When Using MT in the Workplace

If we want to enable professionals to harness the full potential of MT while at the same time mitigating the risks that could ensue from using MT irresponsibly, we need to gain insight into their decision-making process with respect to using (or not using) MT. More specifically, we need to uncover the common elements in this decision-making process across different professional contexts. To do this, we followed a process consisting of two phases:

- Phase 1: collecting input from professionals. During this phase, we assembled a number of realistic use cases from professionals using MT in different professional contexts, e.g., the healthcare and social services sector, the legal sector, the field of communications, and other professional contexts.
- Phase 2: for this phase, we selected a number of representative use cases from the above-mentioned professional contexts. These use cases were subsequently discussed and analyzed in a focus group setting with the objective of establishing the commonalities in the decision-making process. Both phases are described in detail below.

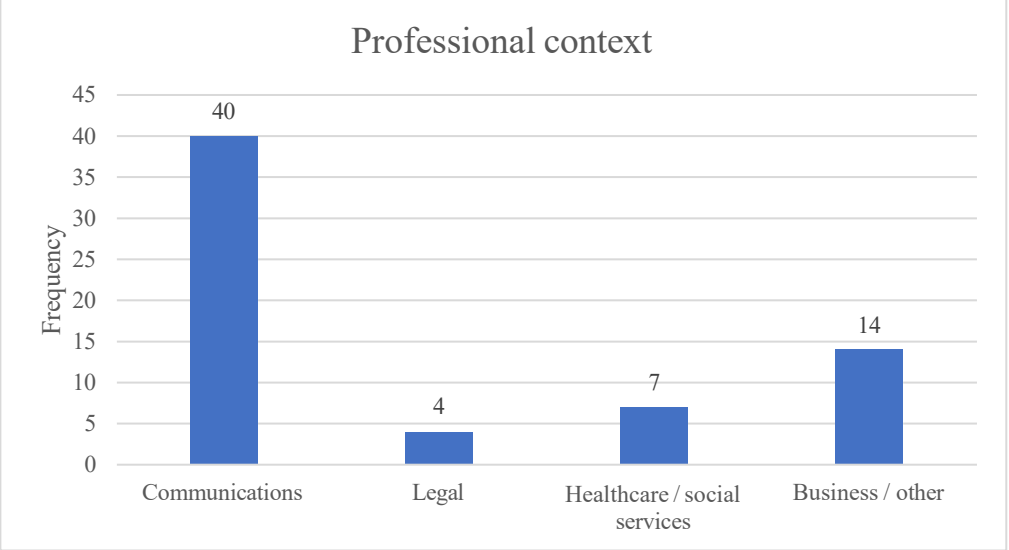
Phase 1: Collecting Input From Professionals

The first phase was aimed at collecting use cases from professionals using MT in diverse workplace contexts. We did this by means of an online survey, for which we recruited professionals from different disciplines as respondents. We made use of our respective online and offline networks to recruit participants. Potential

participants could access the survey via a web link, which redirected them to an online survey environment created using Questback.

A total number of 66 people responded to the survey, including one person who indicated that he/she did not use MT at all. This respondent was excluded from the sample.

In order to get a better understanding of the different respondent profiles, we classified their jobs as belonging to the 'communications', 'legal', healthcare / social services' or 'business / other' sector. Within our sample of 65 respondents, we identified 40 communication specialists (e.g., marketeers, PR and communication specialists, copywriters, translators), 4 professionals active in a legal profession (a professor in law, two lawyers and a judge/professor in law), 7 in healthcare and social services (e.g., a radiologist and a number of nurses) and 14 respondents in either business or other positions (e.g., an investment officer, an IT consultant, managers). We are aware of the imbalance in the respondents' backgrounds and discuss some possible implications of this imbalance in the final section of this paper.



The survey itself was introduced by a detailed section explaining the goals and the scope of the study, our privacy and data policy and the setup of the survey, and a separate informed consent section asking users to confirm whether they had received sufficient information about the survey and whether they understood that their participation was anonymous and voluntarily.

The survey, which was administered in Dutch, could be filled out between April 2023 to June 2023, and consisted of a total of 21 questions, although the total number of questions differed per respondent, depending on the question routing.

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For example, respondents indicating that they did not use MT in the workplace did not have to provide examples of their MT use.

The survey consisted of 5 different sections: 1) an introductory section (including the previously mentioned explanatory section and informed consent section), also aimed at establishing whether respondents use MT at all in their professional context; 2) a section aimed at getting a better understanding of the respondents' profiles and professional contexts (containing questions about their mother tongue and foreign languages, their position within their respective organizations, and the official language(s) in their organization); 3) a section aimed at establishing for which (written and/or oral) purposes they mainly use MT (for instance, translating/understanding reports, e-mails, or as a tool during interviews, presentations, etc.); 4) a section that asked respondents to report one representative situation in which they use MT, inviting them to describe the setting in detail and explaining their motives for using MT in this particular case (the main input for phase 2 of our project) and which MT solution they mostly use in this case; and 5) a final section that allowed respondents to indicate the perceived usefulness and quality of MT for their particular purposes. This final section also included a number of statements that allowed us to evaluate respondents' perceived ability to use MT in a critical manner and in line with different regulations in place regarding privacy and confidentiality. We concluded this section by asking the respondents what they believe future professionals in their field should be taught regarding the use of MT.

A translated version of the survey questions is available upon request.

The survey data was analyzed using IBM SPSS version 28 and visualized with the help of Microsoft Excel (Microsoft 365). The data and syntax logs as well as a number of visualizations are available upon request. A total number of 66 people responded to the survey; this included one person who indicated that he/she did not use MT at all. It is important to note that while the setup of the survey was quite elaborate, the only input that we used for phase 2 of the current project was the job title/profile of the respondents and the input from section 4, a section that asked respondents to describe one representative situation in which they use MT.

As mentioned before, our main goal at this stage was to gather a number of diverse MT use cases from professionals in different workplaces (section 4 in the above description of the survey). After a thorough reading of the descriptions provided by the respondents, we could indeed distinguish a large variety of use cases. The use cases ranged from cases describing the use of MT to understand sources of information, as also found by Anazawa et al. (2013) and Nurminen (2019) – for instance for understanding websites, articles, legislation or e-mails; to cases focusing on the use of MT as a tool to communicate with clients and colleagues in spoken interaction, and cases highlighting the use of MT as a source of inspiration for creating material in another language, with or without an

additional 'post-editing' check – for instance for writing e-mails, press releases or other documentation to be published.

As input for the second phase, we wanted to select a number of use cases to be discussed and analyzed in a focus group setting, in order to find the commonalities in the decision-making process when professionals use MT. Admittedly, since discussing *all* use cases in a focus group setting would invariably have taken too much time, we limited the selection to one typical use case per professional context. As such, we selected a) a case presented by an assistant at a medical practice, who uses MT for communicating with patients in non-urgent situations; b) a case presented by a copywriter/editor who uses MT for a variety of purposes (writing e-mails in other languages and as source of inspiration when translating articles); c) a case presented by a partner in an international law firm, who uses it to translate various types of legal documents to be used in court and d) a case presented by a head of an international financial institute, who uses it to translate e-mails or prepare conversations in other languages.

PHASE 2: FINDING COMMON GROUND

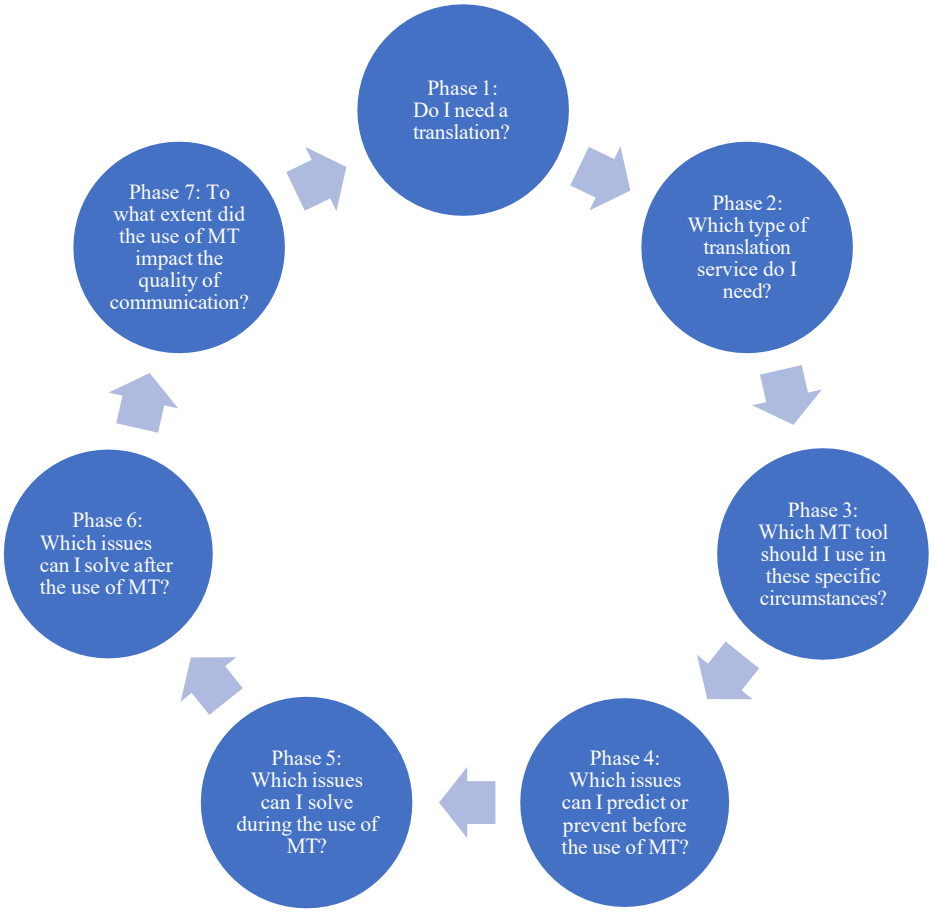
This phase was dedicated to uncovering the steps that (potential) MT users undertake and the issues and considerations that weigh in on the process of deciding whether, why and how to use MT in a professional context, with the help of the aforementioned use cases. To this end, we organized a focus group made up of experts recruited from the healthcare and social services, legal, and communications sectors (Acocella, 2011). Due to unforeseen circumstances, only representatives of the healthcare and social services and the communications sector were present, i.e. an expert in multicultural communications in social work settings and coordinator of a pre-bachelor programme for refugees, a lecturer in translation, and a lecturer-researcher specialized in translation technology with a background in PR, copywriting and translation, who is also one of the co-authors of this article. The session was moderated by an experienced professor and research supervisor, another co-author of this article. In order to facilitate further analysis, the focus group session was recorded (with the consent of the focus group participants) and transcribed.

As input for the focus group, we presented the expert panel the outcomes of the survey and highlighted the aforementioned use cases, with the specific goal of systematically analyzing these cases, focusing on the decision-making process and the different phases that all potential MT users (should) go through.

As such, during the focus group, the panel was able to distinguish several common phases in the process of using MT in any multilingual situation, whether oral or written. Each phase within this process was elaborately discussed: what are the considerations that should be taken into account during the execution of this

specific phase? What is its relation to other phases in the process? Are these phases similar in all the different use cases, or are there notable differences?

This discussion, which was summarized on a flipboard by the moderator and recorded on camera, resulted in a basic outline of the decision-making process concerning the use of MT in multilingual communicative situations in the workplace (see Figure 1), The outline of this process, as well as the considerations that should be taken into account in different phases of the process, are described below.



Firstly, one should consider whether resorting to a translation is at all necessary in a given situation (phase 1). A number of considerations come into play here, such as the availability of an intermediary language that the communicators could resort to – in oral situations – or – in case of written communication – the presumed linguistic proficiency of the intended audience, for instance if the audience in question is already familiar with the basics of the language of the

material in question. Other factors, such as the complexity of the communicative situation and financial considerations, might also play a determining role in deciding whether to opt for a translation.

Once the decision has been made to actually make use of a translation in a specific communicative situation, a number of factors come into play that have a direct effect on the decision to either seek *a professional solution* (i.e., a professional translator, interpreter or translation agency), *an informal solution* (i.e., a bi- or multilingual colleague, family member or acquaintance) or *an automated solution* (i.e., MT) (phase 2). We have identified 6 factors that influence this particular stage of the decision-making process, namely: the ability to check a given translation; time; the availability of the required language(s); money; privacy; and the complexity of a communicative situation. In each communicative situation, every one of these factors can carry a different weight. These factors are detailed below:

- the ability to check a given translation: to put it simply, if one does not have the option of verifying the correctness of MT generated content, one runs the risk of running into issues due to miscommunication. Thus, opting for a professional or informal solution might be wiser if one does not have that option;
- time: finding the right professional solution takes time and effort, while finding an informal solution might be easier to do in certain cases. MT, on the other hand, is practically instantly available. If one is in a hurry and quality is not a main priority, MT might prove to be the better option;
- the availability of the required language: whilst it can sometimes be difficult to find an interpreter or translator working in a ‘smaller’ language, MT is available in a wide range of languages or language variants;
- money: an informal solution or MT is usually free of charge or relatively cheap, whilst a professional solution costs money;
- privacy: most (unpaid) MT solutions do not comply with existing privacy regulations, in the sense that the information that serves as input and the translation output are shared with the MT provider, may be used for further development of their systems, may be sold to third parties, and both input and output are stored on servers that could potentially be subject to data leaks. Professional translators and interpreters, on the other hand, comply with strict privacy policies, ethical guidelines and NDAs;
- complexity of a communicative situation: the level of accurateness of the MT output depends in a large degree on the complexity of a communicative situation (i.e. the intercultural dimensions of a certain communicative situation, the complexity of the language and terminology used, the availability of contextual information in that specific situation etc.). In

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complex communicative situations, a professional solution can be expected to work better.

Once the decision has been made to resort to MT, several factors can be expected to influence the decision to opt for a specific MT solution (phase 3), such as the availability of the required language(s) and mode (for instance, not all MT providers offer text-to-speech translations in all languages, and some providers are better in specific language pairs), money and privacy (whilst most MT solutions are free of charge, it might be worthwhile to pay for a subscription in order to prevent the sharing of confidential information with the MT provider, especially when dealing with confidential information), and the complexity of a communicative situation (for highly specialized content, a domain-specific or even custom-built MT system might be better suited).

In phase 4, potential MT users are (in some cases) able to influence the quality of the MT output in advance: in asynchronous communicative situations (written texts, video messages, etc.), it is sometimes possible to manipulate a number of factors that could improve the effectiveness in the use of MT and avoid issues at a later stage. MT users can reduce the complexity of the language input, for example by avoiding the use of overly long or complicated sentences, avoiding terminology, or adding clear contextual information, and by removing sensitive information. The 'ten guidelines for translation-friendly writing' mentioned by Bowker and Ciro (2019, pp. 63-70) are a good starting point for MT users trying to maximize the quality of MT output by rewriting or 'pre-editing' a source text. They advise writers or editors among other things to use short sentences, to use the active voice rather than the passive voice, to avoid wordiness, to use terminology consistently and to avoid abbreviated forms, idiomatic expressions, humor and cultural references.

In synchronous communicative situations (conversations, presentations, chat), it is more difficult to control the "input" in advance, but an awareness of potential pitfalls due to the complexity of the communicative situation (for instance: the more culturally sensitive the topic, the more likely there will be errors in the MT output, etc.) could help these users repair the communicative situation *in situ* if needed.

As such, in phase 5, during synchronous communicative situations, MT users can solve potential issues due to the use of MT by reducing the complexity of their language during the communicative situation (avoiding terminology and ambiguity, refraining from complex cultural references or expressions and providing the necessary context), and by refraining from sharing privacy-sensitive information with the MT tool, if at all possible. Also, unlike in asynchronous communicative situations, one can always decide to break off the use of MT and resort to a professional or informal solution instead.

In asynchronous communicative situations (written texts, video messages, etc.), the possibility to resolve issues resulting from the use of MT afterwards exists in certain cases, assuming that the required expertise is at hand (phase 6): by carefully correcting the output ('post-editing'), one can eliminate errors introduced by the use of MT. If this proves to be too laborious and time-consuming, it might be wise to consider using a professional solution for similar material in the future.

In the final phase, it is advisable to evaluate the effectiveness of resorting to MT and carefully weigh whether the use of MT has produced the desired results: Was it cheaper? Was it faster? Did it cause any major issues in getting the message across to the target group? Was any privacy-sensitive information shared? Based on these considerations, the professional can make a better-informed decision next time.

Conclusion and Discussion

In a rapidly globalizing world, it is increasingly common for professionals to be confronted with language barriers in everyday workplace communication. The increasing quality and wide availability of machine translation (MT) technology may offer a solution, but using MT without sufficient awareness of its strengths and weaknesses is not without risk. In order to become critical and proficient users of MT, professionals need to develop MT literacy, which entails that they know "how MT works, how it can be useful in a particular context, and what the implications are of using MT for specific communicative needs" (Ehrensberger-Dow et al., 2023, p. 145). Earlier research on MT literacy, however, has mainly focused on language and translation students or professionals working in the language industry. Little research has been done on how MT is used in other professional fields and which decision-making process professionals in these fields follow when using – or deciding not to use – MT. Our study aimed to change that.

By conducting a survey about MT use among professionals working different fields and discussing a number of representative use cases with experts during a focus group, we discovered that ideally, this decision-making process consists of seven steps. The first decision professionals need to make when they are confronted with language barriers in the workplace is whether translation is necessary for successful communication to occur. If they answer that question with "yes", they can consider different types of translation solutions, one of which is MT. At this stage, their choice can be impacted by a number of different factors, including time pressure, financial considerations and the complexity of the communicative situation. Once the decision to use MT has been made, professionals can look for the most suitable MT application for their specific situation and improve the quality of the output by modifying the input and closely monitoring the course of the interaction.

Although the decision-making process regarding the use of MT appears to be more or less uniform across different professional fields, it is highly unlikely that professionals who have not been trained as translators or language specialists are always aware of the possibilities and limitations associated with using MT, or the issues they need to consider in order to make informed decisions along the way. Therefore, we plan to use the outcomes of this study to create a decision-making tool that makes potential MT users aware of the issues and considerations they should take into account when making decisions regarding the use of MT. Such a tool could help professionals develop their MT literacy by making them aware of potential risks and pitfalls and by providing practical cues to enhance the effectiveness of their MT use. In the creation of this tool, we aim to collaborate with professionals to ensure that the tool meets their needs and provides them with the necessary information without overburdening them with too many technical details.

Of course, our study also has its limitations. The fact that our survey participants were only recruited via existing, Dutch-speaking professional networks prevents us from generalizing the survey results to the professional community at large, particularly if we also consider the disbalance between the different professional disciplines represented in our sample (e.g., 40 out of 65 respondents fell into 'communications' category). As such, the outcomes of our survey do not paint a complete, representative picture of how MT is used in different professional fields across the world. Additionally, one could claim that with the current approach we may have missed other relevant use cases from less represented professional contexts. This is certainly an issue that future researchers should address, preferably by using a more representative and more balanced sample with use cases for MT in different professional disciplines and in different countries. After all, the more we know about how professionals use MT to overcome language barriers, the better we will be able to support them in doing it critically and responsibly.

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