
Technology-Augmented Multilingual Communication Models: New Interaction Paradigms, Shifts in the Language Services Industry, and Implications for Training Programs

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Abstract

This paper explores how technology, particularly digital tools and artificial intelligence, are impacting multilingual communication and language transfer processes. Information and communication technologies are enabling novel interaction patterns, with computers transitioning from pure media to actual language generators, and profoundly reshaping the industry of language services, as the relevance of language data and assisting engines continues to rise. Since these changes deeply affect communication and languages models overall, they need to be addressed not only from the perspective of information technology or by business-driven companies, but also in the field of translation and interpreting studies, in a broader debate among scholars and practitioners, and when preparing educational programs for the training of specialised language professionals. Special focus is devoted to some of the latest advancements in automatic speech recognition and spoken translation, and how their applications in interpreting may push the boundaries of new ‘augmented’ real-world use cases. Hence, this work—at the intersection of theoretical investigation, professional practice, and instructional design—aims at offering an introductory overview of the current landscape and envisaging potential paths for forthcoming scenarios.

1 Language Technologies

Information and digital technologies have had a profound impact on society and communication over the past decades and even more in the last few years. Statistical and neural systems are at the foundation of many high-tech and ‘intelligent’ solutions employed in almost any domain nowadays, including language—in all its dimensions and areas of application.

Computers and devices process and analyse language data for several purposes (from text analysis and speech recognition to data mining and information retrieval) by applying the models of computational linguistics and natural language processing (NLP).

Today, applications of language technologies include automatic speech recognition (ASR) systems providing dictation and transcription, voice assistants, chatbots, spelling and grammar checkers, writing assistants, speech synthesis, and interactive voice response (IVR) systems, just to name a few.

However, research in the field is seldom public or shared since it often deals with trade secrets of the companies that hold such valuable technology and know-how, which they also leverage for the related remarkable commercial value. Moreover, as it will be recalled later, publications on the topic are often confined to computer science (CS)—despite language technologies entailing a multi- and interdisciplinary approach by their very nature.

1.1 Translation Technologies

In the space of language transfer processes, traditionally associated with the spheres of translation and interpreting, technology has also gradually achieved a prominent position.

Language databases such as translation memories (TMs) and termbases are largely used and leveraged by translators not only to improve their speed and productivity, but also their consistency and accuracy. These resources are integrated in software platforms referred to as translation environment tools (TEntTs) and are already regularly introduced to students of university programs in translation.

Over the years, the use of computer-assisted translation (CAT) tools has also gradually incorporated automated or machine translation (MT) engines, which not only aid human translators in their task, but are also capable of offering interlingual rendering as a standalone solution.

In the digital space, billions of words needing scalable and immediate interlingual adaptation are produced every day, and human translators simply cannot keep pace with these volumes. Therefore, first and foremost, MT is (and cannot avoid being) used in the localization processes of this content, and the significant enhancement of output quality derived from the disruptive introduction of neural machine translation (NMT) helped reducing the gap between human-crafted and machine-generated translation quality.

Nonetheless, performance and output levels are still not consistent across all language pairs and domains, due to varying volumes and quality of relevant training data—currently, the main areas of research interest in this field include precisely the study of models and systems to meet the challenge of the so-called low-resource languages (the majority of human languages, still lacking sufficient monolingual or parallel corpora or manually-crafted resources to build functional statistical NLP applications) (Magueresse et al., 2020; Conia and Navigli, 2020).

Following the large-scale use of MT and translation technologies in the real world and their integration in the localization workflows of language service providers, they also gradually made their way into training programs for translators, with at least some modules dedicated to them (Pym, 2013; Sikora and Walczyński, 2015).

1.2 Interpreting Technologies

Conversely, in the area of spoken translation, i.e. interpreting, the adoption and integration of technology-based systems in the workflows and practice of interpreters has been slower and less far-reaching (Fantinuoli, 2018).

Tools aiding practitioners in some of their activities (from the preparation phase to actual ‘in-booth’ support, e.g. glossary creation and management, terminology extraction and research), fall under the category of computer-assisted interpreting (CAI).

Partially because of its limited representation in interpreting literature, the ‘technological shift’ in the profession is still underway, although developments and interest in interpreting technologies are considerably growing (Prandi, 2017)—also due to the latest breakthroughs in remote or distance interpreting, while other applications remain still largely unexplored.

Indeed, only recently, following a steadily growing production of multimedia content, machine interpreting (also referred to as automatic spoken translation or speech translation) has gained momentum both in academic and commercial environments, especially in the perspective of transitioning from current cascade to more promising end-to-end models.

The single modules comprising the concatenated cascade approach (automatic speech recognition or speech-to-text, machine translation, and speech synthesis or text-to-speech) have significantly improved thanks to the high volumes and quality of task-targeted training data, and consequently this remains the most frequently adopted approach to date.

1.3 A Vision for Language AI

Nevertheless, observation, analysis, and evaluation of all the applications of language technologies mentioned above are largely conducted in the framework of information technology (IT) and CS.

Besides a valuable branch of research on translator–computer interaction (O’Brien, 2012; Ferreira and Schwieter, 2017) and translation process research (TRP) (Ferreira and Schwieter, 2015; Carl et al., 2016; Jakobsen, 2017), no systematic investigation experiences and patterns seem to have developed from the broader perspective and in the fields of communication, language, and translation and interpreting (T&I) studies.

However, multilingual activities, translation, and interpreting are first and foremost communication events—not only mere information or transposition processes.

Hence the need to promote a different approach and embrace a novel vision in academic and professional communities of language practitioners to create a wider theoretical and attitudinal framework.

T&I studies and CS ought to increasingly inform each other to mutually improve efficiency, optimise processes and workflows, and even imagine and design new scenarios for the introduction of language applications in technology-enabled use cases.

Hesitancy (or even reluctance) towards technology among a segment of language practitioners seems to be due to a lack of trust in the tools, considering them as a source of distraction and additional cognitive load, or scarcely effective and satisfactory (Tripepi Winteringham, 2010; Corpas Pastor and Fern, 2016; Fantinuoli, 2019), but also partly as a result of an approach to artificial intelligence (AI) as opposed to human intelligence or humans outright.

Beyond the possible semantic reasons behind that (the word ‘artificial’ may be associated with something unnatural, insincere, or fraudulent), the whole narration around AI should be reconsidered to facilitate its acceptance and enjoyment.

Some of the most evident benefits brought to language services by this technological revolution (speed, productivity, accuracy, consistency) suggest that the main advantages derive from automation (Herrmann, 2018). Automated processes can undoubtedly be seen as a winning facet, since they reduce and optimise repetitive and unproductive steps of processes, and ensure more time and resources are devoted to highly demanding tasks. Automated intelligence (and intelligent—or smart—automation) can definitely be introduced to all current and aspiring practitioners, as well as end users and customers, since they do not represent a risk for the parties involved.

As a consequence, by accomplishing such delegated tasks, AI can enhance human activity without replacing human decisions and responsibility, yet supporting and augmenting the possibilities and outreach of human performance. In this respect, along with the above-mentioned ‘automated intelligence’, an additional facet of AI to be endorsed would also be that of ‘augmented intelligence’ (Floridi et al., 2018).

Indeed, translation and interpreting professional communities are already starting to refer to technology-supported language transfer processes as augmented translation and interpreting, and the next shift could be from computer-assisted to computer-augmented language services (DePalma, 2017).

Finally, the scientific community is also progressively starting to suggest a different meaning for the second term of this phraseme, acknowledging that in modern digital tools ‘intelligence’ does not coincide with human-like ‘cleverness’, but rather with ‘smartness’ and ‘agency’, i.e. the ability to successfully solve problems or complete specific tasks (Kelly, 2017; Floridi, 2019; Crawford, 2021)—thus confirming the overall perspective described in the above paragraphs.

2 Combining Language and Computer Studies

2.1 New Interaction Paradigms

Media and artefacts have a deep impact on the message they carry and directly shape the structure and nature of communication itself (McLuhan, 1964), affecting the way the message is perceived, and consequently how both senders and receivers think and behave.

Early on in their history, it became clear that computers were going to enable and facilitate communication among humans, rather than directly interact with them (Licklider and Taylor, 1968). For decades, machines have subsequently been a medium for human interaction, with varying preeminence attributed to written and spoken language.

Language has always been the distinctive feature characterizing humanity and differentiating it from any other intelligent species or living being. In particular, speaking has traditionally been the natural channel for spontaneous interaction, while writing has primarily been used for information storage or formal communication, but these roles have alternated repeatedly (even only over the last century) following a sequence of favoured communication channels (printing, telephone and mass media, internet and instant messaging tools) throughout history.

However, with the recent development of neural networks and deep learning algorithms, information and communication technologies (ICTs) are starting to act not only as pure intermediaries (as communication artefacts have always been), but—to a certain extent—also as ‘autonomous’ and original language and content generators.

Presumably, technology (not only language technology) will increasingly integrate with human senses by moving from external hardware to wearable devices, ultimately changing everyday communication paradigms and human interaction with reality (Sayers et al., 2021).

Despite being still distant from complete satisfactory performance (since they largely depend on training data and would require a higher degree of ‘intelligence’ to advance), generative language models are a reality with real-world applications in a few niche industries already.

This area is still in its infancy, yet its groundbreaking role and societal impact cannot be ignored. If hereinbefore only humans had enjoyed the privilege of holding the exclusive property of language, now a new active player is entering the scene, i.e. machines and technological artefacts (Benanti, 2021). This will have serious and unavoidable implications on communication patterns (Floridi and Chiriatti, 2020) which are still to be adequately explored.

2.2 Shifts in Multilingual Communication and the Language Services Industry

The study and assessment of language technologies in CS is commonly product-oriented and primarily takes into consideration parameters such as output quality (as compared to benchmark reference translations or datasets), usability, or technical performance.

Conversely, T&I studies—besides the long-standing debate on the definition of quality and evaluation methodologies (House, 2015; Moorkens et al., 2018; Chatzikoumi, 2020; Rivera-Trigueros, 2021)—generally consider criteria including functional equivalence, faithfulness, intelligibility, and the facilitation of communicative interaction (Pöschhacker, 2001).

Only recently, have scholars in the field of T&I studies started observing language technologies from a more comprehensive language and communication viewpoint, thus hopefully paving the way to a new area of research and study combining T&I and CS.

The intersection of the two disciplines could benefit both language and technology experts—the former, typically lacking deep practical technical knowledge to design and develop digital tools and resources to support them, could leverage technological insights to their ad-

vantage, whereas the latter would better understand the potential linguistic, communicative, and societal consequences of current and emerging technologies.

Especially in the field of real-time multilingual communication, besides simultaneous interpretation—still the most resorted-to activity for this task—this field could soon include other modalities such as interlingual respeaking, automated speech-to-text translation, live subtitling, and instant multilingual information retrieval or key concepts extraction.

The results of early testing (Fantinuoli and Prandi, 2021) show a better performance by humans in terms of intelligibility (i.e. the perception of the target text in terms of fluency, clarity, and adequacy) and a more accurate performance by machines in terms of informativeness (i.e. the evaluation of the target text in terms of content and semantic information in comparison with the source text).

Considering that automated speech translation systems do not provide completely satisfactory outcomes by themselves yet, the current focus of research should be on how digital systems can integrate human work, by supporting and enhancing human-performed activities (Desmet et al., 2018). This is what is happening in most other professions (where technology integrates and improves the effectiveness of several tasks), including written translation, as the use of CAT tools and resources like TMs, termbases, and MT is already part of almost any translator’s toolkit.

In addition to the implementations described in section 1, AI and machine learning (ML) are also propelling translation and localization processes by automating workflows to meet tighter turnaround times and incorporating computer-generated translation as a final product or as the basis for activities like machine translation post-editing (MTPE) and machine-assisted subtitling (MAS)—even in fields where it seemed inconceivable until not long ago, such as medicine and life sciences or the media and entertainment industry.

In this direction, innovation departments of companies, academic research projects, and even institutions and international organizations have begun to explore the usability of newer-generation and AI-empowered CAI tools too, where ASR provides in-session support to human interpreters in relation to problem triggers such as numbers, unit conversions, acronyms, named entities, and specialised terminology (Defrancq and Fantinuoli, 2021).

At the same time, both language service providers (often also referred to as translation agencies) and individual practitioners are diversifying and redirecting their offer from strictly language-related activities to broader adjacent AI-related language needs, including training data creation, collection, annotation, and validation.

3 Renovating Language Programs and Vocational Training

Just like research on language technologies (and technology for language practitioners) needs to overcome the boundaries of CS to enter T&I studies too, the time has also come for training programs—both university degrees for aspiring linguists as well as vocational training and continuing professional development (CPD) courses—to systematically integrate all of this in the classrooms.

To achieve the desired outcome, a holistic and integrated implementation approach is required. Indeed, current challenges in the realization of such programs include—but are not limited to—the diverse backgrounds and expertise degrees of both trainees and trainers (since they are still typically formally trained in either one of the two environments) and the compelling necessity to design curricula in which technology is not a mere supplement segregated to specific courses, but rather an element underlying the structure of programs and a tool regularly available to trainees.

3.1 The Need for Consistent Training in Language Technologies

First, this is because research in the field and on the actual products should not be an exclusive domain of private corporations (often the so-called ‘big-tech’ companies or businesses receiving massive funding), but also stem from the academia and institutional centres. Given their potential communicative and societal impact, these tools should not be developed in search of improving performance and economic profit only, and the related information is worth being widely accessible.

At the same time, CS—and especially AI, since it inherently entails (or at least aims at establishing) an interaction with basically any aspect of the real world—are required to welcome contributions from other disciplines. Interdisciplinarity can be more broadly (and metaphorically) conceived as the creation of ‘neural networks’ of studies by assimilating epistemological concepts along with analytical and research practices from other specialties.

Finally, and most importantly, the labour market is increasingly requiring the new generations of language professionals to be experts who can combine their domain expertise and knowledge with digital and IT skills (Sikora, 2014). As some institutions* across the world have already started doing (Diño, 2021), and in response to the needs for new industry roles, language and T&I programs are to include language programming modules—and most linguists are to add coding to their arsenal—since language services and language technologies will only be increasingly intertwined. Translators and interpreters will probably be no longer allowed to disregard NLP and computational linguistics, and language engineers will inevitably work closer to language service providers.

A widespread concern among human language professionals is to be eventually replaced by machines in their job. Indeed, a substantial share of the lower-end translation demand is already met by MT, with translators intervening in emerging human- or expert-in-the-loop models by fine-tuning the work of engines, or addressing highly specialised niches otherwise.

The same could happen with speech translation, with some portions of the labour space being taken over by automated spoken translation systems, when communication is particularly linear and unstratified. Similarly to what is already happening with written translation, humans would therefore progressively be covering high-end needs, where more than a plain linguistic equivalence is necessary, e.g. when managing different legal systems or requiring compliance with diverse regulations.

As a consequence, with greater availability of good-quality automated translations, expectations towards human language professionals are going to be even higher. This will be an additional challenge for practitioners and training institutions alike, being demanded a broader yet solid preparation as well as narrowing subject matter expertise.

Heading towards that direction, language professionals will be expected to offer trustworthiness—both for validating and enhancing machine work as well as performing the activity firsthand—rather than simple language support (Pym, 2020).

Technology and AI have gained a pivotal role in almost any professional activity, and NLP resources prove useful and effective in many instances of reality (Tavosanis, 2018), therefore successful human–machine synergy can only revamp the offer of language transfer solutions, and advance the accuracy and efficiency of practitioners to help them excel.

*For instance, the consortium of universities promoting the pioneering European Master’s in Technology for Translation and Interpreting (EM TTI) offers a program combining computational linguistics and NLP with translation and interpreting technologies: <https://em-tti.eu/>.

3.2 Research and Training in Translation and Interpreting Technologies

However, as previously outlined, a remarkable share of translators and even more interpreters are still not familiar with IT resources already at their fingertips. Therefore, in addition to programming languages, another gap in skills and mindset needs to be bridged.

In training environments, research and professional practice should increasingly nurture one other by designing didactic methodologies and tools that would blend vocational and academic elements, and instruct qualified professionals who are in step with the times (Orlando, 2016).

Curricula should already devote at least some modules providing a framework for learning translation and interpreting technologies to gradually increase the awareness and proficiency of students with such systems (Fantinuoli and Prandi, 2018).

Nevertheless, courses cannot only aim at teaching the basics of the tools in an effort to chase resources which are already established in the ‘real world’, but institutions should notably be the driving space where those innovations are primarily experimented or even envisaged or designed.

For instance, post-editing and remote interpreting should not only be taught to translation and interpreting trainees once they become established practice on the professional market, but they should—and could—have been introduced when they were still expected to be ‘the next big things’ in the related fields.

Likewise, T&I programs should now consistently design courses enabling trainees to familiarise with the resources and frameworks they are likely to encounter in the early stages of their careers (namely in a very near future), i.e. language coding and programming, language data management, automated and machine-assisted translation and localization workflows, and CAI tools, just to name a few.

Once again, alongside practical abilities and know-how, an open and long-sighted attitude would be the key for aspiring and established practitioners alike to embrace and even lead future advancement. Trainees should not only be learning how IT tools actually work, but also how to conceive and approach them in a process of true technological literacy (Kornacki, 2018), with valuable integrations from disciplines such as human–computer interaction and interaction design.

4 Future Scenarios and Final Remarks

The foundation for the introductory overview outlined in this work is considering language transfer processes as communication acts, rather than mere information or lexical correspondence. This is the reason for encouraging the inclusion of language technology studies within a wider communicative framework.

Text-based language technologies already significantly impacted human communication and human–machine interaction patterns, and written translation activities are extensively benefitting from numerous applications.

These innovations have already had a critical impact on how communication is performed with regards to language solutions. For instance, search engine optimization (SEO) has overturned how online content is conceived and put into words. Machine translation (MT) too has influenced the way global content and texts addressed to international audiences are drafted, to such an extent that pre-editing has become common practice for globalization service providers. Likewise, the long-term influence MT has even on the language used by translators and post-editors is worth further investigation.

On the other hand, fast-paced improvements are also shedding a new light on voice-based language technologies, whose consideration is turning from accessibility to full productivity resources with other paradigm shifts on the horizon.

Just like language varies diaphasically depending on context, e.g. with ‘baby talk’ and ‘foreigner talk’, the same may presumably happen when communicating to computers by resorting to specific ‘computer-’ or ‘machine talk’.

Since these technologies amplify diamesic variations in the use of language, it can be reasonably expected that speech addressed to machines will become different from spontaneous verbal expression. That could only be consolidated over time by society becoming accustomed to interacting with machines through voice, as well as an increasingly blurred dividing line between spoken and written language (due to the ubiquitous usage of mobile devices, chats, and voice messages) and a machine-induced alignment to common cognitive structures representing the linguistic knowledge of speakers of any language (Chomsky, 1957, 1965).

Furthermore, text-based NLP applications like pre-filled responses or suggested writing hint at how much human communication relies upon automatic and perfunctory mechanisms, and how many interactions can truly be managed with little ‘intelligence’ or language understanding.

Still, it seems unlikely that communicators will completely adapt their speaking style to the outreach (and limits) of digital tools in some sort of pre-editing process of their talks. As conference speakers never adapted their rhetoric to the modality they were being interpreted with (e.g. simultaneous or consecutive), it will not happen with machine talk or computer-assisted interpreting either. Nonetheless, it is also true that real-world environments are becoming increasingly ‘AI-friendly’, i.e. ever more shaped around the abilities of computational artefacts (Floridi, 2019).

At first, it is far more likely—as practice with support tools already proves to practitioners who make use of them—that interpreters may alter and adjust their interpreting techniques to the performance and output of these resources and their prompts. Albeit machine talk still looks distant from real-world use cases, computer(-assisted) interpreting talk could more reasonably be an emerging trend.

After all, all communicative acts—just like all translations—are built around degrees of negotiation (Eco, 2003), in which communication is adjusted according to the behaviour of interlocutors, their use of language, their relationship, context, and levels of compromise.

Research in common sense AI is also trying to narrow the gap with in-context human language models (e.g. when deixis is in place) by studying new training methods that would enable technology to detect and exploit elements from the multimodal real world. ‘Vokenization’, as a combination of visual and language training datasets, is one of the most interesting examples of this (Tan and Bansal, 2020). Visual-language models may produce astounding enhancements in robotic assistants or automated subtitling and dubbing, where both verbal and non-verbal traits play equivalent roles.

Despite the existing limits of language technologies and still high word error rate (WER) scores in the performance of ASR dampen the enthusiasm towards silver bullet AI solutions, there are numerous operating resources not even specifically designed for translators or interpreters (like multilingual semantic networks and knowledge graphs, or named entity recognition and terminology extraction tools) which can turn out to be valuable assets (Rodríguez et al., 2021).

As linguists become acquainted with technological tools, proficiently learn to use them, and consequently improve their performance, further experimental assessments even on a remodelled and tailored version of Turing’s (1950) popular testing for computer intelligence could be investigated to detect and observe the difference in outputs from language practitioners who make use of IT support tools and those who do not.

Ultimately, technology should not be conceived as an impending threat aiming at replacing humans, but as a resource providing support to ingeniously achieve the best possible cooperation between human abilities and computational efficiency.

This objective can be attained by thoroughly considering springing communication paradigms to bolster high-quality training data and valuable language resources (ELRC, 2019) and, above all, by adequately educating practitioners for a critical, accountable, and transparent use of language technology.

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