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Human-Centered augmented translation: against antagonistic dualisms

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ABSTRACT

Industry commentators have recently proposed the concept of ‘augmented translation’. Drawing on the notions of ‘antagonistic dualisms’ and ‘human-centered artificial intelligence’ (HCAI), this paper considers various definitions of ‘augmentation’ from an augmented cognition standpoint including definitions focussing on problem-solving, interdisciplinary field theories, and cognition supported by sensing technologies and AI. It is suggested that translation has been an augmented activity for some decades now. However, according to other views of augmented cognition, the level of augmentation is low in comparison to what could theoretically be achieved if the sensing and technological mitigations envisaged for augmented cognition could be realised. Translation technology has not been driven by an empowerment or intelligence amplification (IA) agenda, but by an emulation and artificial intelligence (AI) agenda. The mechanisms, technical and ethical challenges of achieving augmented translation, beyond what is currently in place in translation tools, are tentatively explored. It is, in conclusion, suggested that the HCAI focus on intelligence amplification rather than on replacement of human ability, on a move from emulation to empowerment, is pointing the way forward.

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Augmented cognition; translation; human centered artificial intelligence; translation technology; intelligence amplification

1. Introduction

This paper presents a discussion of the concept of ‘augmented translation’, understood as an example of an augmented cognitive task, which has been gaining traction in the language industry of late (Lommel & DePalma, 2021). The aim is to explore the various definitions and understandings of augmentation, both in general and in the practice of translation along with what the technical, societal and ethical challenges are of doing so. Examining the concept of augmentation and its implementation is important because once the notion of augmented translation gains currency many commercial entities are likely to adopt it and claim to have implemented it. The contention in this paper is that it is not in the interest of any stakeholders in the translation profession or academic discipline to make claims about augmented cognition without first fully

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investigating and exploring what it really means, how it could be more fully implemented, and what the ramifications might be of doing so.

Before delving properly into the topic of augmentation, however, the paper will first consider the idea of 'antagonistic dualisms' (Haraway, 1985) and Human-Centered Artifical Intelligence (HCAI – Shneiderman, 2020a, 2020b) and how they might apply to the study and practice of translation in particular in discussions centering on machine translation (MT). The antagonistic dualism in question is already embedded in the Call for Papers for this special issue in the form of the phrase 'Mean Machines?', though, the call has been accompanied with an all-important question mark, leaving authors and readers open to answering the implicit question. The implication, as this author interprets it, is a setting up of the dualism of us (humans) and them (machines) and the threat that machines present to translation as a human activity. A HCAI, augmented cognition viewpoint potentially removes, or at least dilutes, the binary standpoint.

1.1 Antagonistic dualisms and the Cyborg Manifesto

In 1985, Donna Haraway published her essay entitled *A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s* (Haraway, 1985). As the title suggests, this was intended first and foremost as a feminist critique, but it has been interpreted beyond that scope to include more general interpretations of the sociotechnical aspects of life. As Wajcman puts it (2004, p. 80): Haraway 'embraces the positive potential of science and technology, to create new meanings and new entities, to make new worlds'. Wajcman (ibid) sees Haraway's thinking as a refreshing antidote to the technophobia that typified radical feminist and ecological thought at the time of publication (ibid.). Haraway posited as early as 1985 that we are all already cyborgs, i.e. 'a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction' (1985, p. 7). Decades have passed since and we have become, undoubtedly, even more cybernetic in the meantime, given our daily reliance on technology in general. With the advent of computer-aided translation and, more recently, more successful MT, this is also true of translators. Is this something to resist, as seems to be the dominant position in translation studies where MT in particular is positioned both as a threat and – sometimes simultaneously – not as a threat (Bywood et al., 2017)? Is it something that produces an output we negatively label as 'post-editese' (Castilho & Resende, 2022; Toral, 2019), suggestive of something unquestionably inferior to what so-called 'human translation' produces, as something that strips translators of agency and creativity (Guerberof-Arenas & Toral, 2022), reduces the value of what they do, and as something to be resisted (Cadwell et al., 2017)? Interestingly, Woolgar (2012, p. 304) highlights that '[a]ttempts to determine the characteristics of machines are simultaneously claims about the characteristics of nonmachines'; discussing what technology should and should not do is the flip side of the debate on the moral entitlements of humans. Is there something to be gained from adopting a less binary stance, as Haraway urged, presenting her essay as 'an argument for pleasure in the confusion of boundaries and for responsibility in their construction' (1985, p. 8)? Boundaries, in other words, do not have to be antagonistic dualisms: i.e. human translator versus machine translator.

To tackle the theme of this volume, it is important to stand back and ask why we need to position a machine as 'mean', and, especially, what this says about our own fears and vulnerabilities. Haraway wrote: 'Late-twentieth-century machines have made thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines. Our machines are disturbingly lively, and we ourselves frighteningly inert' (1985, p. 11). Perhaps this starts to present us with an answer as to why we position machines in opposition to humans? She goes on to suggest that '[…] a cyborg world might be about lived social and bodily realities in which people are not afraid of their joint kinship with animals and machines, not afraid of permanently partial identities and contradictory standpoints' (p. 13). We have already entered into a stage of partial identities in the field of translation, where the dichotomy of human vs. machine (or, more generally, computer) translation makes no sense whatsoever (see O'Brien, 2012) and where we need to become more comfortable with contradictory standpoints such as, for example, the contention that machines cannot be creative, only humans can, or only a human can produce top quality, acceptable and accurate translation. Haraway's viewpoint allows us to ask if the dichotomy should be dismantled and replaced by a view where translators have 'kinship' with machines and the translator's ability is amplified by that of the machine.

Very recently the technology known as ChatGPT was launched amid much amazement. ChatGPT is an implementation of Large Language Models (LLMs) which demonstrates the impressive strides being made in the field of AI in general. The system has a machine translation feature, but this is not its only functionality. There have been many reactions to its MT abilities, positive and negative, but it suffices to say that ChatGPT is yet another system with MT capabilities built on the power of and with the inherent limitations of LLMs. It is expected that entire papers will be written about its automatic translation functionality but this is not the aim of the current one. Of note, however, is a recently published posting by a member of the American Translators' Association which highlights how ChatGPT can be used by translators to relieve some 'tedious' tasks such as compiling terminology or globally changing word choices in an intelligent way (Pierce, 2023). While this does not go so far as to present ChatGPT in terms of 'kinship', or augmented cognition, it certainly presents a positive and open attitude towards such developments.

1.2 Human-centered artificial intelligence (HCAI)

A second framework of interest to the discussion in this paper is that of human-centered artificial intelligence (HCAI), as proposed by Shneiderman (2020a) who presents alternatives to the 'dystopian future in which robots control and dominate humanity' (2020a, p. 111). The objectives of HCAI are to amplify human abilities and empower people, while maintaining human control and, as such, it fits well into a consideration of augmented translation. His is a reframing of the 'human-in-the-loop' concept in AI to one of 'IA' – Intelligence Amplification – with AI in the loop around humans, who are at the centre (see Section 3 for further discussion of this in relation to the translation industry and proposals for augmented translation). In his 2020a paper, Shneiderman presents what he calls three 'fresh ideas' on HCAI. First, it is proposed that high levels of human control *and* automation are concurrently possible. Previously, it was thought that the higher the automation, the less control a person has. Second, he calls for a shift away from AI designers trying to emulate humans to one where they empower humans: '[…] many users want to be in control of technologies that support their abilities, raise their self-efficacy, respect their responsibility, and enable their creativity' (p. 116). The third idea centers around governance structures for HCAI. Fifteen recommendations for such governance structures are proposed in Shneiderman (2020b). While these are very important, we will not focus on them here due to lack of space.

The first and second proposals are important when considering the potential and objectives of augmented translation. One of the biggest concerns expressed in relation to MT has been the loss of agency and eventual replacement by a machine (see, for example, Cadwell et al., 2017; Moorkens, 2020; Nunes Vieira, 2020; Olohan, 2011), though it must be acknowledged that all stakeholders, including NLP researchers, developers and industry representatives, are at pains to point out that human translators are still very much needed. The fact that this has to be stated so regularly is testimony to the underlying and pervasive fear that exists. The reasons articulated as to why translators will not be replaced are often very basic, highlighting, for example, that translation is not a word for word replacement process and that MT can make mistakes (see, for example, Ordorica, 2020).

Shneiderman's first idea – that high levels of automation are possible while retaining control – would be crucial for the successful acceptance of any future augmented translation paradigm. The second idea, i.e. to move away from emulation and towards empowerment, is equally crucial. The resistance (Cadwell et al., 2017), ambivalence (Koskinen & Ruokonen, 2017), disillusionment with translation technology (O'Brien et al., 2017) that has been well-documented could very well be explained by the mistake made by translation technology developers for years that what they are aiming for is a speedier *emulation* of human translation by modelling the translation product without understanding the underlying cognitive processes and without focusing on user experience. Instead of emulation should tools be designed to *amplify* human capabilities and empower them further?

Clear distinctions are drawn between the emulation and application approaches (Shneiderman, 2020a). In emulation, the aim is to produce an intelligent agent that is a thinking machine, a cognitive actor, with knowledge, etc., but in the application approach, the aim is to produce a powerful tool that seeks to extend human abilities, enhance human performance, and empower users. Emulation involves an autonomous system, whereas application entails supervisory control. Emulation is like a 'simulated teammate', a 'humanoid' application, 'a tele-operated device' and clearly a 'mechanoid' (Shneiderman, 2020a, p. 116). It is clear that MT systems have been developed and are used to emulate translation, in particular when an MT system is used to produce raw output with no human intervention whatsoever. However, for an augmented translation system, it is proposed that the approach should most definitely not be emulation, but application: 'The application goal community believes that computers are best designed to be powerful tools that amplify, augment, empower, and enhance humans' (Shneiderman, 2020c, p. 74). It is important to note that these positions are presented only as a simplified dichotomy by Shneiderman and he points this out explicitly, recognising that there are positions and compromises between the two. This could involve, for example, taking limited but mature emulation features and applying them to support human augmentation.

On first reflection, Haraway and Shneiderman's contributions on cyborgs and HCAI respectively might seem at odds with each other. Haraway, after all, called for a dissolution of boundaries between human and machine (and animal) and Shneiderman positions himself firmly in a paradigm favouring the machine serving the human. Yet, they are not disconnected and not so far apart. Haraway challenges us to rethink our superior anthropomorphic positions; Schneiderman then offers ways of thinking about how we, as humans, can benefit from machines through human-centered (though not necessarily superior) approaches, asking how limited human abilities can be amplified by complementary machine abilities. Haraway challenges us to accept our cybernetic condition and Shneiderman offers ways in which we can be at ease with it through a lens of empowerment rather than replacement. Both are helpful starting points for examining augmentation generally and augmented translation specifically. Haraway's position could be said to represent the view that translation is already and will continue to evolve as a hybrid, symbiotic human-machine endeavour. This view is closely aligned with some industry views on translation (though not all, it must be said), as described later in this article. From Shneiderman's perspective, the translator's skill is amplified by the machine and the latter is firmly the servant of the former, a view that aligns more closely with that of scholars in translation studies.

2. What is 'Augmentation'?

Prior to considering what 'augmented translation' currently means or could mean in the future, it is necessary first to understand the various conceptualisations of cognitive augmentation more generally and methodologies for its achievement.

Definitions of augmentation

Engelbart's seminal publication (1962) positions augmentation of human intellect as:

> increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble. (1962: Para 1a1)

Engelbart places augmentation in the realm of human problem solving. In the conclusion to his report, he posits that any possibility of improving 'the intellectual power of society's problem solvers warrants the most serious consideration. This is because man's problem solving capability represents possibly the most important resource possessed by a society' (ibid, p. 6a). The positioning of augmentation as an aid to problem solving is relevant for translation which is itself frequently positioned as a problem-solving task (Angelone, 2010; Gaddis Rose, 1979; Shih, 2015). However, as Muñoz Martín and Olalla-Soler (2022) rightly point out, the conceptualisation of translation (only) as a problem-solving task is highly problematic. To extend this idea, we can also view translation as a tool for helping to solve problems by assisting with the dissemination of academic and scientific knowledge, for example (Schögler, 2019).

Taking Engelbart's (1962) definition above and applying it to translation, it could be argued that the process of translating has already become 'augmented', thanks to the development and deployment of general tools and technologies such as the internet, email, broadband, and computer-aided translation tools such as translation memory (TM), term management technology, and MT. With the combination of these tools, translators have, as per Engelbart's description, been able to achieve faster and better comprehension, for example through internet searching as opposed to having to manually consult many general or specialised dictionaries. Translators produce translations faster with the assistance of exact and fuzzy matching in TMs, and with higher quality or, at least, with increased consistency afforded by translation databases and shared glossaries. With the caveat that MT does not (yet) consistently contribute to faster and better comprehension, or for all languages and contexts, humans, in general, have increasingly been able to gain a useful degree of comprehension through its use in settings beyond that of professional translation (Nurminen, 2019, 2020). Evidentially, although not unproblematically, MT was used by governments to provide information at a faster pace (Pym et al., 2022) and by lay persons (O'Brien et al., 2022) to fill information deficits quickly during the COVID-19 pandemic.

There are, however, other varied representations of human augmentation and the related concepts of 'augmented human' and 'human 2.0'. Raisamo et al., describe it as '*technologies* that enhance human productivity or capability, or that somehow add to the human body or mind' (2019, p. 132, author emphasis). The same authors proceed then to characterise it as an *interdisciplinary field* that addresses methods, technologies and their application for enhancing the sensing, action and/or cognitive abilities of a human which is achieved through sensing technologies and artificial intelligence methods. Stanney et al. (2015) define augmented cognition as comprising 'a set of theories, principles, and computational systems to support and extend human cognitive abilities in real time by taking into explicit consideration well-characterized limitations in people's attention, memory, problem solving, and decision making' (2015, p. 329). They provide us with the metaphor of a 'cognitive prosthetic' (ibid, p. 330) and label it as the next evolutionary step in human information-processing technologies. The goal of the system is to maximize the cognitive power of the human brain and the computational power of the computational agent. Finally, we should also consider and contrast this with the concept of human enhancement technologies (HET) which, according to Bavelier et al. (2019, p. 204) 'challenges to the core of what it means to be human'. Raisamo et al. (2019) differentiate augmented cognition from HET by stating that HET concerns attempts to overcome limitations in the *human body* using technology and can include surgical or chemical means and do not focus on human-technology interaction specifically, though there are clearly fuzzy boundaries between the two. Overall then, augmentation can be understood to be the use of technologies to help overcome limitations in human cognition and the interdisciplinary field that studies the methods, theories and principles underlying its deployment, but it generally excludes surgical or chemical enhancements to the physical human body.

Motivation for augmentation

Human performance is constrained by cognitive load and augmentation seeks to overcome this limitation (Alicea, 2018), to amplify intelligence (Stanney et al., 2015) by deploying technologies related to human perception and cognitive performance. These days, the technologies used for augmented cognition are largely driven by artificial intelligence (AI). The sensing technologies required for augmented cognition (e.g. cameras, pulse monitors, etc.) have become more miniaturised and integrated into the technologies we use daily, making the goal of amplification more viable. Interestingly, Engelbart (1962) proposes 'intelligence amplification' or 'IA' as an objective of augmentation. This counterpoint of AI vs. IA is taken up again in more recent discussions of HCAI, as discussed earlier, the proposal being that IA should be supported by AI, but AI should not be the end goal (Shneiderman, 2020a; Shneiderman, 2020b). At the same time, Engelbart recognised the two-way, symbiotic nature of the relationship whereby humans can complement AI systems while AI-driven systems can amplify human intelligence. Importantly, augmentation is seen as a way to complement rather than counter existing processes (Alicea, 2018).[1]

Examples of applications

Augmentation has already been deployed in several domains such as e-learning, the automotive sector and in air-traffic control. For example, the human ability to safely drive a vehicle has been augmented in new models of cars where park assist, speed controls, automatic lane adherence and automatic breaking have become available as features. In air traffic control, the EU-funded Retina project is a good example[2] where tasks that are negatively affected by poor visibility conditions – due to the limitations of human vision – can be enhanced through a combination of synthetic vision and virtual/augmented reality. Augmented reality is a type of technology that has become more and more applied over time in various e-learning environments (Martin et al., 2011), including in informal learning environments (Salmi et al., 2017). It is important to note, however, that augmented reality is not a synonym for augmentation and should not be assumed to entail, or guarantee, augmented human performance, since it mainly involves a mix of real-world and digital illusions, online interactivity with the real environment and three-dimensional impressions (Salmi et al., 2017). As Raisamo et al. (2019, p. 32) remind us: 'Augmented human *uses* elements from AR, VR, ubiquitous computing and other user interface paradigms, but merges them in novel ways' (author emphasis). AR, then, is simply one means by which human performance might be augmented in different application areas.

How augmentation happens

Put simply, to augment human cognitive abilities and overcome limitations, a system first needs to be able to monitor affective and cognitive states and then apply appropriate mitigations (Alicea, 2018). Currently, this is not a feature of any translation technology, broadly understood. Relatively non-invasive neurophysiological sensors such as ECG (electrocardiogram), EEG (electroencephalogram), GSR (galvanic skin response), eye tracking for pupillometry, pulse and breathing monitors can be used robustly to both measure and classify affective and cognitive states. Early test beds focused on military tasks and the results demonstrated substantial improvements in human performance (Stanney et al., 2015). Accuracy of monitoring is greatest when many sensors are used at the same time, though this set-up is clearly more suited to lab-based experiments than it is to daily work settings, a topic that will be addressed further below.

In principle, when a certain level of cognitive or affective state is sensed, mitigations must then be activated. According to Stanney et al. (2015), there are three categories of mitigation: adaptation of presentation, schedule, and level of system automation.

The first modifies the manner in which information is presented by, for example, switching from one sensory modality (e.g. sight) to another (e.g. auditory). This seeks to optimize the distribution of processing load. Other mechanisms might include cues for directing attention or decluttering information when overload is detected. The second ('schedule') is a temporal measure which involves adapting the task pacing and sequencing; the third involves adapting the level of automation and might involve providing context sensitive help when confusion is detected. How each of these might be applied in a CAT system is tentatively explored in Section 3.

Mitigations are aligned with different human cognitive goals and are context dependent. They require trade-offs because, for example, a mitigative measure might be appropriate when a human is cognitively overloaded, but such a measure would be inappropriate during 'normal' processing conditions where there is no overload. One of the challenges is to avoid a yo-yo effect between switching on and off a mitigation measure.

Challenges of augmentation

Accurately sensing affective and cognitive states in a relatively non-invasive way and of deploying relevant and useful mitigations to achieve amplification is enormously challenging. There is certainly no one-size-fits-all approach. Augmented cognition requires a tight coupling between a user and a system to detect the neurophysiological state and also needs to draw on situational needs. In other words, personalised AI is required (Raisamo et al., 2019; see also O'Brien & Conlan, 2019 for earlier proposals on personalisation of translation technology). Mitigations require input from multiple dimensions, not just one, and unidimensional measures are insufficient (Raisamo et al., 2019). Different wearable sensors can be used for electroencephalography, to capture facial muscle activity and sweat gland activity. These can be used to measure cognitive states like workload or confusion. Eye movement behavior can also be used to measure cognitive load and emotional states.

A second, considerable challenge is the tension between generalisation and personalisation. To generalise augmentative systems, they would need to be deployed within and across social groups and biological populations in order to understand social differences in perception. Yet, as already mentioned, augmentation is highly context and individual-dependent. This presents significant challenges from a technical perspective. Furthermore, challenges exist on the sociotechnical and ethical level where tensions could exist between the possibilities of individual enhancement, benefiting the individual, but not society at large, or vice versa.

Ethical concerns

In their welfarist approach to human enhancement technologies (HET, see above), Bavelier et al. (2019) enumerate several ethical challenges that apply in the field of HET but also more generally to augmentation. First, they point out that while targeted human manipulations such as taking performance or memory enhancement drugs are currently an exception, their possibility 'raises unprecedented ethical questions regarding the future of humanity and of human societies' (Bavelier et al., 2019, p. 205). It is also mentioned that implanted enhancement devices could eventually be intentionally used to modify our sense of what is morally acceptable (they refer to this as 'moral bioenhancement'). Bostrum and Savelescu, in 2008, were already discussing the emerging biopolitical faultline between proponents of bioenhancement (transhumanists) and bio-conservatives and the ethical debates pertaining to all views. They suggest that '[t]o decide whether we have reason to promote a particular enhancement will require wisdom, dialogue, good scientific research, good public policy, and academic debate' (Bostrum & Savelescu, 2008, p. 21). While the ethical questions pertaining to physical human enhancement and transhumanism specifically are quite particular, some of the ethical challenges highlighted by commentators would equally apply to augmented cognition. Privacy, or its invasion, would be of serious concern. Monitoring of physiological and cognitive performance could be seriously abused by corporations and cybercriminals. Additionally, if the system is not well calibrated then it could lead to sensory overload by changing modalities too often, for example. This could be frustrating at the very least but could also lead to negative implications for the well-being of the user. Augmentation could lead to disparities whereby only those who can afford the enhancements can have them. But the opposite could also be true: in a world of constant sensing and monitoring perhaps only those who can afford *not* to be monitored could escape such monitoring. As Engelbart stated, augmentation warrants full pursuit 'if there could be shown a reasonable approach and some plausible benefits' (1962, Para: 1a2), all of which would have to consider the ethical challenges of augmentation. However, regarding translation and approaching the topic from a theoretical perspective, O'Thomas (2017, p. 298) sharply jolts our assumptions on (machine) translation, ethics and human entitlement, pointing out that the ethical questions are not one-sided: '[…] a posthuman translation theory might need to account for the ethics and rights of the machine translator as much as the human translator'. The ethics of augmented translation deployed as technological solutions to enhance individual cognitive performance, driven by AI and monitored through sensors, remains to be explored more fully.

3. Augmented translation

Recent industry commentary would have us believe that translation is about to become augmented and 'is on the verge of a profound technological shift' (Lommel & DePalma, 2021, p. 3), ignoring the fact that translation has been augmented to some degree for some time now (cf. Engelbart's definition above). Indeed, there is ample literature in translation studies that supports the idea that translation is already augmented by technology, to some extent, even if the term itself has not been used frequently (see, for example, O'Brien, 2012; Risku and Windhager (2015); Bundgaard et al., 2016; Ehrensberger-Dow & Massey, 2019). Yet, as discussed in the previous section, this is not a full form of augmentation that relies on detecting cognitive states and implementing personalised mitigations on the fly.

The Common Sense Advisory (CSA) report defines augmented translation as 'where artificial intelligence-driven technologies combine human and machine capabilities to enhance the effectiveness and efficiency of human translators' (ibid). There are echoes of Engelbart's definition here: better comprehension, better and speedier solutions, but the focus is steadfastly on a competitive, efficiency paradigm that serves the market and not one of empowerment, as per the HCAI framework (Shneiderman, 2020a). In fact, it is proposed in the report that those who adhere to traditional methods (by which is mainly meant post-editing either within or outside a standard translation memory environment) will be at a disadvantage because their high-tech competitors will be able to translate more at a lower cost while still meeting quality requirements, and they will earn more doing so.

At the same time, while being machine-driven and focused on commercial efficiencies, this version of augmented translation is also presented as being human centric. One diagram used in the report places the translator firmly in the centre of the diagram, depicting them surrounded by a number of supporting technologies. The seven supporting technologies that create this augmented environment are, in fact, technologies that already exist, some for a very long time[3]: Translation Memory, Adaptive MT, Quality Estimation, Automated Content Enrichment, Terminology Management, Lights-out Project Management, and a Translation Management System (TMS). By combining these in an augmented infrastructure, it is claimed that '[h]uman translators will gain deeper levels of insight and context into their work, while machines eliminate a labor-intensive but inefficient set of project management tasks' (Lommel & DePalma, 2021, p. 7). This development is furthermore presented as a 'tide that will lift all ships' (ibid, p. 17), that will improve relationships between LSPs, linguists and enterprise content creators – translators will be able to focus on more interesting tasks and will 'offload boring or repetitive elements' (p. 17), but just how this might be achieved is unclear.

Considering the facets of augmentation presented above, this conceptualisation of augmentation within the translation industry does not fully match the expected features of augmented cognition. First, the focus is not firmly on amplification of ability or empowerment, but rather on efficiency in the service of the markets and offloading of 'boring' tasks. One could argue that this vision is mostly about rectifying poor translation technology design and processes that have pervaded the profession since the early development of translation tools which result from the fact that little attention has been paid to HCI design principles (O'Brien et al., 2017). The claim that it will lead to deeper levels of insight and context is unsubstantiated. There is no consideration of the requirements for detecting affective cognitive states and initiating mitigation strategies, nor of which strategies would be required for which tasks and circumstances. All translators are presumed to be identical and to need the same kinds of technological supports, thus the proposal is an unrealistic generalised one.

To provide a more realistic conceptualisation of augmented translation, some fundamental questions still need to be asked and answered. As a starting point, we need to consider the degree to which translation has already been augmented by technology (AI or otherwise) and to ask what else could be augmented? In other words, what do translators feel would be a desirable amplification of their current cognitive abilities? Are they even able to articulate those needs and to see beyond the fear of replacement by the machine? What might they find helpful, what would they tolerate? How will this differ from translator to translator, from one translation context to another? Would, for example, an expert translator even benefit from augmented translation technology (however we might define and implement that), or would a trainee translator be likely to benefit more from augmented technologies?

A second set of questions centres on the tools and techniques for augmentation. What tools might be best used to detect affective cognitive states (EEG, ECG, pupillometry, Galvanic Skin Test, a combination of these and which combinations)? Furthermore, how could these measures be leveraged from an experimental, controlled lab environment to a real-time translation workplace? What losses will be incurred with that leverage?

Next, what mitigation strategies could be used once we are capable of detecting cognitive states? As reported above, there are three main approaches to mitigation: (1) how information is presented; (2) a temporal measure which involves adapting the task pace and sequencing; (3) a measure which involves adapting the level of automation. Let us explore for a moment how this could possibly be operationalised in an existing CAT system that has interactive MT built in as a feature along with all the usual features.

(1) Changes in modality or how information is presented

The system adds speech output to change the modality for presentation of either the source or target language text, or of both. Theoretically, shifting from written to spoken input and vice versa could assist cognitive processing in demanding contexts (see Zapata, 2014).[4] Additional cues might be added to the text. One such feature already exists in CAT environments, i.e. marking up of fuzzy differences between a previous SL and new SL segment; in addition, a confidence score for MT output could be presented to assist the translator in processing a MT suggestion, or in deciding whether or not they should even bother to look at it. Where a sentence is very long, the system could magnify the part the translator is focussing on, potentially using pupillometry, thereby helping them to concentrate only on that part for a period of time; where a sentence has a lot of formatting or tags, they could be rendered invisible for a short time and then reappear once the system detects that the cognitive load has been reduced. Or, where a system is set up to show multiple suggestions, it could switch automatically to showing only the most probable one, or the one with the highest quality measure, however that is calculated (e.g. fuzzy match, MT confidence level). Although some of these features already exist, they are not deployed in a way that is dynamic, automatic and sensitive to an individual's cognitive state.

(2) Temporal measures

This measure is somewhat more challenging to imagine since a translator is normally in control of the timing with which information is presented to them in any CAT system. However, one possibility is that in an interactive MT system, the presentation of alternative solutions could be slowed down when the system detects a saturation in cognitive load to allow the translator to make a decision. Then, once the load is detected to have lessened, the system could speed up the interaction again. In a similar vein, if the system detects that a translator is simply pressing [Enter] (or an equivalent 'accept' action) so speedily that they could not possibly be engaging with the content being proposed it could slow down the presentation of information in order to encourage engagement and, ultimately, quality.

(3) Adapting the level of automation

The system could propose different types of context-sensitive help when eye tracking or keylogging data, for example, suggest that there is confusion (evidenced by re-reading source text and target text; multiple episodes of typing followed by deletion) or overload; such help might involve a verbal offer to look up a term on the web or in specified resources.

These ideas are, needless to say, tentative and incomplete and only serve to indicate how the abovementioned mitigations might theoretically apply in our current translation technology landscape. Exactly what measures could be applied and how useful they may be in amplifying translator performance is a completely open and underexpolored topic.

4. Human-centered augmented translation - Conclusions

HCAI is presented in this paper as one possible framework for discussing the amplification of human abilities and empowerment, while maintaining human control. Extending from this, human-centered augmented translation can be viewed as a way of amplifying translators' abilities, empowering translators, while also allowing them to maintain control. It could be argued that translation has been an augmented activity for some decades, depending on the definition of augmentation that one uses. Recent developments in AI along with the miniaturisation of sensors have opened up the possibility of further developments in augmented translation which goes far beyond the placement of a translator at the centre of an array of technologies that enables them to be more efficient on behalf of the market and, instead, imagines how sensors could be used to amplify human cognitive abilities in translation through shifts in modality, timing, and levels of automation as starting points. We have not yet considered the needs, possibilities, benefits or drawbacks of true sensor- and AI-driven augmented translation. This paper has sought to highlight this gap.

To return to the antagonistic dualist perspective of 'mean machines', as Bughin et al. (2019a, online) remind us, technology is neither intrinsically good nor intrinsically bad. Rather, '[i]t is how technologies are deployed and how the transition is crafted that conditions the welfare dynamics of societies'. Using a specific economic model, they demonstrate how technology growth has contributed to welfare growth in the past (including GDP and other life markers such as leisure time and mortality rates). Then, in an economic modelling exercise, they demonstrate how welfare growth could continue into the future, but only if the focus is on human-centered AI innovation or the 'tech for better lives scenario', as opposed to a focus on automation efficiency and emulation only. In another report (2019b), Bughin et al., again in the context of AI and technology for good, discuss further the new models for assessing welfare that go beyond GDP, such as the Stiglitz Commission Report, the UN's Human Development Index, the Social Progress Index, and the OECD's Better Life Index.[5] One of the most salient conclusions for the topic that we are concerned with in this paper is that businesses need to engage in proactive management for technology diffusion in a way that is not just good for business, but also for society.

Human-centered augmented translation has the propensity to benefit individuals and/ or society. On the individual level, it could mean that limited cognitive capacities are enhanced, making a person more efficient, effective, creative, more competitive, more fulfilled. It could also mean that, as we age and our cognitive skills deteriorate, augmentation enables us to have longer engagement in specific types of tasks, such as translation, if we deem it so desirable. On a societal level, augmented translation could mean that more people are better supported in translation activity, allowing us to translate more content, for more people to access, across so many more topics, which, in turn, could allow for better intercultural understanding and higher access to content for education, for example.

But let us not be naïve: Overlooking for a moment how technically difficult augmentation is, any augmentation of current human cognitive ability is accompanied by an array of challenging questions, some of which were alluded to earlier: Could access to data on cognitive and affective states be misused by companies and cybercriminals? Would only those who could afford it be able to access augmentation tools? Or, on the flip side, would only those who could afford it be able to switch off such monitoring? Would augmented translation mean that more mis- or dis-information could be disseminated throughout the world via translation? Would augmentation level the playing field more, such that professional translators no longer have an advantage over either the machine or the untrained translator? As Heer (2019) reflects, users of AI-driven systems may become overly reliant on them, leading to a potential loss of critical engagement and domain expertise. Is this likely? What is the cost of the necessary trade-offs and are the advantages worth it? There are so many questions to consider as we progress technologically.

In a human-centered augmented translation paradigm, the machine is neither mean nor meek and we have no need of antagonistic dualisms. As Haraway writes:

> Intense pleasure in skill, machine skill, ceases to be a sin, but an aspect of embodiment. The machine is not an *it* to be animated, worshiped and dominated. The machine is us, our processes, an aspect of our embodiment. We can be responsible for machines; *they* do not dominate or threaten us. We are responsible for boundaries, we are they. (p. 38)

Accepting the narrowing of relationships between human and machine is a challenge for those in the world of translation, whether that be the academic discipline of translation studies or the commercial translation profession. The HCAI focus on intelligence amplification (IA) rather than on replacement of human ability, on a move from emulation to empowerment, is pointing the way forward.

Notes

1. As an aside, this dualism is rarely taken into account when we accuse MT systems of 'being biased'. The bias is contained in the training data, which has – at least until recently and prior to the use of synthetic data – been generated by humans, to be replicated and amplified by algorithms. Stanney et al. (2015) offer an intriguing comment on how augmented systems can learn about users' strengths and weaknesses, including being able to flag their biases, making for a "more effective human computer team" (ibid, p. 338).
2. See: http://www.retina-atm.eu – Last accessed 23/10/22
3. The one relatively 'new' technology in the list is Automated Content Enrichment.
4. Work on the use of text-to-speech in translation settings is also beginning to emerge, e.g. Brockmann et al., 2022, though the latter focuses on the task of error annotation not translation production *per se* and no consideration has been given yet to shifting modes on the basis of cognitive state detection.
5. This can be viewed and tested here (https://www.oecdbetterlifeindex.org/#/44335514313) and includes factors such as social life, health, leisure, education, having a spouse/partner, housing, work-life balance etc.

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