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Technological disruption in foreign language teaching: The rise of simultaneous machine translation

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Introduction

The fear of technology replacing jobs can be traced back to Aristotle, who, before great technological advances existed, ventured that machines may one day end the need for human labor (Campa 2014). In the current era, there is overwhelming evidence of technological unemployment. This evidence comes in the form of jobs that were once common, but have largely been replaced by technology such as switchboard operators, travel agents, booth cashiers, bank tellers, and typists. These jobs still exist, but their numbers have declined sharply because they were easily replaced by technology. Statistical models indicate future job losses in these areas will continue with booth cashiers at an 84% risk of losing their jobs, travel agents at a 10% risk, and typists at an 81% risk (Frey & Osborne 2013). These, generally, entry level positions do not require specialized training or advanced degrees, which may explain some of the job losses. However, current trends indicate that training and advanced degrees do not necessarily offer protection against technological unemployment, with most analysts predicting that technology will soon replace lawyers (Markoff 2011), pharmacy technicians, and accountants (Frey & Osborne 2013). Unemployment in career sectors such as these will have adverse effects not only on the workers, but also on the systems that support them. When the need for lawyers, pharmacists, and accountants collapses, what will happen to law schools, colleges of pharmacy, and accounting departments that train specialists in these fields? What will happen to the support systems that depend on these jobs or the scholars that move these fields forward through research activities?

Initial reaction to technological unemployment is likely sadness followed by sympathy for those that have lost their careers and economic stability. Eventually, we might turn inward to assess our own careers and, hopefully, reassure ourselves that we will not be directly affected by technology and that our future employment resides on firmer ground. If you are a language teacher or involved in teacher training or educational research, as many readers of Language Teaching are, job security may seem resilient since employment models show that most classroom teaching positions are less susceptible to technological unemployment (Frey & Osborne 2013).
Nonetheless, some teaching positions are at risk. For instance, adult education teachers have a 20% chance of being replaced by computers and teacher assistants have a 56% chance of replacement (Frey & Osborne 2013). While technology will not replace most teaching jobs, teachers’ roles in future classrooms will likely differ drastically when compared to contemporary roles, with technology pushing a movement from teachers as content specialists to curriculum facilitators (i.e., a movement of ‘sage on the stage’ to ‘guide on the side,’ Godsey 2015). The language classroom of the near future will likely rely on a virtual interface which will stream lessons from a decentralized specialist teacher that includes professional footage, excerpts from content specialists, educational games, automatic assessment of learning, and automated and personalized student feedback. The responsibilities of the on-site classroom teacher will likely be widely altered and include facilitating discussions, coaching students, and managing the classroom. The uses of specialists and guides should allow for greater equity to be achieved within public schools since all students will have access to the same material taught by the same expert teachers and all students will be similarly assessed (Godsey 2015).

Thus, while teaching jobs may change drastically with the advent of technological advances, most teaching careers will likely remain viable. However, this may only generalize to public school teachers who focus on teaching core content such as math, science, and language to traditional student populations (i.e., students in kindergarten through twelfth grade). The trends and models discussed above may not generalize to teachers focusing on other types of language education. For this article, I will concentrate on the effects technology may have on language teachers instructing adults in a foreign language (FL) setting (i.e., teaching a language in a context where the language is not commonly spoken). Here technology may play an even more important role in radically changing the economic dynamics of FL learning and teaching. However, the concern is not technology replacing the FL teacher, but rather technology replacing the need and the demand for FL learning in general.

The driving technological force that has the potential to supplant the need for FL teachers is simultaneous translation devices. Simultaneous translation devices provide simultaneous, automatic translation between two different languages and will eventually allow for seamless, real time conversations between speakers of two or more first languages (L1s). Such devices already exist and show real promise with accuracy gains increasing both steadily and quickly. While these devices may not have the potential to replace FL teachers, they do have the potential to lower the demand for FL teaching. This possibility is based on the premise that many FL students have little motivation to learn a language beyond instrumental demands (e.g., learning a language to increase commercial prospects; Lukmani 1972; Benson 1991; Gardner & MacIntyre 1991; Belmechri & Hummel 1998; Shaaban & Ghaith 2000) because they may not be deeply committed to the learning process and they may not have strong connections to the language beyond instrumental purposes. As such, simultaneous translation devices could meet these learners’ pragmatic language needs in the absence of the language classroom or other language learning environments. In doing so, such devices could save these potential learners time, money, and cognitive effort. Within the increasingly fast pace of the twenty-first century, these personal resources could be used for endeavors other than language learning.
Below, I offer a brief overview of the development of simultaneous machine translation applications to provide those unfamiliar with sufficient background on the subject. I then provide an overview of simultaneous translation applications that are relevant for FL learning, the focus of this paper, followed by arguments for why FL teaching is likely to drastically change as a result of simultaneous machine translation. I then present counter arguments and end the article with potential implications for students, teachers, administrators, and researchers.

The rise of simultaneous translation devices

Simultaneous translation differs from historical approaches used in automatic text translation in that it does not focus on translating written texts but rather focuses on speech-to-text or speech-to-speech algorithms that convert voice audio into written or spoken text. Since the turn of the twenty-first century, translation software has improved remarkably although accuracy data is often hard to come by and measures of accuracy differ widely within the field as do methods for assessing accuracy (Choi et al. 1999; Watters & Patel 1999; Papineni et al. 2002; Savoy & Dalamic 2009; Hampshire & Salvia 2010). The current top performing machine translation software is likely Google Translate, which relies on deep learning models derived from giant data samples consisting of parallel language texts in different languages. The deep learning algorithms search for statistical patterns between the parallel corpora and self-learn the implicit regularities between them. Generally, systems like Google Translate rely on n-gram approaches (i.e., continuous sequences of words) and do not rely on grammatical or syntactic structures. With large enough corpora, the machine learning algorithms can distinguish patterns between the two corpora and develop rules to produce one language given input from another language. More importantly, because simultaneous translation relies on deep learning algorithms that allow for feedback within the system, mistranslations can be highlighted and that data can be flagged for future improvement. Feedback to the system can also be shared across large numbers of users and other potential contributors through processes of crowd-sourcing to better ensure accurate translation of difficult items. Since the deep learning algorithms used by Google Translate rely on data, as more data is collected, the algorithms can learn from their mistakes and, as a result, errors at the syntactic, grammatical, semantic, and phonological levels that may be common now will be improved upon over time. Thus, even though detractors may argue that machines will never be as accurate as humans, it is likely that machines will be just as accurate with time given increased computing power and languages samples. Not only will machines be as accurate as human translators, they will also be faster, more accessible, more dependable, and cheaper.

A key benefit of Google’s translation system is not only accuracy, but also its availability in that it can be accessed on computers, tablets, and smart phones. The system goes beyond simple text translation and allows for voice and text input and can also produce voice or text output. The system also includes optical character recognition algorithms which offer dynamic translations of static text using a smart phone’s camera, which is particularly convenient for reading menus or street signs in an FL. In its current stage,
Google Translate is capable of receiving spoken input in one language (e.g., English) and, within a few seconds, producing similar, spoken output in another language (e.g., Mandarin). A particularly practical feature is that the system need not be dependent on a wireless connection since language packages can be freely downloaded to selected devices individually. Recently (October, 2017), Google introduced Pixel Buds, which bring the reality of simultaneous machine translation yet a step closer. Very small and portable, Pixel Buds are wireless ear buds that can automatically translate among 40 different languages using a smart phone. To use, you tell your smart phone to translate to a specific language (e.g., Japanese). You then begin speaking in your native language (e.g., English) and the phone will begin translating your words into Japanese as you speak them. Any replies (presumably in Japanese) can also be translated back to you in English through your smart phone and relayed through the Pixel Buds. Demonstrations show that the lag time between input and translation is very short, enabling machine-mediated communication that is very close to simultaneous translation.

Simultaneous translation devices are not the purview of a single company, of course. Many companies see the potential of simultaneous translation and are investing heavily in the technology with the understanding that simultaneous translation devices are reaching efficiency levels that will lead to large-scale adoption and application. For instance, Microsoft have developed their own simultaneous speech software (Microsoft Translate) that can translate text in pictures, websites, documents, and conversations on a number of mobile devices. They also offer the software to businesses in order to help globalize marketing and interaction. Microsoft have also incorporated their translator software into their Voice over Internet Protocol software Skype to allow instantaneous voice translation of eight languages and text translations for 50 languages. Simultaneous translation devices are also becoming common in social media applications (e.g., Twitter, Facebook) which have an economic interest in translating user input into as many languages as possible to meet a broader market. For instance, Facebook has active simultaneous translations on its pages and has plans to use simultaneous translation on all its pages so that users can view all posts in their preferred language (Gehring et al. 2017). The market for simultaneous translation is enormous and companies, large and small, are quickly developing methods and software to capture it. These companies see immediate application of simultaneous translation software and are investing accordingly in their development under the prediction that the software will continue to improve and large-scale adoption will be common, or even ubiquitous, in the near future.

**Simultaneous translation and FL learning**

Currently, simultaneous translation devices are not marketed toward FL learners but rather toward travelers in foreign countries where their native language is not spoken. The basic notion behind this push is that simultaneous translation applications offer a marked improvement over gestures, pidgins, and translation dictionaries that often serve to support the communication strategies of international travelers.
Changes to how FLs are translated imply that in the near future there may be less of a need, or perhaps no any need at all, for an international lingua franca such as English. Effective interpersonal communication between speakers of two different languages may soon be happening simultaneously with the aid of machine translation. Immediate and automatic communication in multiple languages at multiple levels (spoken, written, gestures) may obviate the need for a lingua franca internationally, which will have a profound effect on a number of human endeavors including politics, business, entertainment, tourism, and education. While politics and business at the global level have always benefitted from access to human translators, machine translation devices will allow local governments to interact more effectively in other languages be it in developing international relationships, promoting tourism, or affording the opportunity for emergency care and/or social workers to more adequately interact with citizens from non-dominant languages. Likewise, machine translation software will allow operators of small business to spread their ideas and services to an international audience, be it through marketing, customer service, or developing business collaborations. In terms of tourism, machine translation software will afford almost seamless communication while visiting foreign countries allowing travelers to better understand directions, menus, transit options, museum docents, and other practical language concerns that commonly plague tourists. Tourists seeking a more authentic experience will be aided by machine translation software that will allow for a greater understanding of cultural, economic, and social norms (Salim, Ibrahim & Hassan 2012) through direct conversation with local citizens. In terms of education, simultaneous machine translation will have the effect of altering language learning models and linguistic theory, all of which could affect student populations, business models, academia, and associated organizations. For instance, machines fluent in hundreds of languages could profoundly impact our understanding of how languages are structured cognitively and how languages are acquired by children, second language (L2) learners, and even later iterations of such machines because, by their very nature, the models driving these machines can provide data on the statistical regularities within languages that lead to successful language acquisition.

Importantly, the rise of simultaneous machine translation applications will likely affect the need for FL learning and classes. If a person has a choice between dedicating years to the pursuit of learning an additional language or downloading a computer application to communicate in that language instantly and with ease, experience suggests that many of us, including potential language students, will simply download the application. This will, in turn, influence business models for language schools. If the demand for language learning and teaching severely diminishes, many, if not most, language schools will no longer have a product to sell. Many, if not most, language schools may shut. When this happens, there will be an over-supply of language teachers seeking a limited number of available teaching positions. Such structural changes to the teaching profession may impact the private sector particularly hard, especially in English as a foreign language environments. Much like newspapers, which have seen a rapid decline brought on by technology, only the top FL schools may survive and prosper. For these schools, there will likely be an abundance of trained teachers for the relatively small number of teaching positions that remain. Once FL teaching positions begin to disappear, the institutions that train teachers will lack a student clientele and will either have to engage in other activities or reduce their resources. As a result, the organizations
supported by these institutions (e.g., publishing houses, journals, professional organizations, and conferences) will also be susceptible to economic and demographic changes. In effect, the potential for simultaneous machine translation to cause major disruptions within the fields of FL learning and teaching through technological displacement is highly probable and the effects, as in other fields, may be immense.

I limit projections to FL teaching and purposefully exclude L2 learning and teaching (i.e., learning or teaching another language in an environment in which that language is commonly used) because, while L2 learning and teaching will face technological disruptions, they will likely continue to thrive because learning an L2 is a cultural phenomenon that is less likely to be as heavily impacted by these emerging technologies. This notion is predicated on using language for societal needs, which is strong for L2 learners who either grow up or relocate to a region where an additional language is spoken natively. However, using language for a societal purpose would not hold true in an FL environment where the FL is not dominant. It is FL contexts where simultaneous machine translation applications will most likely negatively influence the need and/or desire to learn an additional language, especially for adults, who may not be required to take FL courses during primary or secondary school.

Thus, the basic notion underlying the ability for simultaneous machine translation to weaken demand for FL teaching is that the motivation for learning a FL is very different from that of learning an L2. Historically, two types of motivation are thought to influence L2 learners: intrinsic (integrative) motivation and extrinsic (instrumental) motivation. These terms, borrowed from social psychology (Gardner 1959; Masgoret & Gardner 2003), reference motivation as the desire to become part of a community (integrative motivation) and motivation related to the pragmatic benefits tied to business, money, and job promotions (instrumental motivation). In general, studies support the notion that instrumental motivation is a key component of studying an L2 in an FL setting for a variety of learners (Lukmani 1972; Benson, 1991; Gardner & MacIntyre 1991; Belmechri & Hummel 1998; Shaaban & Ghaith 2000).

More recent motivation work conducted by Dörnyei and colleagues has investigated how dynamic changes in society can affect language learning motivation. In a key study, Dörnyei & Csizér (2002) analyzed over 8,500 Hungarian children’s language learning attitudes and motivations for learning English, German, French, Russian, and Italian at two different time points (1993 and 1999). Importantly, between these two different time points, significant sociocultural changes occurred within Hungary (e.g., the collapse of communism in the country). Statistical analyses identified five main motivational constructs: integrativeness (positive outlook on L2 and its culture), instrumentality (pragmatic benefits of learning the language), direct contact (attitudes toward actually meeting L2 speakers), cultural contact (consumption of cultural products in L2 such as television shows and movies), and vitality of L2 community (perceived importance and wealth of the L2 community). Dörnyei & Csizér found that integrative and instrumental motivation scores decreased significantly from 1993 to 1999 for all languages except English, which increased. In general, motivation for learning English was maintained, while declines were reported in the other four languages.

This work propelled Dörnyei and colleagues to champion a movement away from discussing integrative and instrumental motivation in strictly binary terms. Instead they
proposed the L2 Motivational Self System. In this system, three identities interact to predict motivation: ideal self (the language learner he/she wants to be), ought-to-self (the language learner society thinks he/she should be), and anti-ought-to-self (the language learner society thinks he/she should not be). These selves include features of integrative and instrumental motivation in that the ideal self subsumes aspects of integrative motivation, and the ought-to-self subsumes aspects of instrumental motivation (Dörnyei 2009). However, these links are fluid with research indicating that the L2 self and integrativeness are correlated but, depending on context (i.e., the cultural climate of specific countries), instrumentality is correlated with either the ideal L2 self or the ought-to-L2 self (Taguchi, Magid & Papi 2009). Importantly, though, the status of a language as a lingua franca (e.g., English), may bias motivations in favor of learning the language (Ushioda & Dörnyei 2017) in L1 and L2 speakers of English (Thompson 2017) and for multilingual speakers (Henry 2017).

The motivation research discussed above is important for a few key reasons. First, it indicates that many FL learners study a new language for instrumental purposes. As such, it is likely that technology could replace this motivation by providing instantaneous language access for politics, business, education, entertainment, and tourism purposes. Again, if given a choice between investing years of study to learning a FL along with the associated costs (including mental, physical, and monetary costs) or downloading an application on your phone and communicating immediately, it is very likely that many potential FL learners will opt for the application. This may prove especially true for learners seeking instrumental opportunities (as compared to integrative opportunities).

Additionally, work by Dörnyei has shown how societal transformations can influence language learning motivation. While the transformations he observed were political, there is reason to believe that technological transformation could also influence learner motivation. In such a case, the advent of simultaneous machine translation could decrease the motivation to learn a lingua franca such as English. Specifically, attitudes toward ought-to-self and anti-ought-to-self may change radically if society adopts simultaneous machine translation software as a means of effective interpersonal communication between speakers of different languages. Society may come to see learning a new language in an FL environment as an antiquated endeavor akin to using a horse for transportation or relying solely on a postal service for communication with friends and family. This technology-facilitated shift in the cross-linguistic communication habits of people worldwide may in turn affect the ideal self in that the perceived value of learning a FL may gradually decline for many populations.

Counter arguments

There are, of course, counter arguments to the claim that spontaneous machine translation software will radically alter the landscape of FL teaching and learning. Specifically, arguments exist against the speed and breadth of technology replacing jobs, especially for high skilled professions such as language teaching. Historically, technology has had a net gain on productivity, employment and wages although this may be changing (Rotman 2013). More importantly, technology generally replaces low skilled workers such as travel agents, cashiers, and textile workers, but not high skilled workers (i.e., language teachers). In contrast to these
historical examples, however, the technological disruption that will come with simultaneous machine translation will not necessarily REPLACE language teachers. As stated above, a more profound, existential concern is that it will OBVIATE the need for language teachers because many students’ motivations to learn a FL will change. Thus, machine translation will not take over the classroom; it will remove the underlying need for FL classrooms. So, a counter-argument based on the types of jobs that technology generally replaces is not strong.

Many language teaching specialists will rightly point out that people will still need to be fluent in multiple languages, especially in multilingual environments such as Belgium (where French, German, and Dutch are spoken) or South Africa (where Afrikaans, Sotho, and English are spoken, among many others languages). However, the arguments in this paper are founded on FL teaching, where the motivation to learn an additional language is different from L2 environments. L2 environments are common in most parts of the world (Crystal 2012), and it is unlikely that technology will replace language learning in such cases because the need for language is socially grounded and children grow up and acquire multiple languages naturalistically. The need for teachers in L2 environments will also not be replaced by technology because the languages learned serve a community purpose and should thus not be as susceptible to technology disruptions. Thus, there will still be a demand to learn L2s as compared to FLs.

There may also be counter arguments based on the notion that learning a language increases cognitive skills (i.e., the notion that second and/or FL learning should be pursued for purely cerebral purposes). Such arguments are often made for the teaching and learning of Latin, a dead language no longer spoken as an L1 by anyone and one that with few exceptions (e.g., the ecclesiastical administration of the Catholic church, historical scholarship, the development of scientific taxonomies) serves few contemporary communicative functions. Arguments in favor of teaching Latin include the idea that vocabulary and grammar underlie Indo-European languages and that it is the language of science, law, and government. More importantly, Latin is argued to be a superior language whose understanding and acquisition can increase cognitive skills (see Pinker [2007] or Richards & Roberts [2014] for an illustration of this position). While evidence does exist for linguistic and cognitive advantages for multilingual speakers (i.e., the bilingual advantage; Bialystok et al. 2004), these advantages are generally posited for speakers who have multiple fluencies, not for adults learning an FL.

Entrenchment of FL curricula throughout educational systems worldwide can also be used as a counter-argument to technological unemployment. In many education systems, language programs are a mandatory feature of education. For instance, English language classes are required in many outer circle and expanding circle countries beyond English dominant regions of the world (e.g., Korea and China; Bhatt 2001). Even American students are required to pursue the learning of FLs in secondary and tertiary education. In such cases, learning a language is not a voluntary decision, but rather steeped in institutional history. Since institutions change slowly, there is a rough guarantee that some types of FL teaching will continue in the foreseeable future. However, the question is for how long once the practical need disappears as a result of the growing popularity of simultaneous machine translation devices. Consider, as an example, industrial arts classes (i.e., carpentry, metalworking, and
drafting) that once populated public schools in the United States. These subjects have generally disappeared as emerging technologies have made them either redundant or the institutional focus has shifted to subject matters perceived as being even more essential for societal success (e.g., math and science). The latter is particularly apparent in the United States where federal and state education bureaus strongly focus on science, technology, engineering, and math (STEM) domains as a result of students failing to reach proficiency in STEM classes and teachers lacking acceptable subject matter knowledge (Kuenzi 2008).

Implications and conclusion

Technological advances in simultaneous machine translation may have profound effects on the motivation that drives people to learn an FL. It is likely that, in the near future, many potential language learners will decide not to learn an FL and instead rely on simultaneous machine translation applications to communicate with speakers of other languages. Over time, as more and more people begin to employ such technologies for interpersonal communication across languages, the number of people interested in attending FL schools and teacher development programs may begin to decline. Such a decline would severely impact FL schools, FL teachers, and the institutions that provide professional development opportunities to both teachers and administrators. The results could have a profound effect on each of these in turn. First, if a large percentage of potential language learners come to depend on technology as a means of communication, then FL teachers will face technological displacement as the schools that currently recruit and sell their services to these learners downsize in response to decreasing need. As the need for FL teachers decreases, fewer people will be drawn to degree and certificate programs that train such teachers. This decline in the need for FL teacher training will likely cause many degree granting institutions to either downsize faculty and staff or close completely. Certificate programs and private teacher development companies will face similar enrollment challenges. With fewer interested clients and few programs dedicated to the support and professional development of FL teachers, professional organizations (e.g., American Council for Teaching Foreign Languages, American Association of Applied Linguistics, Teaching English to Speakers of Other Languages) will also weaken as their core members seek employment and research opportunities in other fields. With fewer teacher educators, program administrators, materials developers, and researchers and less demand for research related to FL teaching, publishing houses will see a decline in audience and submissions. These declines may herald changes in the scientific and philosophical importance of the field and may even result, lamentably, in an existential crisis.

Of course, this is a narrow perspective. On a larger scale, the ability to universally communicate with people who speak a different language may bring about phenomenal changes in human society that bode well for humanity in general. Simultaneous machine translation may help break down culture barriers, provide opportunities to better understand the human condition across national and regional borders, and may have the potential to revolutionize many aspects of the human experience. It will likely bring great positive changes to society and the rewards of these changes may far outlive the inevitable (and potentially
difficult) period of readjustment that professionals in the field of FL teaching will face. From a theoretical perspective, it may bring greater scientific understanding to processes of language learning and language acquisition. Specifically, if a computer can master language acquisition, it may give us a better understanding of how languages are learned, coded, stored, and processed. This could bring about extraordinary changes in the scientific understanding of the process of language learning.

There are problematic linguistic concerns with respect to the potential changes that simultaneous machine translation will bring as well. For instance, it is likely that simultaneous machine translation will only hasten threats to minority languages, especially those that are not included in the menu of available languages served by machine translation systems. In this sense, simultaneous machine translation could increase the speed of language death and serve to secure the predominance of a few, select languages. In addition, it is possible that simultaneous machine translation could be a tool only available to the affluent, increasing economic disparity among social classes. Alternatively, models that offer high level accuracy in machine translation may have the opposite effect. They may allow for minority languages to be better catalogued and understood. The machines themselves may become more self-adaptive with time allowing them to simply adapt their learning mechanisms to these languages, quickly learning them and affording the opportunity for millions to keep these languages alive by using them to communicate with others. Simultaneous machine translation applications may also act as an economic leveler allowing all consumers to use language to a degree and scale unavailable currently to their advantage when pursuing commercial and social opportunities.

While much is unknown about the effect that machine translation will have on society as a whole, and on FL teaching specifically, there should be little doubt that it will radically transform many aspects of society, including language education. As a field, those involved in the professional development of FL teachers, those involved in researching FL acquisition, and those supporting both of these endeavors need to seriously consider the potential implications of this rapidly emerging technology and consider actions to be taken to best address coming changes. At minimum, this should include frank discussions about the potential for technological displacement for both FL teachers and the teacher development faculty and staff that train them. Part of their responsibilities will be to recognize and responsibly shepherd the field through related potential upheavals. Discussions need to be started, also, about how the field can not only adapt to technological changes but adopt these changes in both research and training so that technology enhances future discipline-specific developments. Discussion should also include not only adoption and adaption of language translation technology, but also how the field can help bring about potential changes in a humanistic manner that prevents major employment and language acquisition disruptions. Lastly, all those involved should discuss how the related fields of applied linguistics and FL teaching can inform coming changes, how they can assist related industries in managing these changes, and how they can remain relevant as the changes occur. While the motivation to learn an FL may decrease, there will still be millions of language learners and those language learners will still need well prepared and equipped teachers. It will be important to continue to transfer knowledge and resources to this population not only to remain relevant as a field, but also to remain an important component of language education.
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References


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