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Lingua Ex Machina **2.0**: The Theological Origins and Destinations of Machine Translation

1. Biblical narratives: The story of the "Tower of Babel" and "Pentacost"

The story of the "Tower of Babel" (Genesis 11:1–9) provides an account of the plurality of languages as issued from an original and apparently universal tongue. This mythic loss of an original, linguistic universality as well as subsequent attempts to reestablish it by overcoming the *confusio linguarum* by way of automatic translation techniques and technologies already constitute a kind of universal idiom. According to Umberto Eco (1995, 1), "the story of the confusion of tongues, and of the attempt to redeem its loss through the rediscovery or invention of a language common to all humanity, can be found in every culture." And it is the digital computer that provides the most recent iteration of this supposedly universal endeavor. This chapter investigates the Babelian legacy and logic circulating through the systems and networks of digital technology. It traces the origin and purpose of the desire for universal understandability, locates the digital computer within this tradition, and examines the underlying values and consequences of this undertaking.

1.1 Mythic origins of linguistic diversity: The Tower of Babel Story

In the Judeo/Christian tradition, the fact that different human communities speak different languages is something that is explained by way of a myth or legend incorporated in the first book of the Holy Scriptures. In Jewish traditions this is called the *Torah*; for Christians, it appears in the Old Testament of *The Bible*. The story is usually titled "The Tower of Babel," and it can be found in the book of *Genesis* 11:1–9.

> "Now the whole world had one language and a common speech. As people moved eastward, they found a plain in Shinar and settled there. They said to each other, 'Come, let's make bricks and bake them thoroughly.' They used brick instead of stone, and tar for mortar. Then they said, 'Come, let us build ourselves a city, with a tower that reaches to the heavens, so that we may make a name for ourselves; otherwise we will be scattered over the face of the whole earth.' But the Lord came down to see the city and the tower the people were building. The Lord said, 'If as

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> one people speaking the same language they have begun to do this, then nothing they plan to do will be impossible for them. Come, let us go down and confuse their language so they will not understand each other.' So the Lord scattered them from there over all the earth, and they stopped building the city. That is why it was called Babel—because there the Lord confused the language of the whole world. From there the Lord scattered them over the face of the whole earth."

"The Tower of Babel" story begins at a mythical point in time, when it is assumed that all of humanity lived in a single place on the planet and spoke one common language. Subsequent generations of scholars and religious teachers have argued that this "original language" was the "Adamic tongue" that had been bestowed on Adam and Eve (the first man and women) by Yahweh, or God. This single language was a powerful tool of communication, because (according to the story) it facilitated cooperation between different individuals, so much so that the entire human population of planet earth could agree to work together and construct a city and a massive tower that reached all the way into the heavens.

Upon seeing this impressive undertaking, God begins to get nervous. He worries that humanity might get too powerful, do all kinds of other impressive things, and that nothing would be impossible for them to achieve. In an effort to curb their ambitions, God puts an end to the building project by confusing the language. This linguistic confusion makes it virtually impossible for the human population to talk with one another and to complete work on the tower. As a result, they abandon the edifice, scatter over the face of the earth, and end up speaking different languages. This is why, as explained at the end of the story, the place where this occurred was called *Babel*, because it was here that God confused the original human language, creating the babble of different languages that we currently live with.

1.2 Task of translation

The Babel narrative, we should remember, is just that. It is a story. It is not a statement of anthropological fact. In fact, the origins (in the plural) of human language and its remarkable diversity are something that is studied and debated by linguists, anthropologists, neurobiologists, evolutionary biologists, behavioral scientists, etc. (cf. Christiansen and Kirby, 2003). But the mythic narrative is informative, because it provides a way to characterize the rationale, task, and objective of translation. Because of linguistic difference – the catastrophic damage that was supposedly inflicted at the Tower of Babel – humans speak different languages. Currently, it is estimated that

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there are somewhere in the range of 6,900–7,100 different languages in use worldwide. This difference often impedes communication and makes it difficult for a person who speaks one particular language to be understood by someone who speaks another. Translation is the process of remediating this difference by rendering into one language the meaning that is expressed by the words of another. The word "translation" literally means "carrying across," and pointing this out is itself an act of translation insofar as the word is initially of Latin origin and therefore needs to be translated into English.

The work of translation typically requires a human intermediary or "translator," some individual who is knowledgeable in at least two different languages and can therefore represent in the target language what had been said or written in the source language. But this is more difficult than it initially sounds, even for individuals who would call themselves bilingual. In English, for example, one can say something like "Makes no difference to me" in response to questions concerning a choice between two alternatives. If we wanted to convey this in Polish, the English sentence could be translated as "Nie ma dla mnie znaczenia." Although this is an accurate word-for-word rendering of the initial English statement, it is unlikely that a native Polish speaker would ever say such a thing. Instead, they might say, "Wszystko jedno," which literally means "Everything [is] one." In other words, the task of translation is not simply rendering the words of one language into the exact words of the other language. It involves more. It requires knowing the meaning and context of words in the source language in order to reproduce that same meaning (or at least a close approximation thereof) in the words of the target language.

1.3 The story of Pentecost as real-time translation

If the Old Testament of the Christian *Bible* narrates the origin and *raison d'etre* of translation between languages, the New Testament provides a clue concerning the ambitions and objectives of automatic, universal translation. This occurs during an event called "Pentecost," which is described in the second chapter of the *Acts of the Apostles*. After the crucifixion and death of their teacher, Jesus Christ, the Apostles hole up in a room in order to avoid suffering a similar fate. This changes when they receive the Holy Spirit, which is represented, both within the story and subsequent religious iconography, in the form of tongues of fire that descend from heaven. After receiving the gift of the spirit, the Apostles leave their stronghold and began

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proselytizing in the streets. As they speak in their native language, everyone hears their words in his/her own language: "And the people were amazed and marveled saying: 'Are not all these men who are speaking Galileans? How is it that each of us hears them in our own language to which we were born?'" (Acts 2:7–8). The story of Pentecost, therefore, narrates the alleviation of Babelian confusion through automatic, real-time translation. In this way, Pentecost promises to reestablish universal understanding between humans despite the problem of linguistic difference that was imposed at Babel. In other words, Pentecost repairs and remediates the babble of Babel.

2. Science Fiction and its technical devices for translation

The promise of automatic, real-time translation is not just a part of our religious traditions. We also see versions of it in the techno-myths of science fiction. Consider, for example, a device called (not surprisingly) the "Babel fish." According to *The Hitchhiker's Guide to the Galaxy* – a title that names both a novel by Douglas Adams and an encyclopedic reference book cited within that novel:

> "The Babel fish is small, yellow, leech-like and probably the oddest thing in the universe. It feeds on brain wave energy, absorbing all unconscious frequencies and then excreting telepathically a matrix formed from the conscious frequencies and nerve signals picked up from the speech centers of the brain, the practical upshot of which is that if you stick one in your ear, you can instantly understand anything said to you in any form of language." (Adams 1979, 59–60)

The Babel fish, therefore, reproduces the miracle of Pentecost for its host by providing automatic and real-time translations from and into any and all languages.

A similar device, called the Universal Translator, is part of the standard equipment of Star Fleet in the science-fiction television and film franchise *Star Trek*. According to the *Star Trek Encyclopedia*, the Universal Translator is a "device used to provide real-time two-way translation of spoken languages" (Okuda et al. 1994, 361). In the original series, which made its debut in the mid-1960's, the Universal Translator was a hand-held device about the size of a flashlight (a graphic representation can be found in Franz Joseph's *Star Fleet Technical Manual*, 1975, T0:03:02:04), and the device makes its initially and only appearance as a prop in the episode *Metamorphosis* (1967). In the sequel, *Star Trek: The Next Generation* (as well as its numerous spin-offs, *Deep Space Nine*, *Voyager, Enterprise, Discovery,* etc.), the Universal Translator is incorporated as an application residing in the

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ship's main computer. According to the *Star Trek Next Generation Technical Manual*, "the Universal Translator is an extremely sophisticated computer program that is designed to first analyze the patterns of an unknown form of communication, then to derive a translation matrix to permit real-time verbal or data exchanges" (Sternbach and Okuda 1991, 101).

Though the Babel Fish and Universal Translator are the product of science fiction, these imaginative technologies supply researchers and developers with accessible examples that can and have been used to explain the efforts and objectives of machine translation for a non-technical audience. "The basic idea of machine translation (MT)," as Vanessa Enríquez Raído and Frank Austermühl describe (2003, 246), "is that of Star Trek's universal translator or a mechanized version of Douglas Adam's Babel Fish —a black box that converts the source language input into a (perfect) target language output without any human interaction."

3. Machine translation before computers

Efforts to overcome linguistic diversity and solve the translation problem by way of technology pre-date the invention of the electronic digital computer. Seventeenth century Europe, in particular, saw the development of a number of techniques and technologies designed to addressing this issue by way of developing an artificial universal idiom. In 1657, for example, Cave Beck, an English schoolmaster and clergyman, proposed something he called a "Universal Character" in a book that had the following rather cumbersome (but descriptive) title: *The Universal Character, by which all Nations in the World may understand one another's Conceptions, Reading out of one Common Writing their own Mother Tongues.* What Beck proposed is something that linguists call *pasigraphy*, from the Greek words "pas," meaning "all," and "grapho," meaning "to write." Beck's pasigraphy was digital. It used Arabic numbers as its symbol system, every word was assigned a unique number, and this number was the same across different languages.

A similar project, titled *The Groundwork or Foundation Laid (or So Intended) for the Framing of a New Perfect Language and a Universal Common Writing*, was published by Francis Lodwick in 1663. This project not only proposed a universal language to which everyone would have equal access but also sought to create a perfected system of communication that would be, as Umberto Eco (1995, 73) describes it, "capable of mirroring the true nature of objects." Similar systems were introduced by Athenasius Kirchner in the *Polygraphia nova et universalis ex combinatoria arte detecta*

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(1663), the *Via lucis* (1668) of Comenius, George Dalgarno's *Ars Signorium* (1661), and John Wilkins' *An Essay Toward a Real Character, and a Philosophical Language* (1668).

But the seventeenth century European innovator who gets most, if not all, the attention in this area is Gottfried Wilhelm Leibniz. This privileged position was codified by Norbert Wiener in the introduction to the text that originated the science of cybernetics. "If I were to choose a patron saint for cybernetics out of the history of science, I should have to choose Leibniz. The philosophy of Leibniz centers about two closely related concepts – that of a universal symbolism and that of a calculus of reasoning" (Wiener 1996, 12). The importance of and connection between these two concepts was summarized in a 1679 missive that Leibniz wrote and sent to the Duke of Hannover.

> "For my invention uses reason in its entirety and is, in addition, a judge of controversies, an interpreter of notions, a balance of probabilities, a compass which will guide us over the ocean of experiences, an inventory of all things, a table of thoughts, a microscope for scrutinizing present things, a telescope for predicting distant things, a general calculus, an innocent magic, a non-chimerical Kabal, a script which all will read in their own language; and even a language which one will be able to learn in a few weeks, and which will soon be accepted amidst the world (Leibniz quoted in Eco 1995, xii)."

Leibniz's proposed invention would accomplish two very important objectives: It would provide a thoroughly rational protocol whereby all debate and controversy in philosophy, science, and mathematics would be resolved through simple calculation, and it would establish a universal character or system of writing that would transcend linguistic differences and overcome the babble of Babel.

None of these grand plans for a pasigraphy or universal artificial language common to all of humanity ever succeeded. But what these failed attempts illustrate are several important assumptions or basic principles that come to inform and influence subsequent efforts in machine translation.

a. Technological Fix. If the problem that is confronted by the effort of translation is the incompatibility of different natural languages, then the solution is assumed to be an artifact or technology that can respond to and alleviate this perceived problem. The pasigraphy of Beck or the *characteristica universalis* proposed by Leibniz are all technological innovations designed to remediate the communications problem that is imposed by linguistic diversity. The idea that there is a "technological fix" for a social/cultural problem is something that is part and parcel of a theory of technology called "technological determinism" (Smith and Marx 1994).

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b. Language is computable. Linguistic data (i. e. words, sentences, and their meanings) can be encoded in mathematical symbols and processed automatically. Beck's pasigraphy encoded language using the 10 ordinal numbers (e. g. 0–9) and Leibniz's invention sought to resolve important debates in human knowledge by encoding data in numeric form and solving disputes not through argumentation but by simple, mechanical calculation. As Leibniz had famously claimed: "If this were done, whenever controversies arise, there will be no more need for arguing among two philosophers than among two mathematicians. For it will suffice to take the pen into the hand and to sit down by the abacus and say to each other (and if they wish also a friend called for help): Let us calculate" (quoted in Russell 1992, 200). This idea is connected to the *computational theory of mind*, the hypothesis that what constitutes human thinking and intelligence is just computation or number crunching. And this way of thinking, which is an essential aspect of artificial intelligence (AI) insofar as the task of AI to reproduce in a computational mechanism the capabilities of human intelligence, is something that is also attributed to Leibniz.

c. Universal Language. Linguistic difference – or, the incompatibility between different natural languages – can be overcome once and for all by encoding language in an artificial idiom that is universal and shared by all of humanity. Unlike medieval efforts to rediscover the original, pre-Babelian Adamic language used by Adam and Eve – and there were some rather interesting and also disturbing efforts to do just that (see Eco 1995) – these modern efforts to develop a Universal Character proposed an artificial language that would repair the babble of Babel through the application of scientific/mathematical principles.

4. The Weaver memorandum of 1949

The notion of applying electronic computers to the task of translation was something initially formulated and presented in a memorandum written by Warren Weaver in 1949. For this reason, Weaver is often credited as "the father of machine translation." During the Second World War, Weaver was head of the Applied Mathematics Panel at the U. S. Office of Scientific Research and Development. In this capacity, he had the opportunity to experience the application of electronic calculating machines – what we now call "computers" – to the task of *cryptography*, the coding and decoding of secret messages. One of the technologies that gave the Nazis a considerable advantage in the conduct of wartime operations was the Enigma

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machine – a sophisticated cryptography instrument, looking something like a rather hefty typewriter, that rendered messages issued by the German high command virtually unreadable when intercepted during transmission. The allies applied an impressive effort to decoding the Enigma code. This had been the wartime occupation of Alan Turing at Bletchley Park in the United Kingdom (dramatically presented in the 2015 film *The Imitation Game*), and the work of the Applied Mathematics Panel that Weaver oversaw in the US.

In 1949, Weaver, who had by that time returned to his pre-WWII position at the Rockefeller Foundation, wrote a brief memorandum in which he proposed that translation between languages might be a special instance of cryptography and therefore solvable using the same tools that had been developed during the war. In fact, Weaver's "Translation," as the memorandum has been called, introduced a number of important concepts that taken together frame the opportunity and challenge of machine translation.

a. Linguistic Difference is a Problem. Right at the beginning of the memorandum, Weaver operationalized an idea that proceeds directly from the "Tower of Babel" story, even if he does not mention it by name. He begins the memo by recognizing the "fact" that linguistic difference is a significant problem, impeding human communication and international cooperation: "There is no need to do more than mention the obvious fact that a multiplicity of language impedes cultural interchange between the peoples of the earth, and is a serious deterrent to international understanding" (Weaver 1949, 1). So right at the beginning, in the first line of the memorandum, Weaver affirms and mobilize the basic "problem space" that is described in the "Tower of Babel" story – confusion between different human languages is a barrier to intercultural exchange and a serious impediment to international understanding and cooperation.

b. Technological Fix. Like Beck, Leibniz and others, Weaver assumes that there must be a technological solution to this problem. In Weaver's case, that solution comes in the form of the new electronic technology of the digital computer: "The present memorandum, assuming the validity and importance of this fact, contains some comments and suggestions bearing on the possibility of contributing at least something to the solution of the world-wide translation problem through the use of electronic computers of great capacity, flexibility, and speed" (Weaver 1949, 1). There are two things to note here. First, Weaver hedges against his proposal failing by recognizing that one first has to agree to the validity of the assumption that linguistic difference is, in fact, a problem to be solved. Although this might

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appear to be a mere rhetorical gesture, we will eventually see how this was a prescient insight and comment. Second, Weaver is entirely realistic about the importance of his work. He does not claim to solve everything once and for all; he simply offers the memorandum as a modest contribution in the direction of an eventual solution. He is, in other words, content to get things started by planting the seeds or the initial ideas of/for machine translation.

c. Translation = Cryptography. Based on his wartime experience, Weaver had surmised that linguistic difference and the task of translation could be addressed in terms roughly equivalent to that of cryptography. As he recounts in the memorandum, this idea was first developed and presented to Norbert Wiener in a letter from 4 March 1947: "One naturally wonders if the problem of translation could conceivably be treated as a problem in cryptography. When I look at an article in Russian, I say 'This is really written in English, but it has been coded in some strange symbols. I will now proceed to decode'" (quoted in Poibeau 2017, 53). Whether Weaver's hypothesis (i. e. translation is a variant of cryptanalysis) is factually accurate or not is something that is still open to debate. What is not in question, however, is the idea of applying the experiences and tools of cryptography to process natural language. Consequently, this sentence, and the memorandum in total, initiated what would become machine translation (MT) and, more generally speaking, natural language processing (NLP).

d. Universal Language. The memo was intended to be a short "think piece" and not a technical paper. So there is very little in Weaver's text that would be considered an actual methodology or approach. Despite this, Weaver does engage in some theorizing about basic procedures and his theory mobilizes both Babelian imagery and the concept of universal language developed by seventeenth century European philosophers and mathematicians, like Leibniz.

> "Think, by analogy, of individuals living in a series of tall closed towers, all erected over a common foundation. When they try to communicate with one another, they shout back and forth, each from his own closed tower. It is difficult to make the sound penetrate even the nearest towers, and communication proceeds very poorly indeed. But, when an individual goes down his tower, he finds himself in a great open basement, common to all the towers. Here he establishes easy and useful communication with the persons who have also descended from their towers. Thus may it be true that the way to translate...is not to attempt the direct route, shouting from tower to tower. Perhaps the way is to descend, from each language, down to the common base of human communication—the real but as yet undiscovered universal language …." (Weaver 1949, 11)

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Weaver's remix of the "Tower of Babel" story concerns not a single tower and the origin of linguistic diversity but a series of different towers and the problem of translation. He tells of a multiplicity of individual towers that indicate the isolation and incompatibility of each language. Translation therefore typically proceeds by trying to make one language understandable in terms of another – a difficult process that can be illustrated, as Weaver explains, by shouting from the top of one tower to another.

This problem can, Weaver continues, be circumvented by descending the individual towers to the common foundation or basement that underlies linguistic differences. The idea is simple. Instead of trying to translate from language to language – shouting from the top of one tower to another tower – one might make better progress in translation by way of "descending" to a more fundamental and universal representation that underlies particular linguistic differences. "Thus may it be true," Weaver (1949, 11) explains, "that the way to translate from Chinese to Arabic, or from Russian to Portuguese, is not to attempt the direct route, shouting from tower to tower. Perhaps the way is to descend, from each language, down to the common base of human communication—the real but as yet undiscovered universal language—and then re-emerge by whatever particular route is convenient."

The influence of Weaver's memorandum cannot be underestimated. The idea of overcoming and putting an end to the problem of linguistic difference – or, fixing the babble of Babel – by way of applying computer technology to the problem of translation definitely had traction. As a result, Weaver's memo along with his access to lucrative funding sources in the US Federal government, launched a concerted effort in machine translation that has, since that time, gone through a number of different technical phases or iterations. The effort begins with simple rule-based systems, extending from direct translation methods suitable for dealing with pair of languages to the use of interlinguas for expanded capabilities across multiple languages; progresses through example-based and statistical MT, which provide for better phrase- and sentence-level transfers; and currently employs sequence-to-sequence recurrent neural networks (RNN) trained on large sets of linguistic data (see Poibeau 2017; Gunkel 2020). Although MT technology has, at times, developed in fits and starts, current systems, like Google translate, are able to provide users with reasonable translations into and out of over 100 different human languages.

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5. Back to Babel or rethinking linguistic diversity after machine translation

Given recent technological progress with digital computers, one might ask whether we have finally achieved the means to repair and overcome, once and for all, the damage that had been experience at the Tower of Babel? Does MT represent a technologically enabled version of the miracle of Pentecost, where no matter who is speaking and in what language, we can all understand what is being said in the language to which we were born? Was Warren Weaver's prediction from 1949 correct and accurate? Have we, in fact, devised a workable solution to the world-wide translation problem through the use of electronic computers of great capacity, flexibility, and speed? Or to formulate it in way that matters for university students, does MT make the foreign language requirement obsolete? Interestingly the answer to all these questions must be both "yes" and "no." It all depends on how we understand language and linguistic difference.

If language is understood as little more than a means of interpersonal communication, and if linguistic difference – or if you like, the diversity of languages that was the unfortunate legacy of the Tower of Babel – is understood as an obstacle to human communication and cooperation, then MT seems to promise a solution that is on par with or at least very close to achieving what was experienced at Pentecost and has been imagined in science fiction with *Star Trek*'s Universal Translator or the Babel Fish from the *Hitchhiker's Guide*. One can, right now, travel the world and, by way of a smart phone app, simply point the phone's camera at some text, i. e. a sign or restaurant menu, and have Google Translate immediately render the unfamiliar words and phrases in one's native language. And by employing some augmented reality (AR) visualization techniques, the scene that is displayed on the phone's screen can look exactly like the world outside with one exception, the text is rendered in another language selected and understood by the user.

Similarly, by using Microsoft's Skype Translator, one can seamlessly interact with another individual, who speaks an entirely different language, in real-time over the Internet. In other words, a person in Australia who only speaks English can have an intelligible conversation with someone in Germany who only speaks Deutsch. The application renders spoken English into understandable German and vice versa, thus mediating the linguistic difference between the two participants. The application "can currently translate conversations in 10 languages, including English, Spanish, French, German, Chinese (Mandarin), Italian, Portuguese (Brazilian),

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Arabic, and Russian" (Microsoft 2020). And its capabilities are planned to be expanded in order to encompass a wider variety of languages in the not-too-distant future. Consequently, and looked at from this vantage point, it appears that these MT applications and tools do in fact remediate the babble of Babel and call for an end to or at least a significant re-evaluation of the need to learn other languages.

But not so fast. There may be more to it. Language is not just the exchange of information, it is also an expression and carrier of culture. In other words, languages are not just different ways of encoding thought, as Weaver had assumed in his "Translation" memo. They are also the means of thought such that different languages make available different ways of thinking about and engaging with the world. This alternative viewpoint is something that is rooted in the Sapir-Whorf hypothesis (named for two linguists who independently developed slightly different versions of it, Edward Sapir [1949] and Benjamin Lee Whorf [1956])—the idea that language determines (or at least strongly influences) thought and that linguistic elements can limit and shape cognitive categories. A similar idea was put forward in the work of the philosopher Ludwig Wittgenstein (1981, 5.6) who famously argued that "*the limits of my language* mean the limits of my world." The proverbial, albeit disputed, illustration of this insight (something initially reported by the anthropologist Franz Boas and repeated with considerable regularity in both the academic and popular literature) is that the Inuit language of the Arctic contains many different names for what we, in English, call "snow," each one identifying a different aspect of the phenomenon not necessarily accessible to or able to be captured by the others (Steckley 2008).

Considered from this perspective, the linguistic diversity that had (supposedly) been instituted at Babel might not be a catastrophic loss of communicative ability; it could be a considerable advantage and gain. Here is how George Steiner (1975, 233) explains it in his book-length examination of translation titled *After Babel*:

> "The ripened humanity of language, its indispensable conservative and creative force live in the extraordinary diversity of actual tongues, in the bewildering profusion and eccentricity (though there is no center) of their modes. The psychic need for particularity, for "in-clusion" and invention is so intense that it has, during the whole of man's [SIC] history until very lately, outweighed the spectacular, obvious material advantages of mutual comprehension and linguistic unity. In that sense, the Babel myth is once again a case of symbolic inversion: [hu]mankind was not destroyed but on the contrary kept vital and creative by being scattered among tongues."

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Steiner's reading suggests an inversion of the traditional interpretation of the Babelian narrative. He argues that the so-called "catastrophe" of Babel, namely the confusion instituted by the multiplicity of languages that had divided humanity, does not constitute a kind of damage to be repaired but is instead a substantial advantage. At Babel, humankind was not destroyed by confusion but was "kept vital and creative" through linguistic diversification. Like biodiversity, Steiner argues, linguistic diversity is a feature and not a bug. It has ensured human ingenuity and survival.

If we look at language from this perspective, then the learning of more than one language and the task of translating between different languages is not just about efficient and effective communication. It involves learning about, experiencing, and living-in a particular way of seeing, conceptualizing, and engaging the world. What is interesting and important about MT, therefore, is that it may alleviate language learning of the assumption and burden of mere communication, opening up opportunities to see other ways to think about and work with languages. So instead of repairing linguistic difference and putting an end to the need to be proficient in more than one language, it is more likely that MT will have the effect of recontextualizing and reformulating – a process Jay David Bolter and Richard Grusin (1999) called "remediation" – the *raison d'etre* for learning languages in the first place.

Consequently, automatic translation by way of digital computer is not the end of the task of translation; instead MT fundamentally resituates and reformulates how we think about translation and the diversity of languages. As Jacques Derrida wrote in "Des Tours de Babel" (1985), an essay about translation that was published in translation: "The 'tower of Babel' does not figure merely the irreducible multiplicity of tongues; it exhibits an incompletion, the impossibility of finishing, of totalizing, of saturating of completing something on the order of edification, architectural construction, system and architectonics" (Derrida 1985a, 165). According to this re-interpretation, linguistic variation is not a mere empirical problem to be overcome by the application of technology or the rediscovery of some universal idiom. It is a fundamental difference that renders the task of translation an interminable undertaking that is both necessary and impossible to finish.

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