Uniform multilingualism: A media genealogy of Google Translate

Ido Ramati and Amit Pinchevski

The Hebrew University of Jerusalem, Israel

New Media & Society DOI: 10.1177/1461444817726951

Abstract

This article applies a media geneaology perspective to examine the operative logic of Google Translate. Tracing machine translation from post–World War II (WWII) rule-based methods to contemporary algorithmic statistical methods, we analyze the underlying power structure of algorithmic and human collaboration that Translate encompasses. Focusing on the relationship between technology, language, and speakers, we argue that the operative logic of Translate represents a new model of translation, which we call uniform multilingualism. In this model, the manifest lingual plurality on the user side is mediated by lingual uniformity on the system side in the form of an English language algorithm, which has recently given way to an artificial neural network interlingual algorithm. We conclude by considering the significance of this recent shift in Translate's algorithm. .

Keywords

Actor–Network Theory, algorithmic culture, Google Translate, media genealogy, neoliberalism, participatory culture, translation

Introduction

On the 10th anniversary of Google Translate, a blog entry by the Translate team summarized their achievements: "Our goal was to break language barriers and to make the world more accessible. Since then we've grown from supporting two languages to 103, and from hundreds of users to hundreds of millions" (Google, 2016). The significance of this growth, according to Google, goes beyond the numbers, for Translate "connects people in communities around the world" allowing them to "help each other often in the most difficult of times." Translate also "reflects current trends and events" (2015 saw a spike in translations for the word "selfie"). But perhaps most importantly, with Translate "you can see the world in your language"; it is "your friend when reading menus, street signs, and more" (Google, 2016). It seems that Translate's greatest achievement is making the act of translation itself invisible. Like Douglas Adams' science fiction creature the "Babel Fish," Google promises speakers of local languages the possibility of becoming universal native speakers, able to use their own language in any foreign language situation. Translate is therefore part of Google's broader goal "to organize the world's information and make it universally accessible and useful" (Google, 2017), and as such calls for examination of what such desired universalism through translation actually means.

Both popular and scholarly literature associates Google with global trends of digital culture (e.g. Battelle, 2005; Levy, 2011). As the main entry point into the online data universe, Google is a key player in organizing and structuring knowledge (Peters, 2015). Positioned at the switchboard of the global flow of information, it plays a major role in the entangled relations between global and local orientations (e.g. Segev, 2010; Vaidhyanathan, 2011). This makes Translate particularly important in this context, given that translation is a form of transmitting information from one language to another, and as such is a clear instantiation of the tension between the global and the local (Liu, 1999; Sigismondi, 2016). Any examination of Google Translate should therefore engage critically with how the function of translation fits within Google's ideology of information flow and global connectivity (Vaidhyanathan, 2011).

This article examines the operative logic of Translate and the way it serves Google's version of global communication. By operative logic we mean the methods it employs, the conventions it assumes, and the practices it generates, through its designated translation algorithm. Focusing on the relationship between technology, language, and speakers, we argue that the operative logic of Translate represents a new model of translation, which we call uniform multilingualism. In this model, the manifest lingual plurality on the user side is mediated by lingual uniformity on the system side in the form of an English language algorithm, which has recently given way to an artificial neural network interlingual algorithm. Translate is based on a method called Statistical Machine Translation, which has dominated the field of machine translation since the late 1980s (Somers, 2011). In this method, the algorithm draws on a corpus of existing human-made translations in order to evaluate the probability of a new translation. The operative logic of Translate, we argue, reveals a particular set of historical determinations that are consistent with Google's investment in human–machine interaction.

In this study we subscribe to a genealogical approach to media. Following Monea and Packer (2016), we seek to investigate how media technologies serve "as tools of governance that shape knowledge and produce and sustain power relations while simultaneously forming their attendant subjects" (p. 3152). As a methodology for examining the historical developments that eventually led to the present, media genealogy uncovers the "play of power from which historical moments emerge" (Monea and Packer, 2016: 3152); it examines the power structure embedded in a technology and its transformations over time, and analyzes the discursive forces and the political dimensions that produce media as epistemological machines. Media genealogy can be compared and contrasted to another recent approach, that of media archeology. Both approaches emphasize the materiality of media, especially given the common "tendency to view informational technologies and processes in disembodied and immaterial terms" (Goddard, 2015: 2), and both stem from Foucault's work but reflect two distinct trajectories within it. Media archeology, to quote Wolfgang Ernst (2013), views media "as governing the range of what can be verbally, audiovisually, or alphanumerically expressed at all," and in so doing proposes an alternative epistemology "to the supremacy of media-historical narratives" (p. 55). It considers historical changes as ruptures, rather than processes, and excavates the technological shaping of society in discrete time layers (Parikka, 2011).

Media genealogy, in contrast, puts an emphasis on continuity and interconnections between historical periods, drawing attention to mutual influences of society and media technologies. Whereas a media archeology of Translate would follow the technological shaping of computer-mediated interlingual connections, a media genealogy, such as we propose here, goes further to consider the underlying power structure of this online translation service in terms of both the social and technological forces that partake in its making. Monea and Packer follow Koopman (2013) regarding Foucault's notion of problematization as central to the genealogical approach. What this approach calls into question, then, is how "problems emerge when a field of action, behavior, or practice becomes uncertain and unfamiliar" as a result of pre- or interdiscursive forces (Monea and Packer, 2016: 3145). Insofar as the genealogy of Translate is concerned, this means concretely investigating how translation itself has come to be subjected to such problematization through the introduction of computer technology against the background of specific social and historical conditions.

Like other technologies that developed as part of the war effort (Kittler, 1999), Machine Translation emerged in the context of the Cold War. It thus provides a concrete instantiation of what Galison (1994) has called the "ontology of the enemy" insofar as formalizing translation as a tool to render the alien understandable and ultimately defeatable. In what follows, we trace the process by which Translate refashions the objective of computational translation from enemy to peer and from warfare to cosmopolitanism. A key feature in Google's translation service is the incorporation of human input into algorithmic procedures, which to a certain extent aligns Translate with the tenets of user-generated content and participatory culture (Jenkins, 2006). Yet Translate's human–machine collaborative, networked enterprise conceals a latent linguistic imperialism in the form of English-based translation algorithm operating below the user level. Recently, Google announced the phasing out of English as pivot language and the employment of artificial neural network translation instead. The media genealogy developed below provides basis from which to examine this recent shift in Translate's operative logic.

Babylonian prelude

Translation is a perennial question of human communication with the Biblical story of the Tower of Babel serving as its founding myth. It depicts the creation of the world's languages, and the subsequent need for translation, as a punishment for human hubris and as a fall from the original utopian state of monolingualism. Translation has traditionally been conceived as a possible cure to the curse of Babel insofar as allowing for the transfer of knowledge from one lingual and cultural context to another (Bassnett, 2014; Venuti, 1995). Hence translation is always a liminal operation, both bridging between languages and at the same time revealing their unbridgeable incongruity (Bhabha, 1994; Krämer, 2015; Venuti, 1998). Translation proceeds as an engagement with otherness and with the impossibility of complete and full translation (Pinchevski, 2005). In this respect, translation negotiates between incorporating the foreign into the familiar, and respecting as well as maintaining the difference between the foreign and the familiar. As a form of linguistic contact with the "other," translation affirms multiplicity and cultural diversity (Benjamin, 2012 [1923]; Spivak, 1993).

A modern strategy for reversing the curse of Babel was the creation of a universal language (Steiner, 1975). Projects like Esperanto or Basic English aimed to overcome the partiality of translation by constructing a functional universal lingo, which inevitably entailed the eradication of cultural differences. From this perspective, Babel can be read as a tale of linguistic imperialism (Derrida, 1991), and the technological achievement of the Tower parallels and symbolizes lingual unification, assimilation, and domination. Universal connectivity through monolingualism aspires to subsume intercultural differences and reduce otherness to sameness.

With the emergence of automatic translation, computer technology was introduced as a new factor in the longstanding relation between translation and otherness, suggesting a mechanical rather than linguistic means for reversing Babel. Conceived during the post–World War II (WWII) era, it reflected a dualism of hostility and peace promoting: on the one hand, it was launched as a tool for translating the enemy's language for intelligence purposes, but soon it was also described as fostering universal connectivity; imagined as a mechanized translator from any language to any language, it held the promise of international communication, understanding, and peace. However, like the Tower of Babel and the modern universal languages that aspired to monolingualism, the idea of a universal automatic translator similarly encompassed a tension between uniformity and differences, between understanding the other and dominating the other. Through its evolution in later years, machine translation continued to embrace this duality, and gradually incorporated variability and delegation into its automatic processes, resulting in a contemporary multifaceted mechanism which advances the interdependence of plurality and unification. The current mode of machine translation therefore suggests new circumstances for translation, stemming from the longstanding challenges associated with translation and at the same time redefining them.

From cryptography to rule-based translation

There are two basic approaches to machine translation: Rule-based Machine Translation, which consists of teaching computers grammatical rules, and Statistical Machine Translation, which is based on the statistical examination of previously human-translated texts (as mentioned above). In the late 1980s, the field shifted its dominant model from Rule-based to Statistical Machine Translation, and saw immediate improvement on the practical level in terms of accuracy and speed (Somers, 2011). After the expansion of Internet use, the move to statistical methods fostered the emergence of web-based translating algorithms, like that of Translate. While the division between these two models of machine translation is commonplace, they are not entirely dichotomous: the statistical method relies on knowledge gained from decades of using rule-based methods, and current translating algorithms are closely tied to theoretical concepts developed in the early days of the field (Mitchell, 2010). The genealogical perspective applied here allows exploring both differences and continuities while tracing the underlying power structures of each.

The founding document of the field of machine translation is a memorandum written by Warren Weaver in 1949. As the director of the Division of Natural Sciences at the Rockefeller Foundation, Weaver was involved in various projects, most famous of which was his collaboration with Claude Shannon in establishing the mathematical theory of communication (Shannon and Weaver, 1949; Hayles, 1999). Such research projects, and the role cryptography played in WWII, directly influenced his memorandum (Liu, 2010; Weaver, 1955b: 17). The memorandum suggests two main principles: (a) a cryptographic approach to language, namely, understanding it as a code and (b) the idea of a universal language consisting of fundamental common structural units across languages. For Weaver, cryptography meant seeing language as "frequencies of letters, letter combinations, intervals between letters and letter combinations, letter patterns, etc. *which are to some significant degree independent of the language used*" (Weaver, 1955b: 16, original italics). Cryptographic investigation of language promised going "so deeply into the structure of languages as to come down to the level where they exhibit common traits" (Weaver, 1955b: 23). Weaver (1955b) had previously conveyed the idea of language as a code in a letter he wrote to Norbert Wiener in 1947: "When I look at an article in Russian, I say: 'this is really written in English, but it has some strange symbols. I will proceed to decode'." (p. 18). This quote has since been widely cited and criticized for its patronizing predisposition (e.g. Raley, 2003), but it is nevertheless suggestive of Weaver's agenda of discovering the common ground among manifestly foreign languages, and in this way getting closer to universal communicability.

In concluding the memorandum, Weaver (1955b) explains the connections between cryptography and universal communication by an allegorical allusion to Babel:

> Think [...] 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 towers. Here, he establishes easy and useful communication with the persons who have also descended from their towers. (p. 23)

Weaver's (1955b) allegory suggests the mathematization of languages as a way to reach a universal common ground. Extricating a mathematical logic would allow numerical-based computers to work with humans' natural languages, and getting "down to the common base of human communication—the real but yet undiscovered universal language" (p. 23). Revisiting this idea in the field's first collection of essays in 1955, Weaver suggests seeing machine translation as a "Tower of Anti-Babel." While this new tower is not intended to reach to the sky, it does hark back to "that mythical situation of simplicity and power when men could communicate freely together" (Weaver, 1955a: vii). Weaver's Anti-Babel promises reversing the old curse of translation through mechanical means, but as was the case with the mythical Babel, this inverted model similarly entails eradication of divergence in favor of "simplicity and power."

The impulse toward uniformity within universality is also articulated in Weaver's reference to Russian in his letter to Wiener: seeing Russian as English in disguise is a commitment to seeing the familiar within the foreign, thereby providing the means for rendering the language of the other as "our" language. This version of universality is also present in Weaver's involvement in establishing international research collaborations, which he deemed as a "world-wide fraternity of scientists" which might advocate for world peace. However, as the Cold War became a geopolitical reality, executive officers at the Rockefeller Foundation sought to make this vision "a pro-American and anti-Soviet mold" (Geoghegan, 2011: 109). Machine translation projects were increasingly supported by government, military, and intelligence agencies, which collectively saw them as a part of the race for scientific superiority between the United States and the USSR (Gordin, 2015). The first public demonstration of machine translation from Russian to English in 1954 drew the attention not only of government power brokers, but also of the Soviets, who immediately initiated their own machine translation projects (Hutchins, 2000).

Weaver's memorandum inspired research into machine translation solely devoted to formulating and programming grammatical rules that would be general enough to accommodate many languages (Hutchins, 1986). In practice, however, these efforts resulted in computerized translations of paired languages, especially of Russian and English, which operated according to set of basic linguistic rules and utilized vocabularies from bilingual dictionaries (Locke and Booth, 1955). Computers were programmed to recognize and analyze clauses in the source language and produce corresponding renderings in the target language. This procedure demanded simplifying the original text as well as eliminating ambiguous and complicated phrases prior to processing. In addition, researchers also began editing the output text by grammatically adjusting it to the target language: a human editor modified the words translated by the computer into correct grammatical forms and rearranged them into proper syntactic order. During the rule-based era, computers were not conceived as replacements for human translators but as tools to accelerate the translation process, and humans acted as guardians of machine translation, monitoring both input and output linguistic strings.

While research into machine translation proliferated, some were more skeptical about its prospects. Yehoshua Bar-Hillel, the first to be appointed as a researcher of machine translation at the Research Laboratory of Electronics at MIT in 1951, gradually realized that full automatic translation would not be achievable in the foreseeable future, both due to the lack of computer power and also because linguistic theories at the time were not up to the task (Bar-Hillel, 1951; Hutchins, 2001). Insisting that quality translations depended on "the machine's ability to understand the text on which it operates," Bar-Hillel (1970) suggested the problem lay in the lack of a "semantic organ" that would rely on "knowledge about the world" (p. 308). Since at the time there was no programmable solution to the problem, Bar-Hillel anticipated that automatic translation would soon reach its limits (Nirenburg, 1995). As the 1960s progressed, syntactic and semantic problems became increasingly obvious and the quality of translations failed to improve, consequently bringing more researchers to share Bar-Hillel's pessimism. In 1966, following a negative evaluation report by the National Science Foundation, US officials decided to cut support for machine translation research, thus effectively shutting down the enterprise for almost 20 years. During that time, research in automatic translation was limited mostly to bilingual countries like Canada (Hutchins, 2001). It was only in the late 1980s that the field was revitalized with new methods and motivations.

Probability-based translation and web-based developments

First proposed in 1981 by Makato Nagao of Kyoto University, statistical methods are based on the assumption that translation involves recalling equivalent examples from existing translations. Inspired by statistical methods in the neighboring field of speech recognition, researchers at IBM further developed this idea: in continuance with Weaver's statistical approach to translation, they suggested that computers could "learn" how to translate based on scanning and analyzing a large amount of previously translated texts instead of the "employment of conventional grammars" (Brown et al., 1988). Following successful experiments with statistical methods, Fredrick Jelinek, leader of an IBM research group, reportedly stated that whenever he fired a linguist, the system's performance improved (Jurafsky and Martin, 2008: 83). His provocation exemplifies the shift in the logic of computerized translation from teaching computers human grammar to applying statistics to human languages. This shift could not have taken place without a massive increase in computer power, which enabled the utilizing of corpora of parallel texts, especially official transcripts and proceedings of multilingual organizations such as the Canadian and the European Parliaments.

With statistical methods proving to be faster, cheaper, and more accurate, the field of machine translation underwent a full-scale paradigm shift. Yet, it was the expansion of the Internet that made this shift into an irreversible reality, by providing access to unprecedented numbers of parallel texts online. Statistical software developed in the 1990s started sprawling into the online realm, seeking more texts in more languages. When Google Translate was launched in 2006, it began utilizing texts like United Nations documents, international treaties, and multilingual corporate websites, all of which were accessible through its various services: in the words of Translate's first architect Franz Josef Och, its algorithms started mining "everything that's out there" (Och, 2010). As stated in a Google research blog, Google employs the "largest corpus of bilingual and monolingual text ever assembled," and relies on "the world's largest computing clusters" and on a "user base of hundreds of millions of people" (Norvig, 2006). Data collected from other Google tools, such as Books and Ngram, are a source for analysis of English as a natural language (Goldberg, 2013; however, Translate apparently avoids relying on metadata as explained in Uszkoreit et al., 2010). While other systems also have sufficient infrastructures, Google's dominance in online services attracts its users to continue from one platform to another, making Translate the most popular machine translation application. As we note shortly, users have an important role in the web-based translation process as they evaluate and correct the translations provided by the algorithm.

By allowing computers to "understand the text" through probability, the shift from rule-based to statistical methods meant more than improved efficiency: it redefined the problematization of computerized translation in terms of statistics rather than grammar. As such, statistical translation is oriented to a different kind of "others": no longer a particular enemy other to be overpowered, but rather a cosmopolitan other, a contingent generalized peer, who might be a competitor or partner depending on circumstances. Relying on texts in the official languages used by multilingual organizations instead of that of a political antagonist, mechanized translation no longer assumes hostility and control, but rather ad hoc instrumentalism—collaboration or competition—as befits the logic of a global market. Indeed, during the 1990s, many statistical systems were gradually integrated into the business market, nourishing currents of globalization (Cronin, 2003); with the rise of web-based applications, more users were given access to free online automatic translation, and were thus introduced to the opportunity of universality through their own language. However, in order to achieve such a lingual environment for each user, Translate depends on English to serve as pivot to all other languages. Relying on the availability of the already translated texts from various languages to English, and vice versa, allows the statistical method to work in a linguistically affixed setting, at least on one end of the translation procedure; at the same time, it fortifies English dominancy as the benchmark to which all languages are compared.

Most statistical translation programs (including Translate) operate according to a similar procedure, which proceeds in two stages called the "translation model" and the "target-language model" (Somers, 2011: 435–436). In the first stage or model, the algorithm analyzes the bilingual corpora and then evaluates the probabilities and occurrences of every string of words it needs to translate (between one word and a whole sentence) in both languages; then, it produces a proposed translation, taking into account grammatical and syntactical features such as word order, multiword phrases, linguistic agreement, and so on. In the second stage or model, the system verifies that the translation is indeed linguistically permissible in the target language (again, by statistically comparing it to the evidence furnished by the control corpus) and adapts it as necessary. The output is, statistically speaking, the most likely sequence to appear in the target language, given the particular input text in the source language.

Thus, for example, the system "learns" the equivalence of the English *dog* and the French *chien* based on the incidence of sentences in which it was so translated, but also takes into account all the cases where it was not translated this way. In more complex cases, such as multiword phrases or context-depended translations—like the English *all* which may parallel *todo*, *toda*, *todos* and *todas* in Spanish—it adjusts the grammatical features (like gender or number agreement) to the basic lexical translation. In multiword phrases (known as *n*-grams), the system learns to recognize the most probable legitimate sequence in both languages. For example, the English sequence "the big house on the hill" contains several trigrams (three-word sequences), only a few of which are linguistically permissible (Somers, 2011: 435; see also Hearne and Way, 2011; Mariño et al., 2006). The system runs the same phrase-based analysis on the parallel language and calculates probabilities for the most appropriate option. This learning process is run when the system is set up, allowing the algorithm to recognize and tune into its designated languages before its release to the translation market. Training of statistical translation systems is typically conducted on materials as similar as possible to the ones they will be applied to. For this reason, in the early stages of statistical translation, business English figured more prominently than English literary texts (Raley, 2003). With the development of web-based algorithms, and with the expansion of machine translation users, the selection of corpora texts has become more varied.

That business English was the formative corpus of statistical machine translation bespeaks the broader context in which these methods were developed: the emergence of a neoliberal and globalized market where flows of people, currency, technologies, and goods travel across and beyond national borders (Castells, 1999; Dyer-Witheford, 2015; Harvey, 2005). Hardt and Negri (2000) describe this new global order as Empire, a supranational formation of sovereignty that enforces global capitalism as the natural state of affairs. Tracing the genealogical transformations from previous imperialist regimes to those of the present, they declare Empire as "the center that supports the globalization of productive networks and casts its widely inclusive net to try to envelop all power relations within its world order" (p. 20). Hardt and Negri further emphasize the key role of communication and communication technologies under Empire, not simply as a means of expression but, and more fundamentally, as a means for organizing the movement of globalization. The global economy is an information economy, with production and consumption undergoing a process of informatization. It is in this respect that our media genealogy of Google Translate can be seen as a metonymy of the grand genealogy of Empire.

Web-based Statistical Machine Translation has realized Weaver's dream of a universal translator, but when taking the critical point of view of Hardt and Negri, the achievement of universal translation is coextensive with the global reach of Empire. The statistical mining of corpora is consistent with Bar-Hillel's prescription of providing machine translation computers with the "knowledge about the world"; but it is equally consistent with Empire's model of "striving toward a continual interactivity or rapid communication between production and consumption" (Hardt and Negri, 2000: 290)—the subjection of all communication to global market data. Under Empire, there is no Other and no outside: alterity and periphery are internalized and operationalized. Google Translate thus emerges as a veritable information machine—a machine in the sense intended by Deleuze and Guattari (1988; and Hardt and Negri following them): interconnected assemblages of bodies, technologies, and practices. With statistical algorithms as its technical infrastructure, Weaver's Machine Translation is revealed as Empire's translation machine.

Actor-translation network: human participation in algorithmic power

Web-based algorithms learn and improve with use; they rely on the power of the masses as they recruit users from the speech community of the languages concerned in order to perfect the output of the translation process. Even though automatic evaluation is possible (Somers, 2011: 437–438), Google encourages users to join the Translate community, where they correct, validate, and suggest alternatives to the output text. Additionally, it offers a toolkit for professional translators, a program that learns their preferences and improves itself accordingly. Translation Studies have considered this phenomenon, known as "volunteer translation," as one of the changes introduced by the Internet into the practice of translation (Cronin, 2012, 476–478; Kushner, 2013). The data collected from these platforms are used for enhancing the basic Translate algorithm and refining its performances. Other machine translation engines like Bing (which is used by Facebook) similarly combine the algorithmic power with information gathered from human participation, and improve when mining statistical data from numerous sources, which are not necessarily weighted equally. Therefore, the procedure followed by Translate establishes an agentive sequence of human–computer–human: the automatic translation produced by the algorithm is based on statistics, calculating occurrences, and weighing probabilities, while the work done both before and after the automatic process is a product of human effort. The combined result of all these agents creates a network of translation.

The operation of Translate can be described in terms of Actor–Network Theory (ANT): units of various size and nature (from individuals to large-scale institutions, and both human and non-human agents) that form together a network of interrelated actants and activities. The formation of such a network involves a process that Callon and Latour (1981) call "translation": when an actor takes it upon itself to represent other actors and thus unite them into one body, which then becomes an actor in its own right, even if represented by the original one. The lingual translation produced by Google can be seen as translation in ANT terms: by combining the forces of both humans and machines, the algorithm "translates" them into one unit, speaking on this unit's behalf by producing output. Admittedly, each user and computer taking part in this process may still be regarded as an individual agent (or as cyborgs, as suggested by Cronin, 2012), but at the same time in this process they are all integrated into a network with other humans and machines, repeatedly creating larger, "translated" units comprising smaller units.

Two forces, opposing yet complementary, are operating within this translation network and they may be illuminated by the theoretical notions of algorithmic culture and participatory culture. As automatic translated texts are products of algorithmic calculation of occurrences of words and phrases within the inspected corpora, they reflect the most common and probable linguistic tropes. Similar to other algorithm-based programs, web platforms, and apps, Translate adheres to algorithmic culture, a term used to denote the use of "computational processes to sort, classify, and hierarchize people, places, objects, and ideas" and their impact on culture and society (Striphas, 2012: 1). When algorithms collect and analyze information about their users—in order to offer them products, reading recommendations, and other web content adjusted to the users' previous searches and preferences—they define sets of options, from which these users select their actions, and by so doing conform to predetermined templates and categories (Galloway, 2006; Hallinan and Striphas, 2014). Such algorithms may open new perspectives for users but also restructure their reality. By offering high-rated options, algorithms eventually diminish the possibility for surprising combinations and unpredictable cultural encounters; they suggest instead the already known and possible, thus dwindling the variety of cultural products and identities. Moreover, the exact criteria of selection and the nature of the statistical tools by which the process is carried out remain hidden from the users in an algorithmic "black box." Algorithmic culture promotes susceptibility to manipulation by hegemonic power, whose tightening control of society is disguised by tempting suggestions and concealed protocols (Beer, 2009).

A common argument against the statistical methods in translation is that when the algorithm suggests the most probable translation, it eliminates alternative options and makes the language of the text so produced conform to well-documented modes of expression. Moreover, as most texts sifted by the algorithm are of a business or legislative nature, the high-ranking translational equivalents tend to be of a utilitarian register, and figurative language is less likely to be utilized (Raley, 2003, 2012). Echoing a fear of a gradually evolving, computer-controlled Newspeak, critics of statistical machine translation warn about the disappearance of rare words, allegorical phrasing, and innovative tropes—which are not well represented to begin with—at an early stage of the translation process, as they are statistically low rated. Since this is a self-intensifying routine, creative modes of expression are bound to disappear gradually from language, at least as it is represented by automated translators.

While the algorithmic aspect of Translate has potentially dystopian implications, the involvement and contribution of users reflect a form of participatory culture (Jenkins, 2006). Such participation can be regarded as empowering end-users, who can indicate topics ignored by traditional media, advance specific themes, and influence the content of websites. This is particularly evident in the case of Translate, whose user communities can affect the rating and visibility of underrepresented languages, as well as improve the quality of translations to and from such tongues. As a result, languages peripheral to Internet use (even if, like Bengali, they are spoken by millions of people), and languages of relatively small but devoted speech communities (like Yiddish), may still be represented in Translate, and translation related to them may be constantly enhanced. In the age of Translate, human participation is not only crucial for quality control and self-improvement of the algorithm, but it can even take advantage of the algorithm for the sake of promoting ideological causes like the preservation of endangered languages, or enriching the algorithm's output and enhancing the cultural diversity it represents. In this sense, otherness and diversity figure recursively in web-based translations: the algorithm reduces them while human users introduce them anew.

But there is also a darker side to users' participation in online machine translation. Going back to Hardt and Negri (2000), built in to Empire's information economy is the emergence of "immaterial labor": "labor that produces an immaterial good, such as service, a cultural product, knowledge, or communication" (p. 290). Such immaterial labor is often unpaid labor conducted by "cyber-proletariat," who are eventually replaced by algorithms (Dyer-Witheford, 2015). The contributions of users (among them professional translators) to Translate's algorithm clearly constitutes a case of immaterial labor—unpaid labor, to be sure—which serves to increase Google's traffic and bolster its dominancy. The information economy is built on those who participate in it gratis. It is not inconceivable that professional translators might one day find that their contribution to web-based translating algorithms has left them all but superfluous.

An inverse Tower: from English to Interlingua

From its inception, statistical machine translation used English as its reference language: that is, every source text was first translated into English, and only then into the target language. Most contemporary algorithms still use English as a pivot language even when translating between languages that resemble each other (e.g. Arabic and Hebrew) more than either one of them resembles English (Shilon et al., 2012; Wintner, 2004). Since Translate's basic model relies on corpora of texts, languages with more varied texts translations to and from English (like French) are better represented in it. Thus, the dominancy of English persists on the algorithmic level while remaining hidden from user level. Moreover, it is precisely the embedded dominancy of English within Translate's operative logic that supports the manifest multilingualism on either side of the interface. The genealogical analysis of machine translation we propose here reveals the changing status of English from the bipolar "enemy other" attitude of the rule-based period to the corporate "cosmopolitan other" attitude of the contemporary statistical methods.

That is, until recently. In September 2016, Google announced the introduction of a new translation model, one that is based on artificial intelligence learning capabilities: Neural Machine Translation

(NMT; Le and Schuster, 2016). According to the Google Translate blog, the new system demonstrates favorable translation results compared to English as pivot language method (Turovsky, 2016). The NMT system utilizes deep learning capabilities that draw on the vast corpora that Google has accumulated, virtually connecting all languages represented in Translate. Unlike the phrase-based analysis conducted by the prevailing translation algorithm, the new model can handle an entire sentence as an input without breaking it into phrases. The neural network improves translation not only of language pairs with abundant data (e.g. English–German) but also, remarkably, translation of language pairs with relatively little available data (Johnson et al., 2016). This is because the system is able to implement implicitly what it learns from one translation procedure to the other. The result is what Google researchers call "zero-shot translation": the technological capability to translate between language pairs which the system has never directly processed before. For example, a model trained with Portuguese–English and English–Spanish can generate satisfactory translation results for Portuguese–Spanish even though it has not seen any data for that specific language pair (Johnson et al., 2016: 2). Currently, Translate still processes most languages using the previous statistical model, and hence via the mediation of English, but it is Google's aim to gradually phase in the new model and progressively add more languages to it (Turovsky, 2017).

The introduction of zero-shot translation has led Google researchers to speculate about the nature of the neural processing of the new system. This is how they describe what might be going on deep inside it: "the network must be encoding something about the semantics of the sentence rather than simply memorizing phrase-to-phrase translations. We interpret this as a sign of existence of an interlingua in the network" (Schuster et al., 2016). It seems that a novel linguistic construct has emerged from the neural network operation: a statistical interlanguage that both draws from all the languages that Translate processes but at the same time transcends that linguistic multiplicity. While full analysis of this new model will have to wait for future studies, it is possible to point out one consequence of this recent shift and thereby bring our genealogical exploration of Google Translate to the present moment. Abandoning English as pivot language in favor of interlingua represents the next stage in the power structure of translation, or to use once again the terminology of Hardt and Negri, the next stage of Empire's translation machine. Instead of depending on one natural language as statistical bridge between all other languages, Google creates its own non-language as translation pivot; rather than reinstating existing language hierarchy with English at the top, Google creates a new hierarchy with its own linguistic construct at its base. Drawing on all languages but endorsing no single one in particular, Translate's neural network provides a new medium for intercultural contact, which presumably allows for greater diversity within its algorithm. It therefore constitutes a realization of Weaver's metaphor of "a great open basement, common to all towers" (Weaver, 1955b: 23)—an inverse tower, an underlying structure common to all languages. And like Weaver's (1955b) mathematical concept of language, Translate's interlingua is "independent of the language used" (p. 16). However, to complete the metaphor, we might add that while the basement is in a sense common to all languages, its ownership is anything but common, for Google is its principal landlord.

If Translate represents a contemporary virtual Babel, it is one that does not take the shape of an enormous monument seen by all, but rather the shape of an inverse tower—or rather, a subterranean infrastructure. By allowing users to communicate across languages while remaining firmly within their own lingual environment, Translate upholds both the local end and the global end of multilingual translation within one framework. As such, it succeeds where age-old international language enterprises have failed. Projects such as Esperanto and Basic English promised global communicability at the expense of national languages (in the case of Basic, the tradeoff was the imperialist quintet represented in its acronym: British, American, Scientific, International, Commercial). Translate conversely encourages lingual multiplicity in conjunction with universal connectivity, and this is precisely because it is operating in terms of the statistical correlations within and between natural languages rather than following the rules of natural languages. With the introduction of interlingua, a new configuration of human–machine and machine–machine communication begins to appear, one that is based on a common infrastructure and a single interface. Through Translate, Google has redefined what machine translation means in the digital age, which is also the age of Google's dominancy.

References

Bar-Hillel Y (1951) The present state of research on mechanical translation. *Journal of the Association for Information Science and Technology* 2(4): 229–237.

Bar-Hillel Y (1970) *Aspects of Language*. Jerusalem, Israel: The Magness Press.

Bassnett S (2014) *Translation*. London and New York: Routledge.

Battelle J (2005) *The Search: How Google and Its Rivals Rewrote the Rules of Business and Transformed Our Culture*. New York: Penguin Books.

Beer D (2009) Power through the algorithm? Participatory web cultures and the technological unconscious. *New Media & Society* 11(6): 985–1002.

Benjamin W (2012[1923]) The translator's task. In: Venuti L (ed.) *The Translation Studies Reader*. 3rd edn. London and New York: Routledge, pp. 75–83.

Bhabha HK (1994) *The Location of Culture*. London: Routledge.

Brown P, Cocke J, Della Pietra S, et al. (1988) A statistical approach to language translation. In: *Proceedings of the 12th conference on computational linguistics, COLING' 88*, Budapest, 22–27 August, pp. 71–76. Stroudsburg, PA: Association for Computational Linguistics.

Callon M and Latour B (1981) Understanding the big Leviathan: how actors macro-structure reality and how sociologists help them to do so. In: Knorr-Cetina K and Cicourel AV (eds) *Advances in Social Theory and Methodology: Toward an Integration of Micro- and Macro-Sociologies*. Boston, MA, London and Henley: Routledge & Kegan Paul, pp. 277–303.

Castells M (1999) Grassrooting the space of flows. *Urban Geography* 20(4): 294–302.

Cronin M (2003) *Translation and Globalization*. London and New York: Routledge.

Cronin M (2012) The translation age: translation technology and the new instrumentalism. In: Venuti L (ed.) *The Translation Studies Reader*. London and New York: Routledge, pp. 469–482.

Deleuze G and Guattari F (1988) *A Thousand Plateaus: Capitalism and Schizophrenia*. London: Athlone Press.

Derrida J (1991) Des Tours de Babel. In: Kamuf P (ed.) *A Derrida Reader: Between the Blinds*. New York: Columbia University Press, pp. 243–253.

Dyer-Witheford N (2015) *Cyber-Proletariat: Global Labour in the Digital Vortex*. London: The Pluto Press.

Ernst W (2013) *Digital Memory and the Archive*. Minneapolis, MN and London: University of Minnesota Press.

Galison P (1994) The ontology of the enemy: Norbert Wiener and the cybernetic vision. *Critical Inquiry* 21(1): 228–266.

Galloway AR (2006) *Gaming: Essays on Algorithmic Culture*. Minneapolis, MN: University of Minnesota Press.

Geoghegan BD (2011) From information theory to French theory: Jakobson, Levi-Strauss, and the cybernetic apparatus. *Critical Inquiry* 38(1): 96–126.

Goddard M (2015) Opening up the black boxes: media archaeology, “Anarchaeology” and media materiality. *New Media & Society* 17(11): 1761–1776.

Goldberg Y (2013) Syntactic Ngrams over time. *Google Research Blog*. Available at: https://research.googleblog.com/2013/05/syntactic-ngrams-over-time.html

Google (2016) Ten years of Google translate. *Google Translate Blog*. Available at: https://translate.googleblog.com/ (accessed 29 January 2017).

Google (2017) About the company. Available at: https://www.google.com/about/ (accessed 29 January 2017).

Gordin MD (2015) *Scientific Babel: How Science Was Done before and after Global English*. Chicago, IL and London: University of Chicago Press.

Gunkel DJ (1999) Lingua ex Machina: computer-mediated communication and the tower of Babel. *Configurations* 7(1): 61–89.

Hallinan B and Striphas T (2014) Recommended for you: the Netflix Prize and the production of algorithmic culture. *New Media & Society* 23: 1–21.

Hardt M and Negri A (2000) *Empire*. Cambridge, MA and London: Harvard University Press.

Harvey D (2005) *A Brief History of Neoliberalism*. Oxford: Oxford University Press.

Hayles NK (1999) *How We Became Posthuman*. Chicago, IL and London: University of Chicago Press.

Hearne M and Way A (2011) Statistical machine translation: a guide for linguists and translators. *Language and Linguistics Compass* 5(5): 1–21.

Hutchins WJ (1986) *Machine Translation: Past, Present, Future*. Chichester: Ellis Horwood Press.

Hutchins WJ (2000) Warren weaver and the launching of MT: brief biographical note. In: Hutchins WJ (ed.) *Early Years in Machine Translation: Memoirs and Biographies of Pioneers*. Amsterdam and Philadelphia, PA: John Benjamins Publishing Company.

Hutchins WJ (2001) Machine translation over fifty years. *Histoire, Epistemologie, Language* 23(1): 7–31.

Jenkins H (2006) *Convergence Culture: Where Old and New Media Collide*. New York: University Press.

Johnson M, Schuster M, Le QV, et al. (2016) Google’s multilingual neural machine translation system: enabling zero-shot translation. *Arxiv.org*. Available at: https://arxiv.org/abs/1611.04558

Jurafsky D and Martin JH (2008) *Speech and Language Processing*. 2nd edn. Upper Saddle, NJ: Prentice Hall.

Kittler FA (1999) *Gramophone, Film, Typewriter*. Stanford, CA: Stanford University Press.

Koopman C (2013) *Genealogy as Critique: Foucault and the Problems of Modernity*. Bloomington, IN: Indiana University Press.

Krämer S (2015) *Medium, Messenger, Transmission: An Approach to Media Philosophy*. Amsterdam: Amsterdam University Press.

Kushner S (2013) The freelance translation machine: algorithmic culture and the invisible industry. *New Media & Society* 15(8): 1241–1258.

Le QV and Schuster M (2016) A neural Network for machine translation, at production scale. *Google Research Blog*. Available at: https://research.googleblog.com/2016/09/a-neural-network-for-machine.html (accessed 29 January 2017).

Levy S (2011) *In the Plex: How Google Thinks, Works and Shapes Our Lives*. New York: Simon & Schuster.

Liu LH (1999) *Tokens of Exchange: The Problem of Translation in Global Circulations*. Durham, NC and London: Duke University Press.

Liu LH (2010) *The Freudian Robot: Digital Media and the Future of the Unconscious*. Chicago, IL and London: University of Chicago Press.

Locke WN and Booth AD (1955) *Machine Translation of Languages: Fourteen Essays*. Cambridge, MA: The MIT Press.

Mariño JB, Banchs RE, Crego JM, et al. (2006) N-gram-based machine translation. *Computational Linguistics* 32(4): 527–549.

Mitchell C (2010) *Situation normal, All FAQHT up: language, materiality & machine translation*. PhD Thesis, McGill University, Montreal, Quebec City, Canada.

Monea A and Packer J (2016) Media genealogy and the politics of archaeology. *International Journal of Communication* 10: 3141–3159.

Nirenburg S (1995) Bar Hillel and machine translation: then and now. *Proceedings of the Fourth Bar Ilan Symposium on Foundations of Artificial Intelligence*. Available at: https://www.aaai.org/Papers/BISFAI/1995/BISFAI95-027.pdf

Norvig P (2006) Making a difference. *Google Research Blog.* Available at: https://research.googleblog.com/2006/02/ (accessed 29 April 2017).

Och FJ (2010) Franz Josef Och, Google's translation uber-scientist, talks about Google translate. *Los Angeles Times*, 11 March. Available at: http://latimesblogs.latimes.com/technology/2010/03/the-web-site-translategooglecom-was-done-in-2001-we-were-just--licensing-3rd-party-machine-translation-technologies-tha.html (accessed 29 April 2017).

Parikka J (2011) Operative media archaeology: Wolfgang Ernst's materialist media diagrammatics. *Theory, Culture & Society* 28(5): 52–74.

Peters JD (2015) *The Marvelous Clouds: Toward a Philosophy of Elemental Media*. Chicago, IL and London: University of Chicago Press.

Pinchevski A (2005) *By Way of Interruption: Levinas and the Ethics of Communication*. Pittsburgh, PA: Duquesne University Press.

Raley R (2003) Machine translation and global English. *Yale Journal of Criticism* 16(2): 291–313.

Raley R (2012) Another kind of global English. *Minnesota Review* 78: 104–112.

Schuster M, Johnson M and Thorat N (2016) Zero-shot translation with Google's multilingual neural machine translation system. *Google Research Blog*. Available at: https://research.googleblog.com/2016/11/zero-shot-translation-with-googles.html (accessed 29 January 2017).

Segev E (2010) *Google and the Digital Divide: The Bias of Online Knowledge*. Oxford: Chandos Publishing.

Shannon CE and Weaver W (1949) *The Mathematical Theory of Communication*. Urbana and Chicago: Univ of Illinois Press.

Shilon R, Habash N and Lavie A (2012) Machine translation between Hebrew and Arabic. *Machine Translation* 26(1–2): 177–195.

Sigismondi P (2016) Babel and globalization: translating in the 21st Century. *International Journal of Communication* 10: 860–867.

Somers H (2011) Machine translation: history, development, and limitations. In: Malmkjær K and Windle K (eds) *The Oxford Handbook of Translation Studies*. Oxford and New York: Oxford University Press, pp. 427–440.

Spivak GC (1993) *Outside in the Teaching Machine*. London and New York: Routledge.

Steiner G (1975) *After Babel: Aspects of Language and Translation*. London, Oxford and New York: Oxford University Press.

Striphas T (2012) What is an Algorithm? *Culture Digitally*. Available at: http://culturedigitally.org/2012/02/what-is-an-algorithm/#sthash.SFtM0W91.dpuf (accessed 29 April 2017).

Turovsky B (2016) Found in translation: more accurate, fluent sentences in Google translate. *Google Translate Blog*. Available at: https://blog.google/products/translate/found-translation-more-accurate-fluent-sentences-google-translate/ (accessed 29 April 2017).

Turovsky B (2017) Higher quality neural translations for a bunch more languages. *Google Translate Blog*. Available at: https://www.blog.google/products/translate/higher-quality-neural-translations-bunch-more-languages/ (accessed 25 July 2017).

Uszkoreit J, Ponte JM, Popat AC, et al. (2010) Large scale parallel document mining for machine translation. In: *Proceedings of the 23rd International Conference on Computational Linguistics, COLING '10*, Beijing, 23–27 August, pp. 1101–1109. Stroudsburg, PA: Association for Computational Linguistics.

Vaidhyanathan S (2011) *The Googlization of Everything: (And Why We Should Worry)*. Berkeley, CA: University of California Press.

Venuti L (1995) *The Translator's Invisibility: A History of Translation*. London and New York: Routledge.

Venuti L (1998) *The Scandals of Translation: Towards an Ethics of Difference*. London and New York: Routledge.

Weaver W (1955a) Forward: the new tower. In: Locke WN and Booth AD (eds) *Machine Translation of Languages: Fourteen Essays*. Cambridge, MA: The MIT Press, pp. v–vii.

Weaver W (1955b) Translation. In: Locke WN and Booth AD (eds) *Machine Translation of Languages: Fourteen Essays*. Cambridge, MA: The MIT Press, pp. 15–23.

Wintner S (2004) Hebrew computational linguistics: past and future. *Artificial Intelligence Review* 21(2)–: 113–138.