

# "Language is the Dress of Thought"

Samuel Johnson

### Georges M. Halpern, MD, DSc

and Yves P. Huin

There is no exact count of the number of words in English, and one reason is certainly because languages are ever expanding; in addition, their boundaries are always flexible. Consider such words as "cannoli" and "teriyaki," which come from other tongues but are established through use, context, and frequency as English. There are many other thorny considerations that complicate the task of counting individual words and tallying up the language in that way. For example, are all of the inflected forms of a word–for instance, "drive," "drives," "drove," etc.–one word or several separate words?

Another puzzle: should "port of call," another *Webster's Third* entry, count as a word, even though each of its components is entered separately?

It has been estimated that the vocabulary of English includes roughly 1 million words (although most linguists would take that estimate with a chunk of salt, and some have said they wouldn't be surprised if it is off the mark by a quarter-million); that tally includes the myriad names of chemicals and other scientific entities. Many of these are so peripheral to common English use that they do not or are not likely to appear even in an unabridged dictionary.

*Webster's Third New International Dictionary*, Unabridged, together with its 1993 Addenda Section, includes some 470,000 entries. *The Oxford English Dictionary*, *Second Edition*, reports that it includes a similar number.

But these are *written, transcribed* words. Language (from *lingua* = tongue) is *spoken* not *written* initially. All human babies of the world *speak* from a very young age, and *write* (usually much) later in life –and some never do. Hence our *tongue* (or for that matter *all* tongues) are perpetually evolving, changing, enriching by borrowing or creating new words. *Tongues* are **alive** –like the people who speak them; printing dies on its support. In fact, out of the 6,912 known living languages in the world today, parts of Africa, e.g. Congo, Papua New Guinea, some parts of the Philippines, are the most linguistic diverse countries in the world. To these we must add the nomadic populations, e.g. Sami of Lapland, Masais of Kenya/Tanzania, First Nations and many more that are rich in *written* or carved *symbols* but have no written language on their own.

An interesting –and most important- group of languages are these who use *a written* system totally independent from but encompassing *many spoken* tongues e.g. Chinese and Chinese-derived languages.

This growing diversity, richness and wealth of *spoken* before being *written* (hence codified) languages are critical for our planet. It dramatically contrasts with the ossification of French under the nefarious diktat of the Académie Française, made of 30 *immortals* buried in the 18<sup>th</sup> century CE; and the infamous Law Toubon that **forbids** any use of another language in official publications or meetings, to prevent (officially) the *pollution* of the sacrosanct French! Xenophobia (against the US English and globalization), racism (against the important and growing Moslem population) are the obvious, but unspoken reasons. Even *Latin* is, thanks to the Vatican, adjusting to the times!

My wife Emiko, a graduate linguist, is very fussy about the use of words in the different languages that she masters; she is also scrupulous on the usage in the *cultural* context. Just like jokes or humor. Words do not exist in a vacuum. They belong.

# Artificial Intelligence Makes Language Matter Even More



In analytic philosophy, any meaning can be expressed in language. In his book *Expression and Meaning* (1979), UC Berkeley philosopher John Searle calls this idea "*the principle of expressibility, the principle that whatever can be meant can be said*". Moreover, in the *Tractatus Logico-Philosophicus* (1921), Ludwig Wittgenstein suggests that "*the limits of my language mean the limits of my world*".

The limits of natural language when it comes to meaning-making have long been recognized in both the arts and sciences. Psychology and linguistics acknowledge that language is not a perfect medium; much of our thought is non-verbal, and at least some of it might be inexpressible in language. Notably, language often cannot express the concrete experiences engendered by contemporary art and fails to formulate the kind of abstract thought characteristic of much modern science. Language is not a flawless vehicle for conveying thought and feelings.

In the field of artificial intelligence, technology can be incomprehensible even to experts. In the essay *Is Artificial Intelligence Permanently Inscrutable*, Princeton neuroscientist Aaron Bornstein discusses this problem regarding artificial neural networks (computational models): "*Nobody knows quite how they work. And that means no one can predict when they might fail.*" This could harm people if, for example, doctors relied on this technology to assess whether patients might develop complications.

Bornstein says organizations sometimes choose less efficient but more transparent tools for data analysis and "even governments are starting to show concern about the increasing influence of inscrutable neural-network oracles." He suggests that "the requirement for interpretability is another set of constraints, preventing a model from a 'pure' solution that pays attention only to the input and output data it is given, and potentially reducing accuracy." The mind is a limitation for artificial intelligence: "Interpretability could keep such models from reaching their full potential." Since the work of such technology cannot be fully understood, it is virtually impossible to explain in language. Ryota Kanai, neuroscientist and CEO of Araya, a Tokyo-based startup, acknowledges that "given the complexity of contemporary neural networks, we have trouble discerning how AIs produce decisions, much less translating the process into a language humans can make sense of." To that end, Kanai and his colleagues are "trying to implement metacognition in neural networks so that they can communicate their internal states."

Their ambition is to give a voice to the machine: "We want our machines to explain how and why they do what they do." This form of communication is to be developed by the machines themselves. With this feedback, researchers will serve as translators who can explain to the public decisions made by the machines. As for human language, Kanai refers to it as "the additional difficulty of teaching AIs to express themselves," assuming that computational models have "selves.") Language is a challenge for artificial intelligence.

Elon Musk advances the idea *that we should augment the slow, imprecise communication of our voices with a direct brain-to-computer linkup.* He has founded the company Neuralink that will allegedly connect people to the network in which they will exchange thoughts without wasting their time and energy on language. As Christopher Markou, Cambridge PhD candidate at the Faculty of Law describes it in

his essay for The Conversation, "it would enable us to share our thoughts, fears, hopes, and anxieties without demeaning ourselves with written or spoken language".

Tim Urban, blogger and cartoonist at "Wait But Why", presents Musk's vision of thought communication and argues that "when you consider the 'lost in transmission' phenomenon that happens with language, you realize how much more effective group thinking would be."

This project makes sinister assumptions: Instead of enhancing verbal communication, Musk suggests abandoning it as an inadequate means of social interaction. People generally appreciate improvement of the communication networks that transmit language, but instead, they are offered a corporate utopian future of techno-telepathy and an eerily dystopian present where language is an impediment to cooperation. It is both ironic and reassuring that such criticism of language can be successfully communicated by language.

In the recent essay "*The Kekulé Problem*," American writer Cormac McCarthy discusses the origins of language and is skeptical about its fundamental role in cognition: "*Problems, in general, are often well posed in terms of language and language remains a handy tool for explaining them. But the actual process of thinking—in any discipline—is largely an unconscious affair.*" He defines the unconscious as "a machine for operating an animal."

McCarthy regards language as a relatively recent invention and compares it to a virus that rapidly spread among humans about a hundred thousand years ago (cf. *Language is a virus from outer space.* William S. Burroughs). His vision of language is unsatisfactory for several reasons. First, language is a human faculty developed due to the gradual evolution of communication; it is problematic to conceive of it as a virus or the result of a sudden invention. Second, thought does not need to be unconscious to be non-verbal. Much conscious thought does not rely on language. Finally, humans may be facing problems that are difficult to convey through language. This might be the key challenge for both the arts and sciences in the immediate future.

While language may not be a perfect medium for thought, it is the most important means of communication that makes possible modern societies, institutions, states, and cultures. Its resourcefulness allows humans to establish social relationships and

design new forms of cooperation. It is a robust and highly optimized form of communication, developed through gradual change. For thousands of years, language has been a tool for social interaction. This interaction is facing existential threats (authoritarianism, isolationism, conflict) because the subjective experiences (think of the limits of empathy when it comes to migrants) and the knowledge (think of the complexity of global warming) that are engaged in the arts and sciences appear to have gone beyond the expressive power of language.

Humanity depends on the capacity of language to communicate complex, new ideas and thus integrate them into culture. If people fail to understand and discuss emerging global problems, they will not be able to address them in solidarity with one another.

In "*Our World Outsmarts Us*" (in *Aeon*), Robert Burton, the former associate director of the department of neurosciences at the UCSF Medical Center at Mt Zion, highlights this conundrum when he asks: "*If we are not up to the cognitive task, how might we be expected to respond?*" Individuals alone cannot stop climate change or curb the rising inequality of income distribution. These goals can only be achieved by concerted efforts. To work together, people need language.

In the arts, it is felt that subjective experiences are not always transmittable by language. Artists confront the limits of concrete expression. Scientists, in their turn, understand that language is a crude tool incapable of conveying abstract ideas. Science thus probes the limits of abstract thought. Both the arts and sciences are dissatisfied with verbal communication. To induce wonder, artists may forego language. To obtain knowledge, scientists often leave language behind.

In his essay *"Science Has Outgrown the Human Mind and Its Limited Capacities,"* Ahmed Alkhateeb, a molecular cancer biologist at Harvard Medical School, suggests outsourcing research to artificial intelligence because *"human minds simply cannot reconstruct highly complex natural phenomena efficiently enough in the age of big data."* The problem is that language is a tool for the gathering of knowledge and appreciation of beauty by the whole society.

Abandoning language marginalizes the arts and sciences. Wonder and knowledge become inaccessible for the community at large. When people make decisions about the future, political processes may fail to register what is happening at the forefront

of human thought. Without language, the arts and sciences lose cultural significance and political clout: There is less hope for the arts to move people's hearts and less opportunity for sciences to enlighten the public. With the arts and sciences on the margins, humanity undermines its cultural safeguards. Today's dominant narratives foreground the progress of science and the democratization of art, but global challenges necessitate an even more active engagement with scientific, moral, and aesthetic dilemmas on the part of humanity.

Language is one of the key tools that can realize this ambition. It is important to strike a balance between pushing the limits of language and using it as a tool to communicate and collaborate. Artists and scientists might approach the public with ideas that cannot be easily understood and yet need to be conveyed by language. In *"To Fix the Climate, Tell Better Stories"* Michael Segal, editor in chief at *Nautil.us,* argues that science needs narratives to become culture. He posits that narratives can help humanity solve global problems. This potential is revealed to us if we look at how *"indigenous peoples around the world tell myths which contain warning signs for natural disasters."* Today people can construct helpful narratives based on an expert understanding of the world. These stories can relate unfathomable dangers to the frail human body, and language is the best political vehicle for this task.

In the 2017 New York Times bestseller *On Tyranny*, Yale historian Timothy Snyder, for example, draws from the history of the 20th century to relate the rise of authoritarian regimes to concrete threats to human life, encouraging his readers to stand up to tyranny. He asks them to take responsibility for the face of the world, defend institutions, remember professional ethics, believe in truth, and challenge the status quo. His language is powerful and clear. Such narratives can help address complex social and environmental problems by using human-scale categories of language.

Ultimately, the arts and sciences grasp critically important knowledge and engage significant experiences, but often fail to express them in language. As Wittgenstein says, "*whereof one cannot speak, thereof one must be silent*." This silence might lead to dire consequences for humanity. It is crucial to break the silence. The arts and sciences need to talk to the public and to advance language and culture.

### Your Culture Influences How You Draw a Circle



In the June 16 edition of *Quartz*, Thu-Huong Ha and Nikhil Sonnad ask a simple question: *How do you draw a Circle?* 

In November 2016, Google released an online game called *Quick, Draw!*, in which users have 20 seconds to draw prompts like "*camel*" and "*washing machine*". The game's real aim is to use those sketches to teach algorithms how humans draw. By May 2017, the game had collected 50 million unique drawings.

Ha and Sonnad used the public database from *Quick, Draw!* to compare how people draw basic shapes around the world. Their analysis suggests that the way you draw a simple circle is linked to geography and cultural upbringing, deep-rooted in hundreds of years of written language, and significant in developmental psychology and trends in education today.

Revered by the ancient Greeks, essential to Islamic art, and venerated in Zen and Tibetan Buddhism, circles are a universal shape. No matter where you begin, there are only two ways to draw a circle, a single stroke heading clockwise, or a single stroke heading counterclockwise.

Google's dataset contains 119,000 unique circles drawn by people in 148 countries and includes coordinates for the path traced by each player's finger (or mouse). Applying some simple geometry to data from the 66 countries that submitted over 100 circles, they identified the circle-drawing directions favored by different nations.

Americans tend to draw circles counterclockwise. Of nearly 50,000 circles drawn in the US, 86% were drawn this way. People in Japan, on the other hand, tend to draw circles in the opposite direction. Of 800 circles drawn in Japan, 80% went clockwise.

British, Czech, Australian, and Finnish circles were drawn in the same direction, with the same consistency, as American ones. Some countries are even more regular—around 90% of French, German, and Filipino drawers submitted circles drawn counterclockwise. Most of the world, it seems, draws circles counterclockwise, with just two exceptions from their dataset: Taiwan and Japan.

What could account for the difference? One thing that sets countries apart, of course, is their languages. Could the way people write—top to bottom, left to right, or right to left—explain why they draw abstract shapes differently? Americans, Western Europeans, and Latin Americans of course vary widely in their spoken languages but share similar scripts. Scripts from Asia and the Middle East, meanwhile, have very different sets of rules for how they're written.

In scripts based on Chinese, Japanese is special: there are three types of writing used in Japanese: hiragana, katakana, and kanji. Kanji is based closely on the ideogrammatic Chinese character system, while hiragana and katakana are phonetic. Hiragana, the closest to the English alphabet, has the most circular strokes, and most of its curvy characters are drawn with the curve going clockwise.

Both Japanese and Chinese scripts follow a strict stroke order. Overall, characters are drawn from top left in the direction of the bottom right. If you draw a horizontal line and then a vertical line, like in " $\neg$ ", the rule is to treat these two lines as one stroke, and to complete the stroke without stopping, says calligrapher and Rutgers mathematics professor Yi-Zhi Huang. So, the hand might have a more natural tendency to move in a clockwise direction, like in " $\neg$ ," which signifies the completion of an action.

In written languages based on Chinese, these rules are drilled into pupils' heads from the moment they pick up a pencil, making a strong case for the possibility that people in Taiwan and Japan draw circles based on their shared system of writing.

Though there's no data from China itself, given the country's Google ban, there is some previous research to support this. A 1985 study of Chinese circle drawing found that 72% of 151 participants drew their circles clockwise, perhaps because of the clockwise strokes in semi-cursive Chinese calligraphy, wrote the researchers.

The similarity between Chinese-based languages is even stronger if we look at another mighty childhood shape, the triangle. A full 97% of Taiwanese triangles and 90% of Japanese and Korean triangles drawn with one stroke were drawn counterclockwise. By comparison, triangles in the US, when drawn with one stroke, were counterclockwise a little more than half the time.

The stroke order in Chinese-based systems dictates that diagonals, like that of a triangle, be drawn right-to-left before left-to-right. This is obvious from the common character A, meaning "person."

There's another major cluster of countries that could help us understand differences in circle-drawing. The United Arab Emirates, Kuwait, Algeria, Jordan, Saudi Arabia, Israel, Iraq, and Egypt huddle together on their plot, falling neatly side by side (with Thailand and Korea in between). Arabic contains quite many curves, and along with Hebrew, is read and written right to left. In Arabic, curves in letters tend clockwise, following the direction of the hand, and help connecting each letter to the next.

If one looks more closely at circle-drawing across the rest of the world, one can also identify other patterns. Korea's Hangul writing system, for example, is full of circles. Of the 1,500 circles collected there, 72% were drawn counterclockwise. You might expect South Korea to fall closer on the spectrum to Taiwan and Japan. But as a rule, circles in Hangul go counterclockwise, the opposite direction of the curves in Chinese or Japan. Likely as a result, South Korea is closer to the rest of the world on this crucial issue.

Or consider Thailand, where 64% went counterclockwise, and whose script is full of circles. Of the 42 consonants, nearly all are written starting with a "head," a tiny loop. The heads can go clockwise or counterclockwise, but there are about twice as many clockwise.

The remaining 50 odd countries tend to draw their circles counterclockwise. Nearly all these countries use the Latin alphabet, which runs left-to-right and is not

especially circular. English has a stroke order, too, though it's far less rigid: perhaps it's writing counterclockwise "c" and "g" over and over as kids that has most of the Latin-alphabet world drawing circles that way.

Of course, while there's a lot of evidence that written languages could influence the way people draw shapes, this theory does not account for everything. Vietnam uses a Latin alphabet like the US and drew 95% of circles counterclockwise, while Hong Kong, which uses a Chinese-based script, drew a hefty 82% counterclockwise circles.

Another potential explanation lies in hand dominance. Perhaps it's that right-handed people naturally tend toward counterclockwise circles, unless their writing systems teach them otherwise. The data from *Quick, Draw!* do not show whether users were right or left-handed, which could strongly affect the directions they drew in. Still, hand dominance doesn't differ greatly from one country to the next, and likely wouldn't account for the large disparity between Taiwan and Japan, and the rest of the world. A 1997 cross-cultural study looked at American students in the US, Japanese students in Japan, and Japanese students living in the US, at different ages: About half of the study's 62 Japanese first-graders drew clockwise, a third drew counterclockwise, and a fifth mixed both. But nearly *all* sixth-graders drew their circles clockwise, which suggested to the researchers that as those children got more exposure to writing, their drawing direction grew more pronounced. In contrast, 64% of American children drew counterclockwise, a percentage that changed only slightly by sixth grade.

But it's not just Japan. A 1973 cross-cultural study looked at how US and Israeli children copied shapes at different ages and found, too, that American children overwhelmingly drew circles counterclockwise. The reverse was true in Israel, where the closest letter to a circle, D, is drawn clockwise, noted the researchers. Americans got more consistent in their drawing direction over time, with 100% of adult participants drawing counterclockwise circles. In Israel, 70% of participants drew circles the other way, across ages.

Together these studies show not only that culture and handwriting shape the way people draws abstract shapes; they also suggest our tendencies get stronger over time. The more we write, the more our habits become ingrained.

Now with 90,000 circles collected from across the world for the same purpose, Ha

and Sonnad have a far bigger and more consistent dataset that could back up what these studies have each shown on a small scale.

If English was your first language, you might have forgotten your early school days, spent precariously gripping a pencil and awkwardly forming huge upper and lowercase letters in the recommended formation. In some languages, these rules aren't bygone memories, but paramount for writing.

In Japanese and Chinese, for example, stroke order is an essential component of writing legibly, and can even signal education level. The modern Chinese stroke order system evolved from clerical script, a system prevalent in the Han dynasty. It simply took too long to write, so as people tried to move faster, the system evolved into clerical running script, a semi-cursive style, and eventually evolving into today's script. According to Huang, the calligrapher, the use of soft brushes to write could have informed some of the contemporary stroke rules.

Japanese draws on the same stroke order guidelines as Chinese. In 1958 the Japanese Ministry of Education set out the country's rules for stroke order, to create a consistent system that avoids confusion. (Today the rules have been relaxed.) "*The way I move the brush or pen, it is very efficient, I think, and it's also pretty,*" says Tomoyo Kamimura, director of the language center at the Japan Society. "*Some adults write in a completely wrong stroke order, but we despise that,*" says Kamimura. "We *consider those people as uneducated.*"

Today, American kids are increasingly being taught a method of print and cursive called Handwriting without Tears. It promotes the "magic c", a counterclockwise curve used in the letters c, g, q, o, among others. A US school, therefore, might promote counterclockwise circles with younger children, to help form the underlying motor skills they'll need to later write their first letters.

There's clearly much more to the simple act of drawing shapes than any of us might imagine. A gesture that American psychologists once assumed was natural and right, it turns out, might look odd, even crass, to a native Japanese speaker.

There are countless ways that we subtly, unconsciously carry our cultures with us: the way we draw, count on our fingers, and imitate real-world sounds, to name a few. That's the delight at the heart of this massive dataset. To test their theories, Ha and Sonnad approached colleagues, friends, and family who write in Japanese, Arabic,

Hebrew, Chinese, Thai, and Vietnamese, and, feeling a bit silly, asked them to draw circles. They gladly jumped in, wondering what their fingers would do, and eager to feel part of something larger.

But there's still plenty we don't know. Interest in shape-drawing seems to have gone out of style in psychology. With one exception, all the research they found on cultural shape-drawing and the torque test was from before 1997. They conclude *that increasingly, people around the world communicate by typing and tapping, but while the art of handwriting might someday get lost all together, perhaps we're already forming a whole new crop of keyboard-led cultural differences.* 



Language emerges from the non-trivial interactions of three dynamical systems operating on three different timescales: individual learning, cultural transmission and biological evolution.

### Language Evolves at Random

Today, if you wanted to talk about something that's clear, you'd say that it has *clarity*. But if you were around in 1890, you would almost certainly have talked about its *clearness*.

Joshua Plotkin first noticed this linguistic change while playing with Google's *Ngram Viewer*, a search engine that charts the frequencies of words across millions of books. The viewer shows that a century ago, *clearness* dominated *clarity*. Now the opposite is true, which is strange because clarity isn't even a regular form. If you wanted to create a noun from clear, clearness would be a more obvious choice. *"Why would there be this big upswing in clarity?"* Plotkin wondered. *"Is there a force promoting clarity in writing?"* It wasn't... clear. But as an evolutionary biologist, Plotkin knew how to find out.

The histories of linguistics and evolutionary biology have been braided together for as long as the latter has existed. Many of the earliest defenders of Darwinism were linguists who saw similarities between the evolution of languages and of species. Darwin himself wrote about these "curious parallels" in The Descent of Man. New words and grammatical rules are continually cropping up, fighting for existence against established forms, and sometimes driving those old forms extinct. "The survival ... of certain favored words in the struggle for existence is natural selection," Darwin wrote.

Darwin, Plotkin says, used the way language changes "to popularize his heretical theory and explain for a broad audience what natural selection means. The process wasn't easy to observe in organisms, but it was easier to see in words." But natural selection is just one force of evolutionary change. Under its influence, genes become more (or less) common because their owners are more (or less) likely to survive and reproduce. Genes can also change in frequency for completely random reasons that have nothing to do with their owner's health or strength—and everything to do with pure, dumb luck. That process is known as <u>drift</u>, and it took decades for evolutionary biologists to recognize that it's just as important for evolution as natural selection.

Linguists are still behind. It's easy to see how languages can change through drift, as

people randomly pick up the words and constructions they overhear. But when Darwin wrote about evolving tongues, he said, "*The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their own inherent virtue.*" That's a view based purely on natural selection, and it persists. "For *the most part, linguists today have a strict Darwinian outlook,*" Plotkin says. "When *they see a change, they think there must be a directional force behind it. But I propose that language change, maybe lots of it, is driven by random chance—by* drift."

To see whether that was true, he and his colleagues developed statistical tests that could distinguish between the influence of drift and of natural selection. They then applied these tests to several online repositories, such the *Corpus of Historical American English*—a digital collection of 400 million words, pulled out of 100,000 texts published over the past 200 years.

The team focused first on the past-tense forms of verbs and found at least six cases where natural selection is clearly in effect. In some cases, the verbs were regularized, losing weird past forms in favor of more-predictable ones that end in –ed. *Woven*, for example, gave way to *weaved*, while *smelt* lost ground to *smelled*. That's not surprising: many linguists have suggested that verbs tend to become more regular over time, perhaps because, like Darwin theorized, these forms are just easier to learn.

But Plotkin found just as many instances where selection drove verbs toward irregularity: *Dived* gave way to *dove*, *lighted* to *lit*, *waked* to *woke*, and *sneaked* to *snuck*.

Why? Perhaps because we like it when words sound alike, and we change our language to accommodate such rhymes. For example, *dove* began to replace *dived* while cars became popular, and *drive/drove* became common parts of English. Similarly, the move from *quitted* to *quit* coincided with the rise of *split*, which became much more widely used when it acquired a new meaning—to leave or depart. In both cases, changes in one irregular verb—*drive* or *split*—may have irregularized others. "*We can't definitively say that's the reason, but it's coincident,*" Plotkin says.

"It gets you to think harder about the motivation for change," says Salikoko Mufwene from the University of Chicago. "The general claim is that there has been an evolution toward regularization, and they're showing that this hasn't always been the case. Now we need to think harder about when irregular forms are favored over regular variants."

That is, if anything is favored at all. The team found that the changes that have befallen the clear majority of our verbs are entirely consistent with drift. You don't need to invoke natural selection to explain why we say *spilled* instead of *spilt, burned* instead of *burnt*, and *knit* instead of *knitted*.

In other cases, drift and natural selection work together to shape languages: Plotkin's team also looked at the rapid rise of do in the 16th century, when phrases like "*You say not*" quickly changed into "*You do not say*." They concluded that at first, the word randomly drifted its way into questions, so that "*Say you*?" gradually became "*Do you say*?" Once it became common, natural selection started pushing it into new contexts like declarative sentences, perhaps because it was easier for people to use it consistently.

The team also analyzed a third and more obscure grammatical change called Jespersen's cycle. In Old English, spoken before the Norman Conquest, speakers would negate a verb by putting a *not* in front of *it*. In Middle English, spoken between the 11<sup>th</sup> and 15<sup>th</sup> centuries, the negatives would surround the verb as they do in modern French (*"Je ne dis pas"*). And in Early Modern English, spoken between the 15<sup>th</sup> and 17<sup>th</sup> centuries, the negative followed the verb—the Shakespearean *"I say not."* Now, we've come full circle, back to *"I don't say."* 

Jespersen's cycle exists in many unrelated languages. In French, for example, the formal "*Je ne dis pas*" is giving way to the colloquial *"Je dis pas."* 

Natural selection still explains Jespersen's cycle far better than drift does. Perhaps it's due to emphasis, Plotkin says. If one form is common, speakers could emphasize their disagreement by adding or subtracting words ("*I don't say that at all*," versus "*I don't say that*"). As the emphatic forms become more common, they lose their sting, and are themselves replaced. These results are part of a wider trend where linguists are starting to use these massive online corpora to address long-standing puzzles in language change. "*This is an excellent trend*," says Jennifer Culbertson, from the University of Edinburgh.

"Linguists have uncovered many really fascinating cases of language change, but the explanations on offer sometimes read like just-so stories. Random processes are simply considering drift, too, linguists could "focus our energies on providing interesting explanations where they are really warranted.""

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What about the change from *clearness* to *clarity*, which set Plotkin onto this quest in the first place? He says that he's found signs of natural selection's hand, but that must wait for another publication. "*There's lots to be done*," he says. "*This is just the beginning of an investigation, which need not stop at written texts. Spoken records are just as ready and ripe for scrutiny*."

# The Language of Colors



Industrialization changed the world's palette, adding an array of synthetic hues to the universal, more natural, color scheme. This shifted human vision and experience, literally adding shades to how we see the world as cultures created more objects in ever more tones.

Still, there's something universal that remains constant and common over peoples and time, it seems, in both simple and complex societies.



In a new study, MIT cognitive scientists have found that languages tend to divide the "warm" part of the color spectrum into more color words, such as orange, yellow, and red, compared to the "cooler" regions, which include blue and green. This pattern, which they found across more than 100 languages, may reflect the fact that most objects that stand out in a scene are warm-colored, while cooler colors such as green and blue tend to be found in backgrounds, the researchers say.

This leads to more consistent labeling of warmer colors by different speakers of the same language, the researchers found.

"When we look at it, it turns out it's the same across every language that we studied. Every language has this amazing similar ordering of colors, so that reds are more consistently communicated than greens or blues," says Edward Gibson, an MIT professor of brain and cognitive sciences and the first author of the study, which appeared in the Proceedings of the National Academy of Sciences the week of Sept. 18, 2017.



MIT researchers have found that languages tend to divide the "warm" part of the color spectrum into more color words than the "cooler" regions, which makes communication of warmer colors more consistent. From left to right, this chart shows the order of most to least efficiently communicated colors, in English, Spanish, and Tsimane' languages.

Gibson began this investigation of color after accidentally discovering during another study that there is a great deal of variation in the way colors are described by members of the Tsimane', a tribe that lives in remote Amazonian regions of Bolivia. He found that most Tsimane' consistently use words for white, black, and red, but there is less agreement among them when naming colors such as blue, green, and yellow.

Working with Conway, who was then an associate professor studying visual perception at Wellesley College, Gibson decided to delve further into this variability. The researchers asked about 40 Tsimane' speakers to name 80 color chips, which were evenly distributed across the visible spectrum of color.

Once they had these data, the researchers applied an information theory technique that allowed them to calculate a feature they called *"surprisal,"* which is a measure of how consistently different people describe, for example, the same color chip with the same color word.

When a specific word (such as "*blue*" or "*green*") is used to describe many color chips, then one of these chips has higher surprisal. Furthermore, chips that people tend to label consistently with just one word have a low surprisal rate, while chips that different people tend to label with different words have a higher surprisal rate. The researchers found that the color chips labeled in Tsimane', English, and Spanish were all ordered such that cool-colored chips had higher average surprisals than warm-colored chips (reds, yellows, and oranges).

The researchers then compared their results to data from the World Color Survey, which performed essentially the same task for 110 languages around the world, all spoken by non-industrialized societies. Across these languages, the researchers found the same pattern.

This reflects the fact that while the warm colors and cool colors occupy a similar amount of space in a chart of the 80 colors used in the test, most languages divide the warmer regions into more color words than the cooler regions. Therefore, there are many more color chips that most people would call *"blue"* than there are chips that

people would define as "yellow" or "red."

"What this means is that human languages divide that space in a skewed way," Gibson says. "In all languages, people preferentially bring color words into the warmer parts of the space and they don't bring them into the cooler colors."

To explore possible explanations for this trend, the researchers analyzed a database of 20,000 images collected and labeled by Microsoft, and they found that objects in the foreground of a scene are more likely to be a warm color, while cooler colors are more likely to be found in backgrounds.

"Warm colors are in the foreground, they're all the stuff that we interact with and want to talk about," Gibson says. "We need to be able to talk about things which are identical except for their color: objects."

Gibson now hopes to study languages spoken by societies found in snowy or desert climates, where background colors are different, to see if their color naming system is different from what he found in this study.

Julie Sedivy, an adjunct associate professor of psychology at the University of Calgary, says the paper makes an important contribution to scientists' ability to study questions such as how culture and language influence how people perceive the world.

"It's a big step forward in establishing a more rigorous approach to asking really important questions that in the past have been addressed in a scientifically flimsy way," says Sedivy, who was not part of the research team. She added that this approach could also be used to study other attributes that are represented by varying numbers of words in different languages, such as odors, tastes, and emotions.

### Your Mother Tongue Will Stay with You



Aamna Mohdin is a reporter for *Quartz*, covering migration, identity, borders, and regional politics. She has covered the refugee crisis extensively, reporting on the refugee football teams in Germany, Scotland, and Italy; the young women surviving the makeshift refugee camp in Calais, France known as "the jungle"; and the parallels between the Kindertransport and the movement to give safe passage to child refugees today. In the December 18, 2017 issue of *Quartz*, Aamna Mohdin authored a most interesting (and moving) article based on her own life experience, and multiple interviews:

Natasha Mumbi Nkonde tells Mohdin she's "*haunted*" by what she sounded like as a child. Nkonde, who was born in Zambia in 1984 and moved to the UK when she was six, remembers speaking two different languages -Bemba and Nyanja. Naturally, she was forced to switch to English once she migrated to Britain. But it wasn't Mother tongue until she returned to Zambia in 2008 (almost 20 years later) that she realized how much her first two languages had eroded away. "*My tongue couldn't get itself* 

*'round the words. I'd be able to understand really clearly what people say to me, but couldn't formulate a sentence,*" says Nkonde, a black feminist working as regional organizer at *The Edge Fund* and co-founder of *The GLC Story.* 

As if it wasn't painful enough coming to terms with the slow erosion of her mother tongue, and how isolating that could be when trying to connect with friends and loved ones in her home country, people accused her of doing it on purpose. Some said she was someone who had returned to Zambia from the UK and now felt *"too good"* to speak her native languages, while others suggested she was just being lazy. But, Nkonde is far from alone.

The loss of a native language is a phenomenon known as **first language attrition**. And though it can evoke surprise and at times outrage, first language attrition is becoming all too common as a greater number of people move around the world. *"Attrition sounds very negative. It invokes this mental image of something grinding away at another and wearing it down. We don't think that's what's actually happening,"* says Monika Schmid, the leading researcher on language attrition currently based at the University of Essex. Schmid doesn't believe the new language eradicates the mother tongue—it's still there, just buried and dormant.

More importantly, a growing body of research suggests that in many cases the language can be recovered. In Britain, teenagers must dissect and analyze a dozen or so poems whilst studying English literature and language in school. While the specific poems studied differ slightly from classroom-to-classroom, many Brits will remember Sujata Bhatt's short yet searing poem, *Search for My Tongue*. Written in both English and Gujarati, the poem encapsulates the fear of losing your native language. Bhatt is an Indian poet who grew up in Pune but migrated to the US when she was 12. In her poem, she describes a war between these two languages, as they compete for dominance. She writes about her anguish as English seems to be winning out, but it's when Bhatt is asleep and vulnerable, when she longs most for home, that her first language asserts itself more powerfully than before. Every time she fears she's forgotten, Gujarati comes flooding back to her.

Mohdin sometimes dream in her native language, Arabic. For a slight moment, she speaks and holds conversations fluently. She then wakes up and is ripped back into the present. The sun rises and she's left confused and trying to piece together sentences. She couldn't speak a word of English until she moved to the UK when she

was seven years old. As Bhatt's poem so aptly put it, her Arabic, was rotting in her mouth as she progressed through school. But she didn't seem to notice or care much as a teenager. Among immigrants, there's a real currency in picking up the language of your host country and losing your previous accent.



Aamda Mohdin

The rapid pace she picked up English was a blessing and effectively fast-tracked her family's assimilation into British society— the welfare system, access to health care, education, and other social services, and they found a stability that appears out of reach to so many other migrants.

Though as a school student, Mohdin could memorize the technique Bhatt uses in her poem for her exam -the repetition, the metaphors, and her use of free verse- it has taken a decade for her to truly understand her fear. She wasn't just scared of losing her first language, but the consequence it would have on her sense of self. Without her native tongue, Bhatt would in many ways be severed from her community. She would be stuck, one foot in two worlds. Though she sounds like the people from her new home; she would still be an outsider; and while she looks like the people of her birthplace, the words tumbling out of her mouth would be alien to them. She would feel disjointed, untethered.

It's a fear Nkonde can relate to. *"I can cook Zambian food; I've lived in Zambia—I feel connected to it. It's my home. But not having the language is the thing that makes me feel the most disconnected,"* Nkonde added.

You don't notice losing your fluency in your native language until it's almost too late. One moment you're telling someone *"Yarhamuk Allah"* after they sneeze, and in the next you're saying, *"bless you."* You don't notice how much of your vocabulary has slipped away until you're suddenly forced to speak in only your native language either because you've traveled or have had a loved one come to visit. But once you notice it's gone, a sense of loss weighs on you more heavily.

"I remember many incidences of not being able to formulate a sentence. And after trying a few times the sentence just comes out wrong," says Jaswinder Blackwell-Pal, a PhD student at Birkbeck University in London and play writer. The words sit on the tip of your tongue, feels close, yet so out of reach. "You don't want to turn around to your grandmother and say a few incoherent words." Blackwell-Pal's parents made the conscious decision to raise her bilingual in England, sending her to Punjabi child minders whilst also attending school in English. Blackwell-Pal was fluent in both languages up until she was 15, when she says she couldn't speak Punjabi anymore. She wasn't sure why, or how, but somewhere between the ages of 11 and 14, her ability to speak Punjabi disappeared. "It's frustrating because you still feel that connection to it. But you don't feel ownership over it," Blackwell adds.

Bhatt's iconic poem isn't very far off from the science. Schmid describes a process where two languages struggle and compete for mental resources. When, for example, an Arabic speaker begins to learn English that person must use quite a bit of mental energy to not use an Arabic word or Arabic sentence structure. When they must focus on saying "bread" and "milk" in English, they have built a mental barrier to block the Arabic version of the words. But then if they want to say the words in Arabic, they must override that inhibitory mechanism. This results in a situation where even common words can be difficult to remember. The barrier is even harder to overcome when the speaker is trying to articulate words or sentences out loud, compared to just understanding what someone is saying. That's why some people find they can easily understand a language but can't speak it.

"It's not that you're forgetting that language; what's happening is that it has been buried and you have to dig it up again and that takes quite a bit of energy," Schmid explains. This inhibitory mechanism is more powerful the greater someone is immersed in a second language.

First language attrition doesn't just affect children. Steffi Graf, Germany's most

famous sports star is one particularly infamous example. In 2007, Graf admitted that she struggles to speak German. She announced this awkwardly whilst receiving the German media award for humanitarian engagement. "Sorry, I cannot speak German so much," she said to the crowd—sparking astonished headlines across the country. Graf's struggle to speak German is even more remarkable considering her history. Born in Germany in 1969, Graf spent her childhood and a significant chunk of her adult life and tennis career there (quickly becoming one of Germany's most influential women). She moved to the US in 2000 with her husband, where she went to raise her family. When she returned, however, she was speaking English fluently, but struggled to properly string together German sentences. Graf isn't a unique case. In 2014, US soldier and prisoner of war Bowe Bergdahl was released after five years in Taliban hands. When he was returned, his family said Bergdahl initially struggled to speak English.

Everything is not lost, though. Depending on your age, you can regain the mastery of your first language. If a child grows up speaking one language, he/she would have acquired the grammatical rules of that language by the age of six, Schmid says. There's a period between the age of six and 11 to 12, where the knowledge of that language is consolidated. *"All these things stabilize and firm up,"* Schmid says. During that period in your life, you reach a point where mastering the language comes together and it locks into place.

But it's also for this reason why children younger than 12 may struggle to retain the characteristics of a native speaker if they move. They might retain some knowledge of their first language, but they'll likely speak it with a foreign accent, littered with grammatical mistakes. If you understand the language, but struggle to speak it, it's not a sign of the *"first language eroding or being totally forgotten,"* Schmid says, adding, *"it's still there and can be reactivated"*—it just needs some attention. The speaker must overcome the inhibitory mechanism that made one language more dominant than the other and overcoming that barrier takes practice and lots of it. For some, that practice means going to a class to learn the grammar and more complex vocabulary that they're struggling to remember. But for others, it means immersing themselves back in their home country or being surrounded with native speakers.

Nkonde returned to Zambia and lived there for several years. She said it would have

been quite a "*strange experience*" to sit down in a class and try to formally relearn hear native languages. It was more "*comfortable*" for her to learn it around other people. The key, Nkonde says, is to allow herself "*to be vulnerable to attempt to speak my language*," pointing to the fact that for so many people the fear of saying something wrong is what keeps them silent. But what if you can't understand the mother tongue at all? Retrieving what's known as the "*birth language*" is unfortunately far more difficult.

There's some evidence to suggest that the language we learn at an early age leaves traces on the brain. A 2014 McGill study found that Chinese children adopted at 12 months by French-speaking families in Canada could respond to so-called "*Chinese tones.*" The study recruited girls aged between nine and 17-years-old and put them into three groups; girls who only spoke French and were never exposed to Chinese; bilingual girls who spoke both French and Chinese; and Chinese adoptee who only spoke French. The girls had to listen to "*pseudo words*" that used the tones found in Chinese languages. The study found that bilingual girls and those who had been exposed to Chinese in early years had the same brain activity when listening to the pseudo words.

But though scientists found that early exposure to Chinese left a demonstrable trace in the brain, it doesn't necessarily mean that these girls have a huge advantage when it comes to re-learning Chinese. Another 2014 study, using Chinese adoptees in the Netherlands, found that while these adoptees were better than monolingual Dutch children at producing Chinese tones, they weren't any better at deciphering the distinction between these tones. The advantage to being exposed to another language in early years, Schmid notes, appears to be limited to *"phonological features.*"

That said, those exposed to a language in their early years might have some advantages. A 2009 study looked at Korean adoptees in Sweden who had spent extensive time learning Korean and lived in Korea for a few years as adults. Researchers found that the group of Korean adoptees did better on phonetic tests than a group of Swedish adults who had also been learning Korean and lived in Korea. The study suggested that while the two groups didn't differ much on ability on some language tests, early exposure to Korean gave the group of adoptees an advantage in other tests. In short, the language we are born hearing, however young, has a very strange way of staying with us.

University is in many ways quite a ruthless introduction to adulthood. Young people must pave a way for themselves; picking their career, the person they want to be, the friends they want to surround themselves with, whilst juggling rent, bills, and their studies. But it's when you're forging a new life for yourself that the past can quietly bleed in.

It was a cold December morning and Mohdin was sat in her partner's kitchen watching snow fall. The small three-bedroom house sat on a quiet cul-de-sac. He had asked what she wanted to eat for breakfast, and she asked for the cereal, cornflakes. He looked confused. "Some what?" he said. "Cornflakes," Mohdin said again. He smiled as an understanding dawned on his face. "You mean cornflakes." It wasn't up to that moment that Mohdin had realized I'd been pronouncing it wrong, saying *corn-furla*kes her whole life. It hadn't come up before. She should have felt embarrassed but ended up smiling. They both laughed. For someone who quickly learnt the English language, mostly through reading, there were countless words she had pronounced incorrectly. Over the years, whenever someone pointed out that she had said the word wrong -it's econ-no-mist, not econno-mis-cist- she would make a mental note on how to say it and practice at home. But there is an array of words that creep up in adulthood that she wouldn't have had to say outside her home and among her family. She holds onto those mistakes now after burying them initially under many mental layers -the seven-year-old girl, who lived, breathed, and consumed Arabic, had found a way to burst through.

Mohdin had called her mom and asked her then to speak to her in only Arabic. Their conversations became an awkward dance where Mohdin would suddenly pause midsentence and ask: *What's the Arabic word for banana? Month? Happiness?* And her mom would answer patiently. She wasn't only slowly relearning her first language but rediscovering her mom's dark sense of humor and her wicked turn of phrase.

Research has shown that how someone feels about a language can also have an impact. In other words, the more positive you feel about language, the easier it is to learn or reclaim. Schmid points to her 2002 study of German-Jewish refugees, which found a link between the amount of persecution a participant had gone through under the Nazi regime, and how much German they were still able to speak. She was

surprised to find that other more obvious factors: the age the refugees were when they left Germany, the amount of German they had spoken once moving, and even whether their partner was German—didn't have a direct link to maintenance of their native language. While some participants were keen to never speak German again (*the language*, they said, *of their oppressors*), others held onto the only thing they had left from their parents and loved ones. It was this that ended up being a major factor on their mastery of German.

Growing up in a post-9/11 world, Mohdin was keen to distance herself from her Arab and Muslim identity. She had swallowed the attitudes of what others had said about her mother tongue; that it was harsh, aggressive, and even angry, and found herself parroting it back to others. But Arabic isn't a cold or brutal language; it's one that feels Mohdin with warmth and comfort. It's the language she wants to love others in; the language she wants to joke in; and the one she feels most raw. When her partner has been away and he returns, she thinks "*wahashtny*" ("*I missed you*") a word with the notorious hard "h" sound that so many English speakers struggle to pronounce and use it as a sign to show the language's "*ugliness*." But it's one that highlights its depth. "*Wahashtny*" the word comes from deep down Mohdin's throat, a guttural sound that erupts within her to express the simultaneous ache and relief to see a loved one once more.

Relearning and regaining your mastery in your mother tongue isn't easy; it's one that takes years and you may never sound like you once did as a child. But it's a journey worth taking. On it, you find that once a stranger, your mother tongue envelopes you once again.

### "We Are the World..."



As always, a horror film managed to express the idea before the scientists ever could, and in better, more visceral terms. "*The television screen*," the haunting image of Brian O'Blivion tells us in David Cronenberg's 1983 classic Videodrome, "is the retina of the mind's eye. Therefore, the television screen is part of the physical structure of the brain."

So far, so much media theory: second-hand McLuhan, third-hand Baudrillard. It's what happens next that's interesting.

Our hero, wilting under the caustic nihilism of the video age, finds that strange things start happening not to his mind, but his *body*. A howling cavern opens in his stomach, rimmed by grisly pulsing labial folds. It eats weapons. His hand sprouts metallic

screws, driving into his wrist, locking his gun into a hand that swells into a grotesque of formless and seeping flesh. He is told to kill, and he kills. It's not that his mind has been invaded. It just exists beyond itself; it now contains endless shelves of video tapes. This is, somehow, obscurely, us; this monstrous body is our own.

Among philosophers, biologists, and cognitive scientists, this nightmare is an exciting new field of study, known as *embodied* or *extended cognition*: broadly, the theory that what we think of as brain processes can take place outside of the brain. In some cases, this isn't a particularly radical idea. The octopus, for instance, has a bizarre and miraculous mind, sometimes inside its brain, sometimes extending beyond it in sucker-tipped trails. Neurons are spread throughout its body; the creature has more of them in its arms than in its brain itself. It's possible that each arm might be, to some extent, an independently thinking creature, all of which are collapsed into an octopean super-consciousness in times of danger. Embodied cognition, though, tells us that we're all more octopus-like than we realize. Our minds are not like the floating conceptual *"I"* imagined by Descartes. We're always thinking with, and inseparable from, our bodies.

The body codes how the brain works, more than the brain controls the body. When we walk—whether taking a pleasant afternoon stroll, or storming off in tears, or trying to sneak into a stranger's house late at night, with intentions that seem to have exploded into our minds from some distant elsewhere—the brain might be choosing where each foot lands, but the way in which it does so is always constrained by the shape of our legs. We can't ever stalk like a creature with triple-jointed legs, or sulk in the dejected crawl of a millipede, or stride with a giraffe's airy gangly indifference. The way in which the brain approaches the task of walking is already coded by the physical layout of the body—and as such, wouldn't it make sense to think of the body as being part of our decision-making apparatus? The mind is not simply the brain, as a generation of biological reductionists, clearing out the old wreckage of what had once been the soul, once insisted. It's not a kind of software being run on the logical-processing unit of the brain. It's bigger, and richer, and grosser, in every sense. It has joints and sinews. The rarefied rational mind sweats and shits; this body, this mound of eventually rotting flesh, is *you*.

That's embodied cognition. Extended cognition is stranger. Many years ago, when the author Sam Kriss found himself standing on the roof of a tall building, or on a

platform of the London Underground, or by the banks of the river, he would feel a strange urge to throw himself off. Not because he was miserable or because he particularly wanted at that moment to die; it was like an itch, an obsessive-compulsive tic, the deep gravitational hunger of the death drive. He would visualize himself falling, stupidly and fatally, for no reason other than to indulge in the most pointless destruction. He would almost savor the feeling of being hemmed in on all sides by ordinary life—commuters on the platform, tourists gawping at the Thames—and at the same time, right on the edge of the void, the domain of gods or nothingness or both. Maybe you've felt the same urge. But he doesn't get it any more. These days, he still sometimes feels that cold vertiginous breath down his neck, but it's not his body Kriss wants to throw down into the void. It's his phone. Isn't the phone, now, part of the physical structure of the brain?

In 1998, 15 years after *Videodrome*, the philosophers and cognitive scientists Andy Clark and David J. Chalmers finally made sense of what was happening in their landmark paper "*The Extended Mind*." The mind, they argue, has no reason to stop at the edges of the body, hemmed in by skin, flapping open and closed with mouths and anuses.

Recent studies have added weight to their provocation: it's been shown that spiders can use their webs to process and store information, essentially *"outsourcing"* mental processes to physical structures. Why is it, Clark and Chalmers ask, that mentally rearranging Scrabble tiles is considered a *"part of action"* rather than a *"part of thought"*?

When we jot something down—a shopping list, maybe—on a piece of paper, aren't we in effect remembering it outside our heads? Most of all, isn't language itself something that's always external to the individual mind? We can't invent our own private languages; as Wittgenstein showed in his *Philosophical Investigations*, we can invent our own words for things, but only as substitutes for words that already exist; it's impossible to make the incommunicable meaningful. Language sits hazy in the world, a symbolic and intersubjective ether, but at the same time it forms the substance of our thought and the structure of our understanding. *Isn't language thinking for us*?

This is not, entirely, a new idea. Plato, in his *Phaedrus*, is hesitant or even afraid of writing, precisely because it's a kind of artificial memory, a hypomnesis. (Incidentally

Freud inverts the metaphor 2,000 years later: the unconscious mind is like a child's toy, the Mystic Writing Pad.) Writing, for Plato, is a *pharmakon*, a "*remedy*" for forgetfulness, but if taken in too strong a dose it becomes a poison: a person no longer remembers things for themselves; it's the text that remembers, with an unholy autonomy. The same criticisms are now commonly made of smartphones. Not much changes.

Most of all, though, a theory like extended cognition is present in the work of Hegel and his descendants - and Marx. In the dialectical tradition, the hermetic and selfcontained Cartesian consciousness is impossible: we only become conscious in and through the world and its history. Marx, in the Economic and Philosophic Manuscripts of 1844, describes the process of unalienated labor in familiar terms. "The object of labor is, therefore, the objectification of man's species life: for he ... contemplates himself *in a world that he has created.*" Work, without ownership or scarcity, is a kind of play: you're always turning the exterior world into something else, something more responsive to your needs and your being. In a liberated future, the world of objects can be an externalization of our own consciousness; it can be a true home for humanity, because it is already ourselves. But not yet; first we must overthrow capitalism. In the 20th century, Theodor Adorno picks up this theme: the "separation between subject and object" exists -I am not the world around me, in fact for the most part I'm terrified by it while it's monstrously indifferent to me- but this is "the result of a coercive historical process." It wasn't always this way; it doesn't have to be forever. The difference is that, according to theories of extended cognition, this separation is already over and always was, that subject and object are united right now.

But not entirely. Extended cognition promises to rip up the idea of a mind that lives only in the furrows of the brain, but it doesn't always follow through. Cognition is extended, outsourced, leaking from cranial slime into the material world -but like an octopus's tentacle, it can always dart back in. There are stranger and more dangerous possibilities. Take the grocery list. For Clark and Chalmers, it's a brain process - information storage and retrieval- offloaded onto a piece of paper. But by *whom*? In *Limited Inc.,* Jacques Derrida uses the same object to construct a very different interpretation. "At the very moment 'I' make a shopping list," he writes, "I know that it will only be a list if it implies my absence, if it already detaches itself from me to function

*beyond my 'present' act and if it is utilizable at another time, in the absence of my beingpresent-now.*" The list will still do its cognitive work if you are not currently reading it. The list will still do its work if you are dead. If we can accept that a grocery list is in some way thinking, is the part of the mental apparatus that remains lodged in the human brain so central? The thought capacity of objects is indifferent to whichever bit of brain is plugged into it. A war memorial remembers its list of the dead for us, in the same way that a scrap of paper remembers milk, and it keeps remembering, long after the weeds have grown and the rest of the world has tumbled past caring.

In *Molloy*, Samuel Beckett's strange and gorgeous thicket of a novel, a long section sees the titular character sheltering by a beach, trying to work out a system for passing sucking stones between his various pockets and his mouth, so that he never sucks on the same stone twice. Fantastic methods are devised, new ways of ordering the world: stones moving around by fours across the ordered and Ptolemaic universe of his coat; stones moving singly in postmodern disorder. Is it *Molloy* who is thinking here, or the system, the dynamic complex of pockets and stones? This passage has attracted a fair amount of attention from philosophers, who tend to see it as either a parody of logical systems in general or a form of thought beyond reason. Deleuze and Guattari, in *Anti-Oedipus*, see in it the model of a new kind of reasoning: schizoid, unbodied, and diffuse. Molloy's circulation of pebbles is a "complete machine," one in which "the mouth, too, plays a role as a stone-sucking machine."

We're used to thinking of active machines as digital machines; when we talk about the possibility that unliving things might think, we mean computers. We might be very shortsighted. All the processes we attribute to brains and computers alone might fill the world. In the same way that the legs code the program of walking, unknown information is inscribed in the patterns of grains of sand as the wind tosses them on an empty beach; the frenetic interconnections of the internet and the spoken world are thrumming in a field of grass. The thinking machine thinks; it has its processes and its functions. And the world of inert objects might think too, in slow and strange ways which we can only borrow for a moment, and which disappear again into what sounds like silence.

# "The Limits of My Language Mean the Limits of My World"

#### Ludwig Wittgenstein

Lots of people –way too many! - *speak to say nothing*; their babble is empty, useless, irrelevant; it just shows their awareness, their sociability, that they have a mind (???) in working order. At times, my family claims that I am just one of these. It should be true since I am not addressing myself, but my loved ones.

This zigzagging compilation (much of it *verbatim*) is an attempt to show the progress we have made, the knowledge we have acquired –but also the universe that remains unexplored; the connection we ignore; the infinite complexity of our neural networks and the ever-changing social, inner and surrounding unpredictable events. The Task is far from complete; will Artificial Intelligence help? Probably. But we know, discover, and fear built-in dangers. AI still depends on human brains, minds and algorithms, with all their known (and unknown or wicked) weaknesses. Language is what makes us humans. We should be proud of it in its diversity, but Language is also the *something wicked this way comes.* The pullulation of fake news and the falsification of scientific information –under the disguise of the language of *truth-* are just two recent examples of our conundrums. We depend on language – ours, theirs, all of them- but sorting the grain from the chaff has become overwhelming. And it's getting worse. I wish you Hope –and Success.



## Acknowledgements

This essay, as mentioned above, is an homage to linguists (including my wife Emiko) who are from their discipline opening our minds, our world, and promoting understanding between individuals, peoples and groups that would otherwise ignore, scorn, fight or even kill each other. We know that (too) many political leaders bask in their crass ignorance, and we all suffer from their illiteracy and callowness. We all share one planet and belong to one race. Knowledge is, can and should be power –and language is its medium.

Thanks again to Yves P. Huin, whose skills as webmaster extirpate my lucubrations from my rural corner of California and deliver it to the Internet.

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