

THE
INFORMATION

A History

A Theory

A Flood

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2 | THE PERSISTENCE OF THE WORD

(There Is No Dictionary in the Mind)

*Odysseus wept when he heard the poet sing of his great deeds
abroad because, once sung, they were no longer his alone. They
belonged to anyone who heard the song.*

—Ward Just (2004)

“TRY TO IMAGINE,” proposed Walter J. Ong, Jesuit priest, philosopher, and cultural historian, “a culture where no one has ever ‘looked up’ anything.” To subtract the technologies of information internalized over two millennia requires a leap of imagination backward into a forgotten past. The hardest technology to erase from our minds is the first of all: writing. This arises at the very dawn of history, as it must, because the history begins with the writing. The pastness of the past depends on it.

It takes a few thousand years for this mapping of language onto a system of signs to become second nature, and then there is no return to naïveté. Forgotten is the time when our very awareness of words came from *seeing* them. “In a primary oral culture,” as Ong noted,

the expression “to look up something” is an empty phrase: it would have no conceivable meaning. Without writing, words as such have no visual presence, even when the objects they represent are visual. They are sounds. You might “call” them back—“recall” them. But there is nowhere to “look” for them. They have no focus and no trace.

In the 1960s and ’70s, Ong declared the electronic age to be a new age of orality—but of “secondary orality,” the spoken word amplified and

extended as never before, but always in the context of literacy: voices heard against a background of ubiquitous print. The first age of orality had lasted quite a bit longer. It covered almost the entire lifetime of the species, writing being a late development, general literacy being almost an afterthought. Like Marshall McLuhan, with whom he was often compared (“the other eminent Catholic-electronic prophet,” said a scornful Frank Kermode), Ong had the misfortune to make his visionary assessments of a new age just before it actually arrived. The new media seemed to be radio, telephone, and television. But these were just the faint glimmerings in the night sky, signaling the light that still lay just beyond the horizon. Whether Ong would have seen cyberspace as fundamentally oral or literary, he would surely have recognized it as transformative: not just a revitalization of older forms, not just an amplification, but something wholly new. He might have sensed a coming discontinuity akin to the emergence of literacy itself. Few understood better than Ong just how profound a discontinuity that had been.

When he began his studies, “oral literature” was a common phrase. It is an oxymoron laced with anachronism; the words imply an all-too-unconscious approach to the past by way of the present. Oral literature was generally treated as a variant of writing; this, Ong said, was “rather like thinking of horses as automobiles without wheels.”

You can, of course, undertake to do this. Imagine writing a treatise on horses (for people who have never seen a horse) which starts with the concept not of “horse” but of “automobile,” built on the readers’ direct experience of automobiles. It proceeds to discourse on horses by always referring to them as “wheelless automobiles,” explaining to highly automobilized readers all the points of difference. . . . Instead of wheels, the wheelless automobiles have enlarged toenails called hooves; instead of headlights, eyes; instead of a coat of lacquer, something called hair; instead of gasoline for fuel, hay, and so on. In the end, horses are only what they are not.

When it comes to understanding the preliterate past, we modern folk are hopelessly automobilized. The written word is the mechanism by

which we know what we know. It organizes our thought. We may wish to understand the rise of literacy both historically and logically, but history and logic are themselves the products of literate thought.

Writing, as a technology, requires premeditation and special art. Language is not a technology, no matter how well developed and efficacious. It is not best seen as something separate from the mind; it is what the mind does. "Language in fact bears the same relationship to the concept of mind that legislation bears to the concept of parliament," says Jonathan Miller: "it is a competence forever bodying itself in a series of concrete performances." Much the same might be said of writing—it is concrete performance—but when the word is instantiated in paper or stone, it takes on a separate existence as artifice. It is a product of tools, and it is a tool. And like many technologies that followed, it thereby inspired immediate detractors.

One unlikely Luddite was also one of the first long-term beneficiaries. Plato (channeling the nonwriter Socrates) warned that this technology meant impoverishment:

For this invention will produce forgetfulness in the minds of those who learn to use it, because they will not practice their memory. Their trust in writing, produced by external characters which are no part of themselves, will discourage the use of their own memory within them. You have invented an elixir not of memory, but of reminding; and you offer your pupils the appearance of wisdom, not true wisdom.

External characters which are no part of themselves—this was the trouble. The written word seemed insincere. Ersatz scratchings on papyrus or clay were far abstracted from the real, the free-flowing sound of language, intimately bound up with thought so as to seem coterminous with it. Writing appeared to draw knowledge away from the person, to place their memories in storage. It also separated the speaker from the listener, by so many miles or years. The deepest consequences of writing, for the individual and for the culture, could hardly have been foreseen,

but even Plato could see some of the power of this disconnection. The one speaks to the multitude. The dead speak to the living, the living to the unborn. As McLuhan said, "Two thousand years of manuscript culture lay ahead of the Western world when Plato made this observation." The power of this first artificial memory was incalculable: to restructure thought, to engender history. It is still incalculable, though one statistic gives a hint: whereas the total vocabulary of any oral language measures a few thousand words, the single language that has been written most widely, English, has a documented vocabulary of well over a million words, a corpus that grows by thousands of words a year. These words do not exist only in the present. Each word has a provenance and a history that melts into its present life.

With words we begin to leave traces behind us like breadcrumbs: memories in symbols for others to follow. Ants deploy their pheromones, trails of chemical information; Theseus unwound Ariadne's thread. Now people leave paper trails. Writing comes into being to retain information across time and across space. Before writing, communication is evanescent and local; sounds carry a few yards and fade to oblivion. The evanescence of the spoken word went without saying. So fleeting was speech that the rare phenomenon of the echo, a sound heard once and then again, seemed a sort of magic. "This miraculous rebounding of the voice, the Greeks have a pretty name for, and call it Echo," wrote Pliny. "The spoken symbol," as Samuel Butler observed, "perishes instantly without material trace, and if it lives at all does so only in the minds of those who heard it." Butler was able to formulate this truth just as it was being falsified for the first time, at the end of the nineteenth century, by the arrival of the electric technologies for capturing speech. It was precisely because it was no longer completely true that it could be clearly seen. Butler completed the distinction: "The written symbol extends infinitely, as regards time and space, the range within which one mind can communicate with another; it gives the writer's mind a life limited by the duration of ink, paper, and readers, as against that of his flesh and blood body."

But the new channel does more than extend the previous channel. It enables reuse and “re-collection”—new modes. It permits whole new architectures of information. Among them are history, law, business, mathematics, and logic. Apart from their content, these categories represent new techniques. The power lies not just in the knowledge; preserved and passed forward, valuable as it is, but in the methodology: encoded visual indications, the act of transference, substituting signs for things. And then, later, signs for signs.

Paleolithic people began at least 30,000 years ago to scratch and paint shapes that recalled to the eye images of horses, fishes, and hunters. These signs in clay and on cave walls served purposes of art or magic, and historians are loath to call them writing, but they began the recording of mental states in external media. In another way, knots in cords and notches in sticks served as aids to memory. These could be carried as messages. Marks in pottery and masonry could signify ownership. Marks, images, pictographs, petroglyphs—as these forms grew stylized, conventional, and thus increasingly abstract, they approached what we understand as writing, but one more transition was crucial, from the representation of things to the representation of spoken language: that is, representation twice removed. There is a progression from pictographic, *writing the picture*; to ideographic, *writing the idea*; and then logographic, *writing the word*.

Chinese script began this transition between 4,500 and 8,000 years ago: signs that began as pictures came to represent meaningful units of sound. Because the basic unit was the word, thousands of distinct symbols were required. This is efficient in one way, inefficient in another. Chinese unifies an array of distinct spoken languages: people who cannot speak to one another can write to one another. It employs at least fifty thousand symbols, about six thousand commonly used and known to most literate Chinese. In swift diagrammatic strokes they encode multidimensional semantic relationships. One device is

simple repetition: *tree + tree + tree = forest*; more abstractly, *sun + moon = brightness* and *east + east = everywhere*. The process of compounding creates surprises: *grain + knife = profit*; *hand + eye = look*. Characters can be transformed in meaning by reorienting their elements: *child* to *childbirth* and *man* to *corpse*. Some elements are phonetic; some even punning. The entirety is the richest and most complex writing system that humanity has ever evolved. Considering scripts in terms of how many symbols are required and how much meaning each individual symbol conveys, Chinese thus became an extreme case: the largest set of symbols, and the most meaningful individually. Writing systems could take alternative paths: fewer symbols, each carrying less information. An intermediate stage is the syllabary, a phonetic writing system using individual characters to represent syllables, which may or may not be meaningful. A few hundred characters can serve a language.

The writing system at the opposite extreme took the longest to emerge: the alphabet, one symbol for one minimal sound. The alphabet is the most reductive, the most subversive of all scripts.

In all the languages of earth there is only one word for *alphabet* (*alfabet*, *alfabeto*, алфавит, αλφάβητο). The alphabet was invented only once. All known alphabets, used today or found buried on tablets and stone, descend from the same original ancestor, which arose near the eastern littoral of the Mediterranean Sea, sometime not much before 1500 BCE, in a region that became a politically unstable crossroads of culture, covering Palestine, Phoenicia, and Assyria. To the east lay the great civilization of Mesopotamia, with its cuneiform script already a millennium old; down the shoreline to the southwest lay Egypt, where hieroglyphics developed simultaneously and independently. Traders traveled, too, from Cyprus and Crete, bringing their own incompatible systems. With glyphs from Minoan, Hittite, and Anatolian, it made for a symbolic stew. The ruling priestly classes were invested in their writing systems. Whoever owned the scripts owned the laws and the rites. But self-preservation had to compete with the desire for rapid communication. The scripts were

conservative; the new technology was pragmatic. A stripped-down symbol system, just twenty-two signs, was the innovation of Semitic peoples in or near Palestine. Scholars naturally look to Kiriath-sepher, translatable as "city of the book," and Byblos, "city of papyrus," but no one knows exactly, and no one can know. The paleographer has a unique bootstrap problem. It is only writing that makes its own history possible. The foremost twentieth-century authority on the alphabet, David Diringer, quoted an earlier scholar: "There never was a man who could sit down and say: 'Now I am going to be the first man to write.'"

The alphabet spread by contagion. The new technology was both the virus and the vector of transmission. It could not be monopolized, and it could not be suppressed. Even children could learn these few, lightweight, semantically empty letters. Divergent routes led to alphabets of the Arab world and of northern Africa; to Hebrew and Phoenician; across central Asia, to Brahmi and related Indian script; and to Greece. The new civilization arising there brought the alphabet to a high degree of perfection. Among others, the Latin and Cyrillic alphabets followed along.

Greece had not needed the alphabet to create literature—a fact that scholars realized only grudgingly, beginning in the 1930s. That was when Milman Parry, a structural linguist who studied the living tradition of oral epic poetry in Bosnia and Herzegovina, proposed that the *Iliad* and the *Odyssey* not only could have been but must have been composed and sung without benefit of writing. The meter, the formulaic redundancy, in effect the very poetry of the great works served first and foremost to aid memory. Its incantatory power made of the verse a time capsule, able to transmit a virtual encyclopedia of culture across generations. His argument was first controversial and then overwhelmingly persuasive—but only because the poems *were* written down, sometime in the sixth or seventh century BCE. This act—the transcribing of the Homeric epics—echoes through the ages. "It was something like a thunder-clap in human history, which the bias of familiarity has converted into the rustle of papers on a desk," said Eric

Havelock, a British classical scholar who followed Parry. "It constituted an intrusion into culture, with results that proved irreversible. It laid the basis for the destruction of the oral way of life and the oral modes of thought."

The transcription of Homer converted this great poetry into a new medium and made of it something unplanned: from a momentary string of words created every time anew by the rhapsode and fading again even as it echoed in the listener's ear, to a fixed but portable line on a papyrus sheet. Whether this alien, dry mode would suit the creation of poetry and song remained to be seen. In the meantime the written word helped more mundane forms of discourse: petitions to the gods, statements of law, and economic agreements. Writing also gave rise to discourse about discourse. Written texts became objects of a new sort of interest.

But how was one to speak about them? The words to describe the elements of this discourse did not exist in the lexicon of Homer. The language of an oral culture had to be wrenched into new forms; thus a new vocabulary emerged. Poems were seen to have *topics*—the word previously meaning "place." They possessed *structure*, by analogy with buildings. They were made of *plot* and *diction*. Aristotle could now see the works of the bards as "representations of life," born of the natural impulse toward imitation that begins in childhood. But he had also to account for other writing with other purposes—the Socratic dialogues, for example, and medical or scientific treatises—and this general type of work, including, presumably, his own, "happens, up to the present day, to have no name." Under construction was a whole realm of abstraction, forcibly divorced from the concrete. Havelock described it as cultural warfare, a new consciousness and a new language at war with the old consciousness and the old language: "Their conflict produced essential and permanent contributions to the vocabulary of all abstract thought. Body and space, matter and motion, permanence and change, quality and quantity, combination and separation, are among the counters of common currency now available."

Aristotle himself, son of the physician to the king of Macedonia and an avid, organized thinker, was attempting to systematize knowledge. The persistence of writing made it possible to impose structure on what was known about the world and, then, on what was known about knowing. As soon as one could set words down, examine them, look at them anew the next day, and consider their meaning, one became a philosopher, and the philosopher began with a clean slate and a vast project of definition to undertake. Knowledge could begin to pull itself up by the bootstraps. For Aristotle the most basic notions were worth recording and were necessary to record:

A beginning is that which itself does not follow necessarily from anything else, but some second thing naturally exists or occurs after it. Conversely, an *end* is that which does itself naturally follow from something else, either necessarily or in general, but there is nothing else after it. A *middle* is that which itself comes after something else, and some other thing comes after it.

These are statements not about experience but about the uses of language to structure experience. In the same way, the Greeks created *categories* (this word originally meaning “accusations” or “predictions”) as a means of classifying animal species, insects, and fishes. In turn, they could then classify ideas. This was a radical, alien mode of thought. Plato had warned that it would repel most people:

The multitude cannot accept the idea of beauty in itself rather than many beautiful things, nor anything conceived in its essence instead of the many specific things. Thus the multitude cannot be philosophic.

For “the multitude” we may understand “the preliterate.” They “lose themselves and wander amid the multiplicities of multifarious things,” declared Plato, looking back on the oral culture that still surrounded him. They “have no vivid pattern in their souls.”

And what vivid pattern was that? Havelock focused on the process of converting, mentally, from a “prose of narrative” to a “prose of ideas”; organizing experience in terms of categories rather than events; embracing the discipline of abstraction. He had a word in mind for this process, and the word was *thinking*. This was the discovery, not just of the self, but of the *thinking* self—in effect, the true beginning of consciousness.

In our world of ingrained literacy, thinking and writing seem scarcely related activities. We can imagine the latter depending on the former, but surely not the other way around: everyone thinks, whether or not they write. But Havelock was right. The written word—the persistent word—was a prerequisite for conscious thought as we understand it. It was the trigger for a wholesale, irreversible change in the human psyche—*psyche* being the word favored by Socrates/Plato as they struggled to understand. Plato, as Havelock puts it,

is trying for the first time in history to identify this group of general mental qualities, and seeking for a term which will label them satisfactorily under a single type. . . . He it was who hailed the portent and correctly identified it. In, so doing, he so to speak confirmed and clinched the guesses of a previous generation which had been feeling its way towards the *idea* that you could “think,” and that thinking was a very special kind of psychic activity, very uncomfortable, but also very exciting, and one which required a very novel use of Greek.

Taking the next step on the road of abstraction, Aristotle deployed categories and relationships in a regimented order to develop a symbolism of reasoning: logic—from *λόγος*, *logos*, the not-quite-translatable word from which so much flows, meaning “speech” or “reason” or “discourse” or, ultimately, just “word.”

Logic might be imagined to exist independent of writing—syllogisms can be spoken as well as written—but it did not. Speech is too fleeting to allow for analysis. Logic descended from the written word, in Greece as well as India and China, where it developed independently. Logic turns

the act of abstraction into a tool for determining what is true and what is false: truth can be discovered in words alone, apart from concrete experience. Logic takes its form in chains: sequences whose members connect one to another. Conclusions follow from premises. These require a degree of constancy. They have no power unless people can examine and evaluate them. In contrast, an oral narrative proceeds by accretion, the words passing by in a line of parade past the viewing stand, briefly present and then gone, interacting with one another via memory and association. There are no syllogisms in Homer. Experience is arranged in terms of events, not categories. Only with writing does narrative structure come to embody sustained rational argument. Aristotle crossed another level, by seeing the study of such argument—not just the use of argument, but its study—as a tool. His logic expresses an ongoing self-consciousness about the words in which they are composed. When Aristotle unfurls premises and conclusions—*If it is possible for no man to be a horse, it is also admissible for no horse to be a man; and if it is admissible for no garment to be white, it is also admissible for nothing white to be a garment. For if any white thing must be a garment, then some garment will necessarily be white*—he neither requires nor implies any personal experience of horses, garments, or colors. He has departed that realm. Yet he claims through the manipulation of words to create knowledge anyway, and a superior brand of knowledge at that.

“We know that formal logic is the invention of Greek culture after it had interiorized the technology of alphabetic writing,” Walter Ong says—it is true of India and China as well—“and so made a permanent part of its noetic resources the kind of thinking that alphabetic writing made possible.” For evidence Ong turns to fieldwork of the Russian psychologist Aleksandr Romanovich Luria among illiterate peoples in remote Uzbekistan and Kyrgyzstan in Central Asia in the 1930s. Luria found striking differences between illiterate and even slightly literate subjects, not in what they knew, but in how they thought. Logic implicates symbolism directly: things are members of classes; they possess qualities,

which are abstracted and generalized. Oral people lacked the categories that become second nature even to illiterate individuals in literate cultures: for example, for geometrical shapes. Shown drawings of circles and squares, they named them as “plate, sieve, bucket, watch, or moon” and “mirror, door, house, apricot drying board.” They could not, or would not, accept logical syllogisms. A typical question:

In the Far North, where there is snow, all bears are white.

Novaya Zembla is in the Far North and there is always snow there.

What color are the bears?

Typical response: “I don’t know. I’ve seen a black bear. I’ve never seen any others. . . . Each locality has its own animals.”

By contrast, a man who has just learned to read and write responds, “To go by your words, they should all be white.” To go by your words—in that phrase, a level is crossed. The information has been detached from any person, detached from the speaker’s experience. Now it lives in the words, little life-support modules. Spoken words also transport information, but not with the self-consciousness that writing brings. Literate people take for granted their own awareness of words, along with the array of word-related machinery: classification, reference, definition. Before literacy, there is nothing obvious about such techniques. “Try to explain to me what a tree is,” Luria says, and a peasant replies, “Why should I? Everyone knows what a tree is, they don’t need me telling them.”

“Basically the peasant was right,” Ong comments. “There is no way to refute the world of primary orality. All you can do is walk away from it into literacy.”

It is a twisting journey from things to words, from words to categories, from categories to metaphor and logic. Unnatural as it seemed to define *tree*, it was even trickier to define *word*, and helpful ancillary words like *define* were not at first available, the need never having existed. “In the infancy of logic, a form of thought has to be invented before the content

can be filled up," said Benjamin Jowett, Aristotle's nineteenth-century translator. Spoken languages needed further evolution.

Language and reasoning fit so well that users could not always see the flaws and gaps. Still, as soon as any culture invented logic, paradoxes appeared. In China, nearly contemporaneously with Aristotle, the philosopher Gongsun Long captured some of these in the form of a dialogue, known as "When a White Horse Is Not a Horse." It was written on bamboo strips, tied with string, before the invention of paper. It begins:

Can it be that a white horse is not a horse?

It can.

How?

"Horse" is that by means of which one names the shape. "White" is that by means of which one names the color. What names the color is not what names the shape. Hence, I say that a white horse is not a horse.

On its face, this is unfathomable. It begins to come into focus as a statement about language and logic. Gongsun Long was a member of the Mingjia, the School of Names, and his delving into these paradoxes formed part of what Chinese historians call the "language crisis," a running debate over the nature of language. Names are not the things they name. Classes are not coextensive with subclasses. Thus innocent-seeming inferences get derailed: "a man dislikes white horses" does not imply "a man dislikes horses."

You think that horses that are colored are not horses. In the world, it is not the case that there are horses with no color. Can it be that there are no horses in the world?

The philosopher shines his light on the process of abstracting into classes based on properties: whiteness; horsiness. Are these classes part of reality, or do they exist only in language?

Horses certainly have color. Hence, there are white horses. If it were the case that horses had no color, there would simply be horses, and then how could one select a white horse? A white horse is a horse and white. A horse and a white horse are different. Hence, I say that a white horse is not a horse.

Two millennia later, philosophers continue to struggle with these texts. The paths of logic into modern thought are roundabout, broken, and complex. Since the paradoxes seem to be in language, or about language, one way to banish them was to purify the medium: eliminate ambiguous words and woolly syntax, employ symbols that were rigorous and pure. To turn, that is, to mathematics. By the beginning of the twentieth century, it seemed that only a system of purpose-built symbols could make logic work properly—free of error and paradoxes. This dream was to prove illusory; the paradoxes would creep back in, but no one could hope to understand until the paths of logic and mathematics converged.

Mathematics, too, followed from the invention of writing. Greece is often thought of as the springhead for the river that becomes modern mathematics, with all its many tributaries down the centuries. But the Greeks themselves alluded to another tradition—to them, ancient—which they called Chaldean, and which we understand to be Babylonian. That tradition vanished into the sands, not to surface until the end of the nineteenth century, when tablets of clay were dug up from the mounds of lost cities.

First there were scores, then thousands of tablets, typically the size of a human hand, etched with a distinctive, edgy, angular writing called cuneiform, "wedge shaped." Mature cuneiform was neither pictographic (the symbols were spare and abstract) nor alphabetic (they were far too numerous). By 3000 BCE a system with about seven hundred symbols flourished in Uruk, the walled city, probably the largest in the world, home of the



A CUNEIFORM TABLET

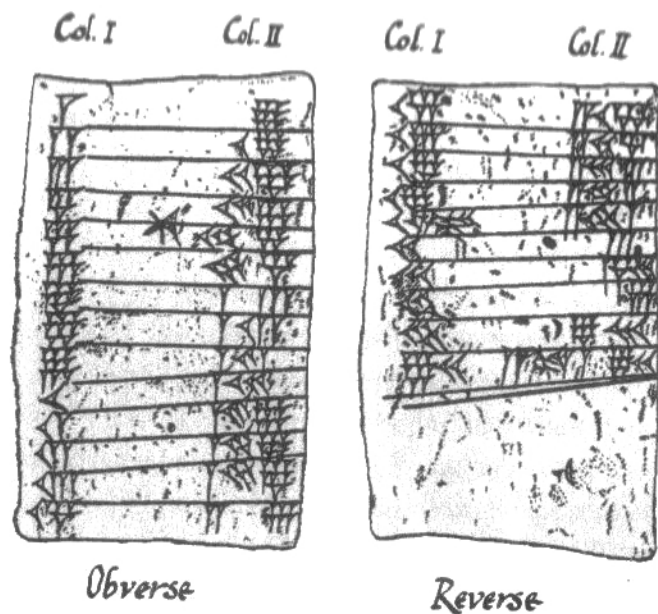
hero-king Gilgamesh, in the alluvial marshes near the Euphrates River. German archeologists excavated Uruk in a series of digs all through the twentieth century. The materials for this most ancient of information technologies lay readily at hand. With damp clay held in one hand and a stylus of sharpened reed in the other, a scribe would imprint tiny characters in columns and rows.

The result: cryptic messages from an alien culture. They took generations to decipher. "Writing, like a theater curtain going up on these dazzling civilizations, lets us stare directly but imperfectly at them," writes the psychologist Julian Jaynes. Some Europeans took umbrage at first. "To the Assyrians, the Chaldeans, and Egyptians," wrote the seventeenth-century divine Thomas Sprat, "we owe the Invention" but also the "Corruption of knowledge," when they concealed it with their strange scripts. "It was the custom of their Wise men, to wrap up their Observations on Nature, and the Manners of Men, in the dark Shadows of *Hieroglyphicks*" (as though friendlier ancients would have used an alphabet more familiar to Sprat). The earliest examples of cuneiform baffled archeologists and paleolinguists the longest, because the first language to be written, Sumerian, left no other traces in culture or speech. Sumerian turned out to be a linguistic rarity, an isolate, with no known descendants. When scholars did learn to read the Uruk tablets, they found them to be, in their way, humdrum: civic memoranda, contracts and laws, and receipts and bills for barley, livestock, oil, reed mats, and pottery. Nothing like poetry or literature appeared in cuneiform for hundreds of years to come. The tablets were the quotidian of nascent commerce and bureaucracy. The tablets not only recorded the commerce and the bureaucracy but, in the first place, made them possible.

Even then, cuneiform incorporated signs for counting and measurement. Different characters, used in different ways, could denote numbers and weights. A more systematic approach to the writing of numbers did not take shape until the time of Hammurabi, 1750 BCE, when Mesopotamia was unified around the great city of Babylon. Hammurabi himself was probably the first literate king, writing his own cuneiform rather than depending on scribes, and his empire building manifested the connection between writing and social control. "This process of conquest and influence is made possible by letters and tablets and stelae in an abundance that had never been known before," Jaynes declares. "Writing was a new method of civil direction, indeed the model that begins our own memo-communicating government."

The writing of numbers had evolved into an elaborate system. Numerals were composed of just two basic parts, a vertical wedge for 1 (|) and an angle wedge for 10 (◁). These were combined to form the standard characters, so that ||| represented 3 and ◁||| represented 16, and so on. But the Babylonian system was not decimal, base 10; it was sexagesimal, base 60. Each of the numerals from 1 to 60 had its own character. To form large numbers, the Babylonians used numerals in places: |◁ was 70 (one 60 plus ten 1s); |◁||| was 616 (ten 60s plus sixteen 1s), and so on. None of this was clear when the tablets first began to surface. A basic theme with variations, encountered many times, proved to be multiplication tables. In a sexagesimal system these had to cover the numbers from 1 to 19 as well as 20, 30, 40, and 50. Even more difficult to unravel were tables of reciprocals, making possible division and fractional numbers: in the 60-based system, reciprocals were 2:30, 3:20, 4:15, 5:12 . . . and then, using extra places, 8:7,30, 9:6,40, and so on.*

* It is customary to transcribe a two-place sexagesimal cuneiform number with a comma—such as "7,30." But the scribes did not use such punctuation, and in fact their notation left the place values undefined; that is, their numbers were what we would call "floating point." A two-place number like 7,30 could be 450 (seven 60s + thirty 1s) or $7\frac{1}{2}$ (seven 1s + thirty $1/60$ s).



A MATHEMATICAL TABLE ON A CUNEIFORM TABLET
ANALYZED BY ASGER AABOE

These symbols were hardly words—or they were words of a peculiar, slender, rigid sort. They seemed to arrange themselves into visible patterns in the clay, repetitious, almost artistic, not like any prose or poetry archeologists had encountered. They were like maps of a mysterious city. This was the key to deciphering them, finally: the ordered chaos that seems to guarantee the presence of meaning. It seemed like a task for mathematicians, anyway, and finally it was. They recognized geometric progressions, tables of powers, and even instructions for computing square roots and cube roots. Familiar as they were with the rise of mathematics a millennium later in ancient Greece, these scholars were astounded at the breadth and depth of mathematical knowledge that existed before in Mesopotamia. “It was assumed that the Babylonians had had some sort of number mysticism or numerology,” wrote Asger Aaboe in 1963, “but we now know how far short of the truth this assumption was.” The Babylonians computed linear equations, quadratic equations, and Pythagorean numbers long before Pythagoras. In

contrast to the Greek mathematics that followed, Babylonian mathematics did not emphasize geometry, except for practical problems; the Babylonians calculated areas and perimeters but did not prove theorems. Yet they could (in effect) reduce elaborate second-degree polynomials. Their mathematics seemed to value computational power above all.

That could not be appreciated until computational power began to mean something. By the time modern mathematicians turned their attention to Babylon, many important tablets had already been destroyed or scattered. Fragments retrieved from Uruk before 1914, for example, were dispersed to Berlin, Paris, and Chicago and only fifty years later were discovered to hold the beginning methods of astronomy. To demonstrate this, Otto Neugebauer, the leading twentieth-century historian of ancient mathematics, had to reassemble tablets whose fragments had made their way to opposite sides of the Atlantic Ocean. In 1949, when the number of cuneiform tablets housed in museums reached (at his rough guess) a half million, Neugebauer lamented, “Our task can therefore properly be compared with restoring the history of mathematics from a few torn pages which have accidentally survived the destruction of a great library.”

In 1972, Donald Knuth, an early computer scientist at Stanford, looked at the remains of an Old Babylonian tablet the size of a paperback book, half lying in the British Museum in London, one-fourth in the Staatliche Museen in Berlin, and the rest missing, and saw what he could only describe, anachronistically, as an algorithm:

- A cistern.
- The height is 3,20, and a volume of 27,46,40 has been excavated.
- The length exceeds the width by 50.
- You should take the reciprocal of the height, 3,20, obtaining 18.
- Multiply this by the volume, 27,46,40, obtaining 8,20.
- Take half of 50 and square it, obtaining 10,25.
- Add 8,20, and you get 8,30,25.
- The square root is 2,55.

Make two copies of this, adding to the one and subtracting from the other.
You find that 3,20 is the length and 2,30 is the width.
This is the procedure.

"This is the procedure" was a standard closing, like a benediction, and for Knuth redolent with meaning. In the Louvre he found a "procedure" that reminded him of a stack program on a Burroughs B5500. "We can commend the Babylonians for developing a nice way to explain an algorithm by example as the algorithm itself was being defined," said Knuth. By then he himself was engrossed in the project of defining and explaining the algorithm; he was amazed by what he found on the ancient tablets. The scribes wrote instructions for placing numbers in certain locations—for making "copies" of a number, and for keeping a number "in your head." This idea, of abstract quantities occupying abstract places, would not come back to life till much later.

Where is a symbol? What is a symbol? Even to ask such questions required a self-consciousness that did not come naturally. Once asked, the questions continued to loom. *Look at these signs*, philosophers implored. *What are they?*

"Fundamentally letters are shapes indicating voices," explained John of Salisbury in medieval England. "Hence they represent things which they bring to mind through the windows of the eyes." John served as secretary and scribe to the Archbishop of Canterbury in the twelfth century. He served the cause of Aristotle as an advocate and salesman. His *Metalogicon* not only set forth the principles of Aristotelian logic but urged his contemporaries to convert, as though to a new religion. (He did not mince words: "Let him who is not come to logic be plagued with continuous and everlasting filth.") Putting pen to parchment in this time of barest literacy, he tried to examine the act of writing and the effect of words: "Frequently they speak voicelessly the utterances of the absent."

The idea of writing was still entangled with the idea of speaking. The mixing of the visual and the auditory continued to create puzzles, and so also did the mixing of past and future: utterances of the absent. Writing leapt across these levels.

Every user of this technology was a novice. Those composing formal legal documents, such as charters and deeds, often felt the need to express their sensation of speaking to an invisible audience: "Oh! all ye who shall have heard this and have seen!" (They found it awkward to keep tenses straight, like voicemail novices leaving their first messages circa 1980.) Many charters ended with the word "Goodbye." Before writing could feel natural in itself—could become second nature—these echoes of voices had to fade away. Writing in and of itself had to reshape human consciousness.

Among the many abilities gained by the written culture, not the least was the power of looking inward upon itself. Writers loved to discuss writing, far more than bards ever bothered to discuss speech. They could *see* the medium and its messages, hold them up to the mind's eye for study and analysis. And they could criticize it—for from the very start, the new abilities were accompanied by a nagging sense of loss. It was a form of nostalgia. Plato felt it:

I cannot help feeling, Phaedrus, [says Socrates] that writing is unfortunately like painting; for the creations of the painter have the attitude of life, and yet if you ask them a question they preserve a solemn silence. . . . You would imagine that they had intelligence, but if you want to know anything and put a question to one of them, the speaker always gives one unvarying answer.

Unfortunately the written word stands still. It is stable and immobile. Plato's qualms were mostly set aside in the succeeding millennia, as the culture of literacy developed its many gifts: history and the law; the sciences and philosophy; the reflective explication of art and literature itself. None of that could have emerged from pure orality. Great poetry could and did, but it was expensive and rare. To make the epics of Homer, to

let them be heard, to sustain them across the years and the miles required a considerable share of the available cultural energy.

Then the vanished world of primary orality was not much missed. Not until the twentieth century, amid a burgeoning of new media for communication, did the qualms and the nostalgia resurface. Marshall McLuhan, who became the most famous spokesman for the bygone oral culture, did so in the service of an argument for modernity. He hailed the new "electric age" not for its newness but for its return to the roots of human creativity. He saw it as a revival of the old orality. "We are in our century 'winding the tape backward,'" he declared, finding his metaphorical tape in one of the newest information technologies. He constructed a series of polemical contrasts: the printed word vs. the spoken word; cold/hot; static/fluid; neutral/magical; impoverished/rich; regimented/creative; mechanical/organic; separatist/integrative. "The alphabet is a technology of visual fragmentation and specialism," he wrote. It leads to "a desert of classified data." One way of framing McLuhan's critique of print would be to say that print offers only a narrow channel of communication. The channel is linear and even fragmented. By contrast, speech—in the primal case, face-to-face human intercourse, alive with gesture and touch—engages all the senses, not just hearing. If the ideal of communication is a meeting of souls, then writing is a sad shadow of the ideal.

The same criticism was made of other constrained channels, created by later technologies—the telegraph, the telephone, radio, and e-mail. Jonathan Miller rephrases McLuhan's argument in quasi-technical terms of information: "The larger the number of senses involved, the better the chance of transmitting a reliable copy of the sender's mental state."* In the stream of words past the ear or eye, we sense not just the items one by one but their rhythms and tones, which is to say their music. We, the

* Not that Miller agrees. On the contrary: "It is hard to overestimate the subtle reflexive effects of literacy upon the creative imagination, providing as it does a cumulative deposit of ideas, images, and idioms upon whose rich and appreciating funds every artist enjoys an unlimited right of withdrawal."

listener or the reader, do not hear, or read, one word at a time; we get messages in groupings small and large. Human memory being what it is, larger patterns can be grasped in writing than in sound. The eye can glance back. McLuhan considered this damaging, or at least diminishing. "Acoustic space is organic and integral," he said, "perceived through the simultaneous interplay of all the senses; whereas 'rational' or pictorial space is uniform, sequential and continuous and creates a closed world with none of the rich resonance of the tribal echoland." For McLuhan, the tribal echoland is Eden.

By their dependence on the spoken word for information, people were drawn together into a tribal mesh . . . the spoken word is more emotionally laden than the written. . . . Audile-tactile tribal man partook of the collective unconscious, lived in a magical integral world patterned by myth and ritual, its values divine.*

Up to a point, maybe. Yet three centuries earlier, Thomas Hobbes, looking from a vantage where literacy was new, had taken a less rosy view. He could see the preliterate culture more clearly: "Men lived upon gross experience," he wrote. "There was no method; that is to say, no sowing nor planting of knowledge by itself, apart from the weeds and common plants of error and conjecture." A sorry place, neither magical nor divine.

Was McLuhan right, or was Hobbes? If we are ambivalent, the ambivalence began with Plato. He witnessed writing's rising dominion; he asserted its force and feared its lifelessness. The writer-philosopher embodied a paradox. The same paradox was destined to reappear in different guises, each technology of information bringing its own powers and its own fears. It turns out that the "forgetfulness" Plato feared does not arise. It does not arise because Plato himself, with his mentor

* The interviewer asked plaintively, "But aren't there corresponding gains in insight, understanding and cultural diversity to compensate detribalized man?" McLuhan responded, "Your question reflects all the institutionalized biases of literate man."

Socrates and his disciple Aristotle, designed a vocabulary of ideas, organized them into categories, set down rules of logic, and so fulfilled the promise of the technology of writing. All this made knowledge more durable stuff than before.

And the atom of knowledge was the word. Or was it? For some time to come, the word continued to elude its pursuers, whether it was a fleeting burst of sound or a fixed cluster of marks. "Most literate persons, when you say, 'Think of a word,' at least in some vague fashion think of something before their eyes," Ong says, "where a real word can never be at all." Where do we look for the words, then? In the dictionary, of course. Ong also said: "It is demoralizing to remind oneself that there is no dictionary in the mind, that lexicographical apparatus is a very late accretion to language."

3 | TWO WORDBOOKS

(The Uncertainty in Our Writing, the Inconstancy in Our Letters)

In such busie, and active times, there arise more new thoughts of men, which must be signifi'd, and varied by new expressions.

—Thomas Sprat (1667)

A VILLAGE SCHOOLMASTER AND PRIEST made a book in 1604 with a rambling title that began "A Table Alphabeticall, conteyning and teaching the true writing, and understanding of hard usuall English wordes," and went on with more hints to its purpose, which was unusual and needed explanation:

With the interpretation thereof by plaine English words, gathered for the benefit & helpe of Ladies, Gentlewomen, or any other unskillfull persons.

Whereby they may the more easily and better understand many hard English wordes, which they shall heare or read in Scriptures, Sermons, or elsewhere, and also be made able to use the same aptly themselves.

The title page omitted the name of the author, Robert Cawdrey, but included a motto from Latin—"As good not read, as not to understand"—and situated the publisher with as much formality and exactness as could be expected in a time when the *address*, as a specification of place, did not yet exist:

At London, Printed by I. R. for Edmund Weaver, & are to be sold at his shop at the great North doore of Paules Church.

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- 34 "IT WAS SOMETHING LIKE A THUNDER-CLAP": "The Alphabetization of Homer," in Eric Alfred Havelock and Jackson P. Hershbell, *Communication Arts in the Ancient World* (New York: Hastings House, 1978), 3.
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- 36 "A BEGINNING IS THAT WHICH ITSELF DOES NOT FOLLOW": Aristotle, *Poetics*, 1450b.

- 36 "THE MULTITUDE CANNOT ACCEPT": *Republic*, 6.493e. Cf. in Eric A. Havelock, *Preface to Plato*, 282.
- 36 "LOSE THEMSELVES AND WANDER": *Republic*, 6.484b.
- 37 "TRYING FOR THE FIRST TIME IN HISTORY": Eric A. Havelock, *Preface to Plato*, 282.
- 37 LOGIC DESCENDED FROM THE WRITTEN WORD: Not everyone agrees with all this. A counterargument: John Halverson, "Goody and the Implosion of the Literacy Thesis," *Man* 27, no. 2 (1992): 301–17.
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