

# Human Being in the Digital World: Lessons from the Past for Future CIOs

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**Abstract** Nowadays, it seems every company is racing to become more and more digital. But what does it really mean to “be digital”? For some, it is a matter of technology. For others, being digital is a new way to be in touch with customers. For still others, it is a completely new way of conducting business. None of these definitions is wrong per se, but each, by themselves, is only partially correct. The “digital disruption” forces us to consider not only business matters, such as methods of production, organizational operations, and money flow. The digital disruption changes every aspect of daily life for every citizen on the planet. This phenomenon might be challenging for some, such as the CIO, who were used to looking people as customers or company employees. Now, the CIO is called to equip everyone with certain tools and a habitable environment. To do so, the CIO’s role must go beyond that of service provider and impartial observer. The CIO must redefine his own professional role by drawing from his personal experiences: only by reflecting on how he himself has changed and become a more digital human being will he be able to assist others in this process.

## 1 Introduction

One must first look back in time to better understand what the Digital Transformation entails and, therefore, be able to describe the new obligations and duties of the Chief Information Officer. A journey from the past to the future will illuminate our understanding of the present and help us to tackle new challenges with mindfulness.

The journey towards a new Digital World concerns all people. In this chapter, we observe the Digital World, not from an abstract, technical or scientific

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viewpoint, but rather from the perspective of the average person. Aside from being a professional, a technician, and a manager, the CIO is, first and foremost, a person. It is important to affirm this notion, given that the Digital Transformation opens the door towards a new world in which humans will coexist with ‘autonomous machines,’ equipped with Artificial Intelligence. As a result, the CIO is susceptible to being replaced by an algorithm.

Retracing the history of what we call *digital* is to retrace the history of all Information Technology as well as the history of the CIO’s predecessor: the manager who provided the technological services necessary for business functions.

Digital is an adjective, but what is the noun? Let us consider the transition of the word digit, originally referring to a human finger or toe, to now being used to refer to an Arabic number symbol. We will look at the distinction between analogical machines and digital machines, and between analogical *codes* and digital *codes*.

Over the course of our journey, we will look at two elements—complementary, but different-of digital technologies: on one hand, we have infrastructures, or platforms. On the other hand, we have tools, devices, and applications that have now become crucial in the new digital world for allowing people to exercise their rights as free citizens, workers, and conscious consumers.

Throughout his existence, the figure we now call the CIO has always managed infrastructures and platforms. This trend is continuing in the new digital world. The difference is that now he must also manage the tools, devices and applications needed to guarantee everyone the ability to operate in their roles as citizens and workers. This new task requires a cultural change.

Looking too closely, or exclusively, at infrastructures and platforms, while ignoring one’s personal experience, can be risky: on this path, it is easy for one to end up imagining a situation in which Designers create a world that is inhabited by citizens and workers, who are, in turn, reduced to the role of platform users, deprived of personal liberties and the ability to test their own creativity, accountability, and entrepreneurship.

Thinking only about infrastructures and platforms is not sufficient. The CIO must provide digital tools to all citizens and workers; these tools must be malleable and adaptable to the worker’s needs. A good tool is co-constructed by the person who will use it.

It is important to consider the visions and personal narratives of the trailblazers who, in the 1940s and 1960s laid the foundations of the Digital Culture; these trailblazers include Vannevar Bush, JCR Licklider, Doug Engelbart, Ted Nelson. These visionary thinkers and technicians showed how technology can be a means for enlarging the consciousness of all people. CIOs can look to these thinkers and technicians as models: they taught us how to cultivate a vision, and of the importance of reconsidering business strategies in light of new opportunities offered by digital tools.

Only through experimenting can one become a digital citizen, only through first hand-hand experience with using tools can the CIO accompany citizens and workers in the transition to the Digital World.

## 2 A Humanistic Stance

*Being Digital*, an essay by Nicholas Negroponte, came out in 1995. This work marked an important turning point: the term *digital* left the technical lexicon of the Computer Science field and entered everyday language.

*Digital*: an adjective that distinguishes one type of machine from another.

During the 1930s and 1940s, two different types of computers existed: Digital Computers and Analog Computers. While the Analog Computer continuously measured the advancement of a process, the Digital Computer worked under a binary numeral system, in which data was converted into strings of 0 and 1. Analog Computing has not disappeared, but the machines that we know and use today are Digital Computers. These digital computers are based on the abstract idea of the Turing Machine, proposed by Alan Turing, and the digital machine architecture proposed by von Neumann.

Since the 1990s, however, *digital* is used not only in relation with machines, but also with people. People are invited to be *digital*. Negroponte wrote: until now, man has lived in a physical world, surrounded by material things. Now, we must prepare ourselves to live in a digital world.

Bits—the smallest unit of information, expressed in binary code—are rapidly replacing objects made of atoms. If we continue to pursue this lifestyle of *bits*, *not atoms*, Negroponte notes, the life of humans, who are becoming increasingly interconnected by computers, will never be the same.

Consequently, the role of Information and Communication Technology Director, more recently known as the Chief Information Officer, must evolve.

Traditionally, the CIO has worked with bits, data, and information. He considered humans as simply being users of machines and programs. The current digital scenario represents a new terrain on which people live and work. For this digital world to be more livable for people, adequate for their needs, and respectful of their rights, a new type of CIO is needed. It is no longer sufficient to have someone who works only with bits, data, and information; the CIO must be capable of hybridizing different fields of knowledge and action. Of course, he will need technical knowledge regarding the appropriate systems, infrastructure, hardware, and software. These hard skills, however, must be combined with soft skills in sociology, psychology, and ethnography.<sup>1</sup> Generally speaking, the CIO is called to take a humanistic stance to his technical position; this new position should be based on wisdom and mindfulness.<sup>2</sup> The CIO is, after all, a human like all others.

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<sup>1</sup>Francesco Varanini, “Il ricercatore debole, o La restituzione poetica”, in Gianluca Bocchi and Francesco Varanini, *Le vie della formazione. Creatività, innovazione, complessità*, Guerini e Associati, Milano, 2013, pp. 57–69.

<sup>2</sup>Francesco Varanini, “Complexity in Projects: A Humanistic View”, in Francesco Varanini and Walter Ginevri, *Projects and Complexity*, CRC Press, Boca Ratón, 2012.

### 3 What Is Digital

*Being Digital* is a collection of columns written by Negroponte for the monthly publication *Wired*, a magazine he himself helped to found in 1993. *Wired* predicted the imminent arrival of a Digital Revolution. The magazine has its headquarters in San Francisco, just a few miles from Silicon Valley and Stanford University, in the heart of an area in which, currently, a new technology, a new culture, and a new economy are being born.

*Being Digital* was immediately distributed on a global scale. In 1995, it was translated into German, French, Italian and Spanish. The Japanese version came in 2001.<sup>3</sup>

By 1967, around the age of 24, the young Negroponte, son of a rich, Greek, ship owner, was already managing the Architecture Machine Group, a laboratory and think tank dedicated to the study of human/computer interaction, at the Massachusetts Institute of Technology. In 1985, to further this research, Negroponte founded the Media Lab at MIT, with the help of Jerome B. Wiesner.

In both English and Latin, the word “media” is the plural of medium. *Media*, treated as singular or plural, can mean ‘main means of mass communication (broadcasting, publishing, and the Internet) regarded collectively’. But this definition is not what Negroponte was referring to.

Negroponte favored the concept used by Canadian philosopher and semiologist Marshall McLuhan who, in 1964, published *Understanding Media*.<sup>4</sup> For McLuhan, *medium* is synonymous with technology. A medium is “any new technology.” One famous example is the lightbulb: “a light bulb creates an environment by its mere presence.” It is a medium, or a technology, and, like any other medium, has a social effect. “The ‘message’ of any medium or technology is the change or scale or pace or pattern that it introduces into human affairs.”<sup>5</sup> The lightbulb allows humans to transform the dark of night into a livable space. Similarly, it changed man’s way of experiencing each new medium that followed: the train, the automobile, the radio, and the television.

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<sup>3</sup>Nicholas Negroponte, *Being Digital*, Knopf, New York 1995. German translation: *Total digital: die Welt zwischen 0 und 1 oder die Zukunft der Kommunikation*, Bertelsmann, München, 1995. French translation: *L’homme numérique*, Laffont, Paris, 1996. Italian translation: *Essere digitali*, Sperling and Kupfer, Milano, 1995. Spanish edition: *Ser digital: Editorial Atlántida*, Buenos Aires, 1995. Chinese translation: *ビーイング・デジタル - ビットの時代 新装版* [Digital Revolution], New Taipei (Taiwan) 1997. Japanese edition: [Being Digital: The Bit Era], Asukī, Tōkyō, 2001. Audiobook: Nicholas Negroponte; Penn Jillette, *Being Digital*, Random House Audiobooks, New York, 1994.

<sup>4</sup>Marshall McLuhan, *Understanding Media. The extension of Man*, MacGrow Hill, New York, 1964.

<sup>5</sup>Marshall McLuhan, *Understanding Media*, p. 8.

Even more significant is the change in the human environment caused by the pervasive presence of computers, each connected to each other and to humans through interfaces.

We have become used to hearing the word *digital*. As a result, the French translation of Negroponte's title—*L'homme numérique*—baffles us; it surprises us and raises some questions. We are not used to substituting *digital* with *numeric*. It is well known that the French are always looking to translate English words—hence *software* becomes *logiciel*. But while *logiciel* does not fully capture the sense of the original English word, *numérique* seems to be a perfectly correct translation, which draws on the hidden history of *digital*.

Let us discuss the Digital Computer; this machine functions by means of codes expressed in chains of 0 and 1. In reality, however, the word *digit* contains no reference to binary numeration.

In Latin, *digitus* means 'finger.' From *digits* comes the Italian *dito*, the Spanish *dedo*, and the French *doigt*. *Digitalis* means 'from a finger', 'having the dimensions of a finger', and 'having the shape of a finger.' A plant that has a shape similar to a finger also takes this name.

The origin lies in the Indo-European root *deik*, which meanings 'to indicate', 'to show', or 'to point out.' This root appears in other language families as well, including the Sanskrit *dic-*, the ancient Greek *deiknynai* and the German *zeigen*, all of which are verbs meaning 'to show.' What's more, the Latin verb *dicere*, still from the same root, means 'to say' or 'to speak.'

Perhaps the word *toe* comes from the same root as *deik* as well.

*Finger* comes from the early Germanic *fingraz*, probably from the Indo-European root *penkwe*, meaning 'five.' Five, as in the number of fingers on a hand. Using the fingers on our hands—with ten, five, two—man learned to count.

By using our fingers, humans are able to distinguish 'I' from 'you' and from other people. We can also indicate the various events and phenomena that surround us.

And finally, with our hands, we create utensils, tools, and instruments.

## 4 An Idea of the Technique

The full title of McLuhan's essay is *Understanding Media: The Extensions of Man*. Each *technique* is intended as an extension of the human mind and body. Here, I am using the word *technique* and not *technology*, because technique is more vast, historical, and philosophical, while technology is a new word, essentially American, associated with the founding of the Massachusetts Institute of Technology in 1865. Technology is a calque from the ancient Greek *technologia*, 'work related to an art.' Technique, a French word integrated into English, harkens more directly back to the ancient Greek *téchnē*, 'art', 'skill', or 'craft in work'. This word originates from the Indo-European root *tek*, 'to create.' From the dawn of time, man has been able to think and work because he has a mind and hands. We

are reminded of this notion with the motto of the Massachusetts Institute of Technology: “Mens et Manus,” mind and hand. Man, through thinking and working, learns through experience and, ultimately, comes to know. In Latin: *experio*: ‘I try.’ As such, through trial and error, man creates extensions of his own body, mind, tools, and *artifacts*. *Artifact* means simply ‘handmade.’ The Latin word *ars* corresponds to the Greek *téchnē*: it means technique, but also *art*—‘expression or application of human creative skills and imagination.’ This word originates from the Indo-European root *are*, meaning ‘to adapt,’ from which comes *art* and also *arm*, referring both to the upper limbs of the human body and weapons.

Thus, *technique* is the art of constructing tools, means, media, and appliances—an art form that has been well known by all men since prehistoric times. *Technique*, or *technology*, is not simply a type of practical or applied science, but rather a term that can be used to describe all *voluntary extensions of natural processes*. As such, if breathing is a necessary human function, then the ability to breathe underwater would be, in a sense, the result of technology.

In 1964, the same year as *Understanding Media*, published by McGraw-Hill in New York, the first volume of André Leroi-Gourhan’s essay was published by Albin Michel in Paris, *Le geste et la parole*.<sup>6</sup> The volume was entitled *Technics and Language* (in the original French language edition, the author used the word *technique*. The English language translator sometimes used *technics*, other times *technique*, and other times *technology*).

Leroi-Gourhan is a paleontologist, archaeologist, and anthropologist. He harbors a special interest in technology and offers readers the opportunity to experience the dawn of humanity in the 1960s, the period in which the culture now known as digital established itself.

In *Understanding Media*, McLuhan offers the same experience to readers, though the historical aspect is limited. Leroi-Gourhan could easily use McLuhan’s subtitle, *The Extensions of Man*. Indeed, he illustrates the meaning of this subtitle better than McLuhan did.

Leroi-Gourhan begins his story at the moment in which humans started to stand upright, differentiating themselves from other animals. The development of the front part of the head allowed for the development of the brain, along with human intelligence; the development of arms and hands allowed people to collect fruit and use stones and wood as tools. These tools became a sort of artificial limbs, *extensions of man*.

Leroi-Gourhan makes note of this evolution, characterized by man progressing from using his hands to using tools created by hand. The author notes also how man progressively transfers his intelligence to things he creates.

Leroi-Gourhan stopped writing around the mid-1960s, but not because the technology presiding over the construction and use of computers (machines capable

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<sup>6</sup>André Leroi-Gourhan, *Le geste et la parole*, 2 vols. (Paris: Albin Michel, vol I *Technique et langage*, 1964—vol II *La mémoire et les rythmes*, 1965. English translation: *Gesture and Speech* (Cambridge, Massachusetts & London: MIT Press, 1993).

of replacing people in the workplace) was fully mature. Rather, these years were also the period in which he invested much of himself in his research on the development of Artificial Intelligence.

Technique is therefore a process powered by man, but that is also leading to man's marginalization. The tool, which was initially a man-made extension of man, is progressively separating itself from man, with no signs of returning. Hence, we might say that we are heading towards a future in which machines are becoming increasingly independent from man, even being constructed by other machines.<sup>7</sup>

Current trends are increasingly pushing us to believe in digital intelligences that are different from human intelligences. Starting in the 1940s, various expressions were used to label machines that defined for themselves how they would work. The following expressions were often heard: Cybernetics, auto-regulation, Artificial Intelligence, Machine Learning, Self-Managed, Self-Operating, Self-Repairing, Self-Sustaining, and Self-Driving Machines. More concisely, all of these expressions relate to an *autonomous* nature, a word coming from the Greek *autos*, 'self,' *nomos*, 'law.'

The role of ICT Director was born in the 1960s, when autonomous Non-Human Systems were nothing more than a project or a concept from Science Fiction. The CIO, a role which evolved from the ICT Director, came about in the new millennium. This person found himself faced with the task of having to manage increasingly autonomous systems.<sup>8</sup>

Against this backdrop, one must wonder if it is unrealistic or too idealistic to look at the Digital Revolution as a time in history that created new liberties for people. Instead, maybe the Digital Revolution was just a triumph for autonomous machines. Maybe it would be better not to talk about a new human environment. Maybe it is better to say that the CIO works for autonomous machines. Maybe it is better to say that the human CIO is preparing the terrain for a revolution that would lead to his own substitution by a software CIO or algorithm CIO.

## 5 Autonomous Machines and Autonomous Human Beings

"Quite soon, the world's information infrastructure is going to reach a level of scale and complexity that will force scientists and engineers to think about it in an entirely new way",<sup>9</sup> writes Mark Burgess, as an opening to *In Search of Certainty*. Burgess is the designer of CFEngine (Configuration Engine, a software framework that automates the configuration and maintenance of infrastructure). If this is true for scientists and engineers, it is even truer for CIOs. One must think in a new way.

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<sup>7</sup>Francesco Varanini, *Macchine per pensare*, cit., 2016, pp. 235–266.

<sup>8</sup>Francesco Varanini, *Macchine per pensare*, cit., 2016, pp. 235–266.

<sup>9</sup>Mark, Burgess, *In Search of Certainty. The Science of Our Information Infrastructure*, O'Reilly, Sebastopol, CA, 2015a. Second edition, p. 1. (First edition 2013).

“The myth of the machine, that does exactly what we tell it, has come to an end.” We now find ourselves obligated to manage autonomous machines. As such, the task is actually to manage one complex, autonomous machine, an information infrastructure. A business’s information infrastructure cannot be seen as being isolated, as it is part of the world’s information infrastructure. It is no longer a collection of separate parts that can be managed individually, but rather a collection of weakly coupled elements that interact and cooperate. This change is the defining feature of the revolution, the disruption: we have been thrown into a “faster, denser world of communication, a world where choice, variety, and indeterminism rule.”

Talking about digital risks being limiting or misleading. *Digital* exists because it relies on the world’s information infrastructure. CIOs are asked not only to manage within their own realms, but also in this global structure.

Burgess knows exactly what this entails. He is the designer of CFEngine, an agent/software robot and a high-level policy language for building expert systems aimed at the configuration and maintenance of large-scale computer systems, including the unified management of servers, desktops, consumer and industrial devices, embedded networked devices, mobile smartphones, and tablet computers.

“We suffer sometimes from the hubris of believing that control is a matter of applying sufficient force, or a sufficiently detailed set of instructions.” Using the co-presence and interaction between human and non-human (software, algorithms) agents, Burgess shows how management models founded on the traditional “command and control” approach, in which the central authority orders agents to behave a certain way, is increasingly inadequate when faced with the information infrastructure.

By observing the realms of physics and biology, one can understand how uncertainty is an inescapable fact of life. From this observation emerges a new approach for governing the infrastructure, in other words, for governing the interactions between humans and non-humans.<sup>10</sup>

Burgess spoke of the *promise theory*: autonomous agents declare their own behaviors in the form of promises. The trust established between agents is the fruit of promises made and kept in the past. The behavior of the system emerges from interactions. It is a bottom-up, constructionist view of the world.<sup>11</sup> It is an important idea for the Digital CIO, both in terms of managing the machines and in terms of relations between people.

The machines—the singular parts of the information infrastructure—are no longer seen as a type of hardware whose function can be completely understood, or as software whose coding and documentation can be understood. Now, machines are accepted as agents of whom the behavior is observed in action.

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<sup>10</sup>Federico Cabitza and Francesco Varanini, “Going beyond the System in Systems Thinking: the cybork”, cit., 2017.

<sup>11</sup>Mark, Burgess, *Thinking in Promises: Designing Systems for Cooperation*, O’Reilly, Sebastopol, CA, 2015b.



Humans are, in turn, accepted as having a degree of liberty in their actions. They are no longer reduced to predefined roles: data entry specialists, programmers, users...In principle, people are capable of any type of behavior. The behaviors, done over time, define the ever-evolving profile of a person.

The environment, in this perspective, is not the result of a pre-defined image, or the fruit of some project. The environment is the terrain occupied by the agents through their explorations. Furthermore, in this perspective, it would seem improper and reductive to speak of a human environment. We are speaking instead of an environment adapted to humans and machines alike.

One does not need to search for a new environment for humans in the Digital Revolution, but rather a terrain where people—autonomous agents in the context of a complex system—coexist with non-human agents, continuously undergoing reciprocal adaptations. Burgess writes “What we seek, in pursuing human-computer relations is a balance between the dynamical stability [typical of machines] and semantic creativity [typical of human beings]. It must allow the business of society to prosper in a predictable and trustworthy way.”<sup>12</sup>

## 6 A Perennial Gale of Creative Destruction

Burgess does not observe the world from an outsider’s perspective. He cannot imagine trusting the governing of the infrastructure to a software CIO or an algorithm CIO. Burgess’s view remains humanistic and does not recognize the potential autonomy of machines. “Technology and machinery exist for the benefit of humans, and we should not forget that”.<sup>13</sup> The actions of the non-human agents are considered in terms of the advantages they provide to humans: “a way to take pointless and bothersome relationships away from humans, freeing them to think about issues more worthy of human dignity”.<sup>14</sup>

Burgess is a technician, close to CIO, who enlarges his viewpoint to include the ethical and social implications of the ubiquity and pervasiveness of digital infrastructures. Still, he maintains the infrastructure’s role as an *underlying layer*, a *lower layer*, on which other, social agents, managers, and political leaders outline social structures, as a *higher layer*, an *overarching layer*.

If one wishes to look, without illusion, at the scenario created by the Digital Revolution, one must go beyond Burgess and read a more radical view of the situation we are currently witnessing.

Leroi-Gourhan and McLuhan remind us that *technique* is an *extension of man*, born of man. Still, it is evolving in a way that leads to autonomous machines. The *information infrastructure* is the terrain on which humans play out their entire lives.

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<sup>12</sup>Mark Burgess, *In Search of Certainty*, p. 313.

<sup>13</sup>Mark Burgess, *In Search of Certainty*, p. 397.

<sup>14</sup>Mark Burgess, *In Search of Certainty*, pp. 296–297.

But it is also the terrain on which non-human actors are present. For this reason, it is not appropriate to limit one's view of the information infrastructure as being an *underlying layer*. The technician's perspective is insufficient. A more complex view is necessary, one that takes into account ethical, social, and political implications of the new scenario.<sup>15</sup>

Benjamin H. Bratton, in *The Stack*, starts with a very clear statement about this phenomenon. "The model does not put technology 'inside' a 'society', but sees a technological totality as the armature of the social itself."<sup>16</sup> We must not look at the infrastructure proposed by some group of technicians, but rather at "an accidental megastructure [...] that is not only a kind of planetary-scale computing system; it is also a new architecture for how we divide up the world into sovereign spaces."<sup>17</sup>

That which Burgess calls infrastructure can more precisely be referred to as a "multilayered structure of software protocol stacks in which network technologies operate within a modular and interdependent order".<sup>18</sup> But what is more deserving of attention is how this infrastructure "is changing not only how governments govern, but also what governance even is in the first place".<sup>19</sup> These changes are the consequences of the Digital Revolution.

Here, we are not talking about a technological *underlying layer*, nor an enabling infrastructure, but rather a *megastructure*. This concept of *structure* requires further reflection.

We can see, in this word, the Indo-European root *ster*, meaning 'to spread out.' We can also see the ancient Greek root *stratos*, 'army deployed,' and *strategós*, 'army chief,' the latter also being the root for the word *strategy*.

The Latin verb *struere*, meaning 'arrange one layer over another,' comes from the root *ster*. From here comes the Latin *construo*, origin of the English *construction*, and the Latin *destruo*, from which comes the English *destruction*. From here also comes the Latin word for an abstract concept: *structura*. From the verb *struere* comes also the Latin *stratum*, meaning 'layer', origin of the English word *street*.

Therefore, the *structure* is a continuous attempt, a continuous piling of layers, one over the other. With each new layer, one must decide whether to add more, remove older layers, or change the position of existing layers.

Let's look now at the meaning of *infra*. The Latin *infra* comes from the same Indo-European root as *under*. *Infra* is a contraction of *infera*, which comes from an even lower layer: the Latin *inferus*—from which comes *inferno*, 'hell'—meaning *lower*.

<sup>15</sup>Francesco Varanini, *Macchine per pensare. L'informatica come prosecuzione della filosofia con altri mezzi (Trattato di Informatica Umanistica, vol. 1)*, Guerini e Associati, Milano, 2016.

<sup>16</sup>Benjamin H. Bratton, *The Stack: On Software and Sovereignty*, The MIT Press, Cambridge, Ma. 2015, Preface, p. xviii.

<sup>17</sup>Benjamin H. Bratton, *The Stack*, Preface, p. xviii.

<sup>18</sup>Benjamin H. Bratton, *The Stack*, Preface, p. xviii.

<sup>19</sup>Benjamin H. Bratton, *The Stack*, Preface, p. xvii.

Thus, we have reason to use *infrastructure* to mean the lowest level of a *structure*, which is a stack, a temporary overlap of layers.

Burgess identified a series of layers that he deems the most significant.

### *Earth*

“There is no planetary-scale computation without a planet”.<sup>20</sup> “Planetary-scale computation needs smart grids to grow, and for smart grids to grow, they need more ubiquitous computation”.<sup>21</sup>

### *Cloud*

“The Cloud layer is also a geopolitical machine, erasing some geographies and producing others, forming and destabilizing territories in competitive measure.”<sup>22</sup> “The geopolitics of the Cloud are everywhere and want everything: the platform wars between Google, Facebook, Apple, and Amazon”.<sup>23</sup> We cannot forget that the cloud also hosts the Deep Web. Economic transitions conducted without regard to Earth laws and bit-coin financial operations are nothing but examples of the digital life that exists in the Cloud.

The Cloud is the setting of new form of politics and geography. We must imagine that even the businesses for which we work are moving towards this new territory: they now longer exist exclusively in the Earth, but also in the Cloud. If we must move towards the Cloud, we must also have a manager—the CIO—who is able to accompany the business in this transition, towards this new territory.

### *City*

The smart city, a place inhabited by humans, a place for settlement and for mobility, has been remapped to more closely resemble the platforms present in the Cloud.

### *Address*

The digital revolution imposes “the addressing of every ‘thing’ therein that might compute or be computed.”<sup>24</sup> Each thing, each human, and each machine is described with a tag, a synthetic address, in order to allow for connections and transfers.

### *Interface*

“An interface is any point of contact between two complex systems that governs the conditions of exchange between those systems”.<sup>25</sup>

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<sup>20</sup>Benjamin H. Bratton, *The Stack*, p. 75.

<sup>21</sup>Benjamin H. Bratton, *The Stack*, p. 93.

<sup>22</sup>Benjamin H. Bratton, *The Stack*, p. 110.

<sup>23</sup>Benjamin H. Bratton, *The Stack*, p. 110.

<sup>24</sup>Benjamin H. Bratton, *The Stack*, p. 191.

<sup>25</sup>Benjamin H. Bratton, *The Stack*, p. 220.

In Latin *inter* means ‘between.’ *Faciem* is an abstraction from the verb *facere*, ‘to do.’ That which is done has a form, an aspect: therefore, *a faciem*, a face.

To understand the meaning of *interface*, we must first consider *surface*. In Latin, it is *superficiem*: the prefix *super* ‘above’, ‘over’, ‘on the top’, is placed before *faciem*.

*Super* is the opposite of *sub*, ‘under’, ‘beneath.’ Behind *super* and *sub*, one notion is present: the stasis on a surface and the vertical movement from low to high. We notice the same exact concept present in the word *structure*.

### *Users*

In Latin *utens*, from which comes the English ‘user,’ is ‘qui utitur aliqua re’, ‘one who uses a thing.’ The Latin verb *uti* translates exactly to ‘use.’ The user is thus the person who uses a tool or device. The user is a human being who uses a digital platform. A digital platform—for example, Facebook used as a company’s Employees’ Portal—has its own rules and laws. Someone, such as the CIO, who builds and manages these platforms has the difficult role of legislator. We can look with hope to the establishment of a future digital citizenship, but there is a difference between the citizen and the user.

The German philosopher and student of Martin Heidegger, Hannah Arendt, speaks quite clearly about the human condition as an attempt to fill spaces of citizenship. The citizen is an active player: in Latin *agens*: a person who acts, powerful. The user is a passive player: in Latin *patiens*, a person receiving care.<sup>26</sup>

Bratton offers us a series of layers described one by one. But even he warns us to be on alert; his description is only an attempt, a proposed breakdown or system for distinguishing elements. Layers are, in reality, intermixed and never separable. What is important is the new complex image of the world: a stack, a structure, an infrastructure. This is the environment in which humans live after the digital disruption.

Burgess, with his limited way of thinking about the specialized technician in a technological *layer*, forced us to think of the CIO as a manager of staff. A manager that manages the *underlying layer*, *lower layer*. A manager that offers support to other managers who, at a higher level, take charge of strategic and political decisions.

Bratton, by describing a structure as a stack of layers, illustrates the vast responsibility of the CIO. The CIO is not only a technician. He is the manager who, more than any other, is capable of understanding and accepting the new terrain on which people and machines coexist. The CIO is, more than any other professional figure, able to understand the complexity of the Layered Infrastructure in which people and machines interact. No one is more capable than the CIO of understanding the implicit difficulties inherent to double management: management of

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<sup>26</sup>Hannah Arendt, *The Human Condition*, 2d edition, The University of Chicago Press, Chicago, 1988, p. 175. Vedi anche Chapter III. Labor, 17. A Consumer’s Society, p. 126 and following. First published in 1958.

people and machines. Only the CIO has an accurate perception of how the *underlying layer, lower layer* does not exist: the pile of layers, as Bratton shows, according to the perennial gale of Creative Destruction: layers are constantly changing and cannot be managed separately. The CIO of the future will not only be coauthor of each strategy and each company policy, but he will also have something to teach political leaders and social reformers.

## 7 A Divine Escape

On Thursday February 16, 2017, Mark Zuckerberg, founder of Facebook, published a long post on Facebook entitled *Building Global Community*.<sup>27</sup> It was more than a speech coming from a chief of state, it was an encyclopedia, a pastoral letter from the pope of the universal church.

In the text, the word infrastructure appears in the fifth line, and then again twenty-four more times. “In times like these, the most important thing we at Facebook can do is develop the social infrastructure to give people the power to build a global community that works for all of us”.

Infrastructure is defined with demanding adjectives: social, meaningful, global. Equally demanding are the adjectives used to define the Communities in which people are claimed to deserve to live: supportive, safe, informed, civically-engaged, inclusive. One immediately understands that Zuckerberg considers Infrastructure as being synonymous with Community.

Mark signed the letter with just his first name, like a real pope.

Zuckerberg also offers his thanks: “Thank you for being part of this community.” We can understand this to mean: Thank you for living in Facebook, The Infrastructure. A new digital environment is proposed—or rather, imposed—on people.

Zuckerberg, in an address to all people, calls us to participate in the construction of the Infrastructure, “the world we want for generations to come.” He seems to forget that Facebook already exists as a platform and that none of us participated in its construction. The citizen is reduced to a user. Loading materials onto Facebook does not constitute participation. Our knowledge and abilities are limited to the pre-defined format and contents of Facebook. In a true situation of freedom, people could choose the way in which they express themselves. But Facebook imposes rules and forms. In the confines of such a pre-established Infrastructure, our knowledge is reduced to content, the thing that is contained, cooped, forced. This problem concerns all software developers and CIOs.

We must wonder if we are inhabitants of the world, like all human beings, or if we are designers of the world in which other human beings will have to live.

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<sup>27</sup>Mark Zuckerberg, *Building Global Community*, <https://www.facebook.com/notes/mark-zuckerberg/building-global-community/10103508221158471/>.

The entire history of the development of software is characterized by this question. Such a question implies series ethical doubts to programmers who limit themselves to developing a single software, a single application aimed at helping a person complete a single activity. The question becomes even more serious in light of the digital disruption, a period in which we are effectively capable of constructing the entire world in which people will live, as in film *Truman Show*.

*Understanding Computers and Cognition: A New Foundation for Design*, published in 1986, is a book that signaled a changing point. The authors are Terry Winograd and Fernando Flores.<sup>28</sup>

At a young age, Flores, of Chile, became the Minister of Economic Development and the Minister of Finance in the government of *Unidad Popular*. After the overthrow of the government in 1973, he built a new career as a Computer Science researcher at Stanford University. There, he met Terry Winograd, professor of Computer Science, already known for his work in natural language systems and human/computer interaction. In 1967, the need for consideration to ethics led Winograd to found CPSR, Computer Professionals for Social Responsibility.

In *Understanding Computers and Cognition*, Winograd and Flores adopt a conscious *humanistic stance*, or, better, given the explicit reference to the German philosopher Heidegger, a conscious *phenomenological stance*. The Greek *phainómenon*, which is ‘that which shows itself’, ‘that which appears—to man’ while man lives in his own world and learns through experience. The behaviors of humans who, through work or play, come in contact with computers, do not intersect much with the behaviors of a computer scientist or an Information Systems specialist who works with data and information. The computer scientist, through his training and education, bases his behaviors on logical deduction and conscious reflection. With people who interact with devices on a more personal level, however, individual interpretation and intuitive reasoning play a central role. Winograd and Flores sought to layout the basis for a programming system aimed not at imposing a predefined type of behavior on people, but rather a system that would take into account the behaviors of people.

It was not by chance that Winograd and Flores referenced two important concepts from Heidegger’s principal work, “*Being and Time*”.<sup>29</sup>

*Thrownness (Geworfenheit)*.<sup>30</sup> our Being-in-the-world is being thrown into the world. The world is not a comfortable, protective, welcoming place. We are living in a wasteland. The *Thrownness* imposes responsibilities on us, but also offers us possibilities.

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<sup>28</sup>Terry Winograd and Fernando Flores, *Understanding Computers and Cognition: A New Foundation for Design*, Addison-Wesley, Reading, Mass, 1986.

<sup>29</sup>Martin Heidegger, *Sein und Zeit*, M. Nyemeyer, Halle an der Saale, 1927. English edition: *Being and Time*, translated by Joan Stambaugh, University of New York Press, Albany, NY, 1996.

<sup>30</sup>Martin Heidegger, *Sein und Zeit*, § 29, § 31, § 38, § 42, § 68B. Winograd and Flores, *Understanding Computers*, § 3.3, p. 33 and following.

*Readiness-to-hand* (*Zuhandenheit*):<sup>31</sup> “The hammering itself uncovers the specific ‘manipulability’ of the hammer”, writes Heidegger. “The kind of Being which equipment possesses—in which it manifests itself in its own right—we call ‘readiness-to-hand’”.<sup>32</sup> We have seen, according to Leroi-Gourhan’s reasoning, how certain tools tend to become machines that are separate from people, *things* that are distant from people, in opposition to humans. One example is the computer, which is moving towards complete autonomy, and even Artificial Intelligence. *Ready to hand* is the hammer with which people learn by experience. The human experience manifests itself in the use of utensils. This word derives from the Latin verb *uti* ‘to use,’ *utens*, ‘user,’ and *utensilis*, ‘tool.’ Winograd and Flores force themselves to imagine digital machines not as autonomous machines, but rather as *utensilia*, tools, always ready to hand.<sup>33</sup> Here, we can think about personal computers, tablets, and smartphones.

Heidegger’s *Readiness-to-hand*, through Winograd, Flores and other researchers of their era, such as Donald Norman,<sup>34</sup> was the source of research dedicated to Human Interface (HI), Human-Computer Interaction (HCI), Usability, User Interface (UI), User Experience, (UX).

The meaning of what we do while using tools depends on the context and the situation in which we are thrown.

Heidegger distinguishes between *Sein*—which translates directly to the English *being*—and *Dasein*—which translates to *being there* or *presence*. Given the importance that Heidegger attributed to *Dasein*, the English translators of *Sein und Zeit*, preferred not to translate it, leaving instead *da-sein* in the English text. But Heidegger is less obscure than one might initially think. Our *being-in-the-world* cannot be programmed nor predicted, nor described by an outside source. *Dasein* is ‘to feel in a certain situation,’ it is the ‘how things are going.’ The German *da* refers to the *state of mind*, *understand*, and can refer to both *there* and *here*.

The *headline* of an AT&T publicity campaign, released in the period in which Negroponte was pushing *Being Digital*, was: *Be there here*. The publicity campaign was referring to a non-place, a virtual space, the cyberspace that two people share during a telephone conversation. That which was true for the telephone conversation then is even truer for us now on the various platforms and digital infrastructures. We have been thrown into an unknown world. We are constantly faced with *being* in this world.

<sup>31</sup>Martin Heidegger, *Sein und Zeit*, § 15, § 18, § 22, § 69A. Winograd and Flores, *Understanding Computers*, § 3.4, p. 36 and following.

<sup>32</sup>Martin Heidegger, *Sein und Zeit*, § 15. English edition, *cit.* p. 98.

<sup>33</sup>Francesco Varanini, “Complexity in Projects: A Humanistic View”, *cit.*, 2012, pp. 52–55. Francesco Varanini, *Macchine per pensare*, *cit.*, 2016, pp. 261–266.

<sup>34</sup>Donald Norman and Stephen Draper (eds.), *User Centered System Design: New Perspectives on Human-Computer Interaction*, L. Erlbaum Associates, Hillsdale, N.J., 1986. Donald Norman, *The Psychology of Everyday Things*, Basic Books, New York, 1988; with new title: *The Design of Everyday Things*, Currency Doubleday, New York, 1990.

The humanistic or phenomenological stance is living *Dasein*. The environment—in German *Umwelt*—is the surroundings, and the world around us here and now. The environment to which we need to adapt surely includes the digital world, the infrastructure. But using Facebook, or, more generally, using the World Wide Web, does not mean, despite what Zuckerberg might want, reducing ourselves to living in a world designed for us by Zuckerberg, or by a CIO. Winograd and Flores question how people can live *Dasein*, along with a *readiness-to-hand* machine.

That is where the shoe pinches. We imagine that Winograd and Flores are interested by the *Dasein*, the state of mind, understanding people who are thrown into the world equipped only with digital tools. But that is not the case. The first two parts of *Understanding Computers* are simply a preparation for the third part, entitled *Design*, which reinforces the book's subtitle: *A New Foundation for Design*.<sup>35</sup> Heidegger tells us that before being technicians, programmers, computer scientists, CIOs, or managers, we are people, human beings who, like all other humans, are thrown into a world that we must come to understand.

Heidegger tells us that just by assuming a humanistic stance, we can eventually come to be good technicians, programmers, computer scientists, CIOs and managers. Winograd and Flores claim to adhere to Heidegger's teaching, but blatantly ignore his lesson. They distinguish themselves along with all programmers and computer scientists by coining a new label: *designers*.

Heidegger's reflections regarding the deep confusion of people who are alone and lost in the wasteland that they inhabit are welcomed by Winograd and Flores as something that applies to all humans, not just them and people like them. As *designers*, they do not consider themselves to be like other humans; they live in another world, a *Sky*, from which they can observe, from high up, the people of the world they seek to redesign.<sup>36</sup>

As Roman historian Livy (Tito Livio) wrote, two types of tools exist: 'human tools and divine tools.'<sup>37</sup>

In the meta-world, Designers, super-humans or gods, and those who work within the Empire, use, at their discretion, *divina utensilia*, design instruments and codes, through which they construct *humana utensilia*, the objects and *platforms* conceded to humans, who are reduced to the role of users.

Keeping this notion in mind, Norman changes the title of *The Psychology of Everyday Things* to *The Design of Everyday Things*.

The work of Winograd and Flores, as well as Norman, has led to the creation of a plethora of segmented professional figures, each with the goal of designing one of the following: Human Interface (HI), Human-Computer Interaction (HCI),

<sup>35</sup>Terry Winograd and Fernando Flores, *Understanding Computers and Cognition*, cit., 1986, part III: Design, pp. 143–179.

<sup>36</sup>Francesco Varanini, *Macchine per pensare*, cit., 2016, p. 156, p. 206 and following.

<sup>37</sup>Livy (Tito Livio), *History of Rome (Ab urbe condita)*, XXXIII, in *History of Rome, Volume IX*, Books 31–34 (Loeb Classical Library No. 295), Harvard University Press, 1935.



Usability, User Interface (UI), Digital Environment Designer, User Experience, (UX). A new General Theory has emerged from their work: *Design Thinking*.

This theory is the origin of a new approach to designing and planning, an approach known as Design Thinking.

The Designer, like a god, is magnanimous, and inclined to do good. But it is always easier to pretend to know more than everyone. Design Thinking considers Participatory Design to be damaging; in other words. Design Thinking is against the notion of involving all users in the design process. This theory assumes that people do not actually know what they want or what is best for them. The lives of people, their experiences, and their behaviors are nothing but “sociomaterial things” with which the Designer works.<sup>38</sup>

The main limitation of Design Thinking is in this view of Designers as external beings, making them Designers of the world, but not inhabitants of it. Each CIO must reflect on how easy and dangerous it can be to fall into this way of thinking.

It is important to highlight that while an architect who works in the world will necessarily clash with nature, and the world’s physical constraints, a *digital worlds* Designer can construct a world from zero and plan each layer, from the foundations to the outer interface. From here we can notice a paradoxical effect: the better the structure and the platform, the more humans will feel separated from it, as humans bear the effects of new attitudes and requirements. The designer never pretends to know the people for whom he designs.

It is in this way, through Design Thinking, that this new terrain is constructed by Zuckerberg and all technicians who are dedicated to creating a digital environment in which people, as users, must live.

As Benjamin Bratton writes, through Design Thinking, we have gone “From User-Centered Design to the Design of the User.”<sup>39</sup> Personally, I do not believe that CIOs who work using the humanistic approach want this, however; they do not want to reduce the people who live in the digital world to the position of a user whose behavior is limited to what is considered appropriate by the Designer.

## 8 Human, All Too Human

If we concede to being humans, without alibi, without Divine Escape, without becoming a detached Designer of the world, we can fully appreciate Heidegger’s lesson: *Thrownness* is the situation in which each human being finds himself. Each person is destined to uncertainty, annihilated by the absurdity of the world in which he lives. Each person must live in an unknown world, a wasteland. This is true of every person in every place, in every moment of human history. But this aspect of the *human condition* is even more striking during the digital disruption, when

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<sup>38</sup>A. Telier (Thomas Binder, Giorgio De Michelis, Pelle Ehn, Giulio Jacucci, Per Linde, Ina Wagner), *Design Things*, The MIT Press, Cambridge, Ma., 2011, p. 6.

<sup>39</sup>Benjamin H. Bratton, *The Stack*, p. 284.

people live in the Stack, on the platform, experiencing a world and a way of life that is new and unknown.

The French philosopher Michel Serres, member of the Académie Française and instructor at Stanford University, marvels at the habits of his young students who belong to the generation we often call Millennials, Post-Millennials or digital natives. He is astounded by their ability to rapidly write messages using their thumbs on tiny keyboards and also by their ability to create a collective identity, through Facebook or similar platforms. The skillfulness that Serres sees in these digital natives is actually rather superficial. Adroitly moving one's fingers does not indicate that one knows what he is doing. As such, it makes sense to suspect that digital natives lack technical knowledge as well as mindfulness. Having lived through the birth of the digital world, they know how to quickly write on touch screens, communicate using WhatsApp, and express themselves on Facebook<sup>40</sup>. Still, knowing how to use Apps signifies very little. It is quite probable that Serres' marveling is just projection, the result of his own capacity for understanding the nature of digital culture. Serres hopes, in vain, that young people at least understand what the digital culture is all about.

Still, we cannot blame Millennials, nor the philosopher. The fact is that, when it comes to the digital world, we are all strangers, newcomers, and outsiders; therefore, with few exceptions, all of us can only act in the limits of what is defined as acceptable for users. Far from being powerful actors, we are passive beings: recipients of care, inhabitants of a platform created by a Designer. The attention given by the Designer to the user does not qualify as care. Heidegger teaches us that *care* can never be separated from beings-in-the-world.

Furthermore, digital natives, the young, the old, students, philosophers, these are not categories that refer to mindful human beings, these categories refer to the masses. Heidegger, in *Everyday Being-one's-Self*, suggests that we distance ourselves from the notion of being indistinguishable from the "große Haufen."<sup>41</sup> We can translate this simply as *great masses*, but, like always, Heidegger chose his words intentionally. The word *große* reinforces the *Haufen*, which we can translate as 'accumulation', 'cluster', 'pile.' Being part of a mass of users' results in us losing our identity. The *Haufen* harkens back to the Stack as well, as a structure made from intermixed layers. Bratton points out that, as users, we make up an important part of the Stack. If we accept this condition, we agree to be part of the indistinct digital matter and it will be impossible for us to construct and use digital tools that are sufficient for meeting our needs and desires.

The CIO is particularly concerned by this *everyday Being-one's-Self*. For him, this implies constantly *Being-one's-Self* in every moment of his life, and never forgetting his professional role nor separating his work life from the rest of his life.

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<sup>40</sup>Michel Serres, *Petite Poucette*, Editions Le Pommier, Paris, 2012. English translation: *Thumbelina: the culture and technology of millennials*, Rowman & Littlefield International, New York, 2015.

<sup>41</sup>Martin Heidegger, *Sein und Zeit*, § 27. English edition, cit. p. 164.

Only by agreeing to accept the difficulties that come with living a digital life on a daily basis can one distance oneself from the artificial limits placed by the Designer. By doing so, the CIO can avoid ending up just a simple regulating agent within the Stack that could eventually be replaced by a software CIO or algorithm CIO.

In the wake of Heidegger's work, the French philosopher Derrida speaks about Thrownness, the sensation of being thrown into an unknown world by way of a narration, like with Robinson Crusoe.<sup>42</sup> Being shipwrecked on an unknown island is a good representation of the Thrownness felt by being stuck living in the digital world. We need to recall the story of Robinson Crusoe and put ourselves in his shoes.<sup>43</sup>

Robinson's loneliness, the result of being abandoned on an unknown island, manifests itself in the lack of tools. The tools that he managed to save from the sunken ship are from another world and not adapted to his situation.

Robinson is not a user. He cannot allow himself to be one, as he has nothing at his disposal that would be useful in the new world in which he finds himself. The situation forces him to start over and re-experience the Readiness-to-hand. He only has hammers, cords and some objects from another world. The first indication of his ability is how skilled he is in the domain of ready-to-hand. Robinson's ability lies in using his hands and the other-world tools to create tools that are better adapted to the new world.

Here we can look back to the idea proposed by McLuhan and Leroi-Gourhan: the tool is "an extension of man," it is a medium for establishing a relationship with the world and the environment. Only by being in a world can we create tools adapted to that world. Only by feeling at home in the new world can we appreciate what the new world offers.

Digital is unexpressed potential that can manifest itself if the appropriate instruments are in the hands of the people. We are all learners when it comes to digital tools. These tools can be constructed and used with the active participation of the digital citizen when he is no longer just a user.

We can distinguish between the Designer and the Programmer. The Programmer acts according to an analysis, looks at an objective, understands the code, and knows how to write good code. The Designer acts according to a vision, follows intuition, addresses weak points, and uses and mixes various codes.

To better understand the difference between the Designer and the Programmer, we can consider the Designer as a bricoleur.<sup>44</sup> This French word, *bricoleur*, harkens back to an idea of "going in a roundabout way." It has to do with knowing how to get by, even though improvising, using tools in an unexpected way. The best

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<sup>42</sup>Daniel Defoe, *The Life and Strange Adventures of Robinson Crusoe, of Tork, Mariner*, London, 1719.

<sup>43</sup>Jaques Derrida, *Séminaire. La bête et le souverain*. Vol. II (2002-2003), Editions Galilée, Paris, 2010. English Edition: *The Beast and the Sovereign*, Volume II (The Seminars of Jacques Derrida), translated by Geoffrey Bennington, University Of Chicago Press, Chicago, 2011.

<sup>44</sup>Claudio Ciborra, "From thinking to tinkering". In Claudio Ciborra and Tawfik Jelassi (eds), *Strategic Information Systems*, John Wiley & Sons, Chichester, 1994.

English translation for the French word *bricolage* is probably *tinkering*. A *tinkerer* works in an amateurish or desultory way, adjusting or mending machinery, discovering solutions while working. At first glance, Robinson appears to be a *bricoleur*. He works using what he has at his disposal. He adapts tools based on his needs. But Robinson is not a Designer. A Designer works in the Sky reserved for Designers, an area closed off to users. The Designer works with tools—*divina utensilia*—that users would never have access to. Robinson, however, is on the ground, not in the Sky, and not alone: he is at a far end of the world, in a waste land. Robinson does not use *divina utensilia*, but rather *humana utensilia*, tools that are available to all people.

Even the CIO is a bricoleur. His role puts him on a different level from the Programmer. The CIO works according to his own strategy, and uses the appropriate codes and tools. The CIO uses the tools and codes at his disposal, sometimes in unexpected ways.

But being a bricoleur does not suffice. The CIO who wants to fully integrate into the new digital world will have to come down from the Designer's Sky and agree to be shipwrecked, like Robinson, on an unknown island. The CIO must concede to being a Designer and a user at the same time, and end up feeling mostly like a user.

The CIO likely has only one effective strategy for ensuring a new human environment to the people in the digital world. Above all, the strategy consists of feeling like one of the people and living their experiences firsthand; he must try to understand their resistances and put himself in the place of a user. Only if the CIO experiences what it is like to live, communicate, and work in the Stack, in the Infrastructure, in a world of Google, Facebook, and Amazon, he is able to accompany other people in this new world.

## 9 A Rebirth of Literacy

We must not forget Bratton's political literature regarding the digital revolution: we must look at the Stack as reducing personal liberties and subordinating people to an entity that is both oppressive and invisible, as is typical in the context of globalization and financial deregulation.

From this perspective, the digital revolution is something of a manifestation of *The End of History* and *Postmodernity*. The human being seems unable to control new technology. The future and progress seem lost in an eternal present. Authority, power, and sovereignty reside in the infrastructure—those who govern the infrastructure govern the world. Here we see the political importance of the CIO.

But this phenomenon must not cause us to forget that the digital revolution exists as a humanistic project, rooted in a historical period with faith in progress and a new type of humanism: the 1960s, a period of growth and change. The decade begins with a departure of the gloomy atmosphere brought about by the Cold War. Kennedy's New Frontier opens new horizons. A new hope for peaceful coexistence took the place of a fear of nuclear conflict. The Vietnam War led to a new pacifism.

Widespread prosperity lead to greater attention to immaterial needs and an increase in personal liberties. “The message,” according to poet Allen Ginsberg, was “to widen the area of consciousness.”<sup>45</sup> These were the years of Counterculture, the Youth Revolution, the Movement, and Sex, Drugs, Rock and Roll.

Many things happened in this decade. In the field of information technology, advances were made in Artificial Intelligence. Meanwhile, IBM introduced the Mainframe System/360 to the market, the first group of computers capable of responding to the needs of a business, furnished with interchangeable software and peripheral equipment. It was a digital machine, but it had nothing to do with what we now call the Digital Revolution.

The Digital Revolution is strongly connected to the ideas regarding technique proposed by McLuhan, Leroi-Gourhan and even Heidegger. This ‘humanistic’ technique, as we have seen, offers tools that could be an extension of man—of which the Mainframe is the most obvious example. The cost of the various technical components, meanwhile, was constantly decreasing. Widely distributed journals, such as *Popular Electronics*, talked about computer architects as hobbyists, bricoleurs, and tinkers, capable of building their own computers. As a result, in this period, visionary technicians built the prototypes for the tools that we now know as the network of Personal Computers, which includes the desktop, laptops, tablets, and smartphones—tools that are increasingly ready-to-hand.

Joseph Carl Robnett Licklider, known as J.C.R. or Lick, was a psychologist specialized in psycho-acoustics. In the 1950s, he developed an interest in computers while working for the Lincoln Laboratory at the Massachusetts Institute of Technology, a research center funded by the Department of Defense.

In 1960, he published a short article: *Man-Computer Symbiosis*.<sup>46</sup> The reference to symbiosis is particularly interesting: Licklider explains that it is a biological concept. In his description, Licklider defines two different classes of organisms, “human brains and computing machines,” that can live “together in intimate association, or even in close union.” “The hope is that, in not too many years, will be coupled together very tightly.” “The resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today.”

Given these assumptions, Licklider continues, “it seems reasonable to envision, for a time 10 or 15 years hence, a ‘thinking center’ that will incorporate the functions of present-day libraries together with anticipated advances in information storage and retrieval.” Licklider does not stop there: he has a clear idea in his head of an infrastructure. “The picture readily enlarges itself into a network of such centers, connected to one another by wide-band communication lines and to individual users by leased-wire services.”

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<sup>45</sup>Allen Ginsberg, *Kaddish and Other Poems 1958–1960*, Pocket Series 14, City Lights, San Francisco 1961, Note, p. 100.

<sup>46</sup>J. C. R. Licklider, “Man-Computer Symbiosis”, in: IRE (Institute of Radio Engineers) *Transactions on Human Factors in Electronics*, volume HFE-1, pp. 4-11, March 1960.

Licklider is able to do more than just conceive anticipatory visions; going beyond his training in psychology, he understands quite well the technical and economic aspects of these visions: “in such a system, the speed of the computers would be balanced, and the cost of the gigantic memories and the sophisticated programs would be divided by the number of users.”

His management capacities were also recognized early on. In 1962, Licklider was nominated as the head of the Information Processing Techniques Office (IPTO) of the Advanced Research Projects Agency (ARPA); like NASA, the ARPA was created in 1958 in response to Soviet Union launching Sputnik into space. In the ARPA, Licklider was in charge of the IPTO. In 1963, he became the ARPA’s Director of Behavioral Sciences Command & Control Research.

A memorandum that was circulated on April 23, 1963, suggested connecting, in one network, all computers involved in research and development projects—called the *Intergalactic Computer Network*.<sup>47</sup> According to Licklider, only by creating such a network and sharing hardware resources and calculation power, can the “aspirations, efforts, activities” of all those involved in the various projects—“advancement of the art or technology of information processing”, “advancement of intellectual capability (man, man-machine, or machine)”—be achieved and completed with success.

With these words, Licklider provided the first description of the ARPAnet, which first appeared in 1969 and would eventually be renamed Internet. Still, it is clear that Licklider did not view the Internet as just an underlying internal structure, a physical layer. Licklider already had a clear vision in mind for the social capabilities of the Internet, the layer of shared knowledge: The World Wide Web.

Licklider did not stop there. In *Libraries of the future*,<sup>48</sup> the final report of a research project commissioned by the Ford Foundation, he discussed an issue of great interest even today, fifty years later: the digitization of libraries, books, and paper archives, and thus, the appearance of the digital Revolution and the conservation of knowledge through digital storage media. Even in the mid—1960s, Licklider had already noticed how the amount of material that people were trying to conserve was growing exponentially. This increase was accompanied by storage media’s growing capacity. Even the structure of texts was affected as, with digital supports, they could always be accompanied by metadata and annotations. Now, we will talk about Document Management, Full Text Indexing, Information Retrieval, Search Engine Technology, Multimedia Objects, and Knowledge Objects: all of these were discussed, in some detail, in *Libraries of the future*.

Licklider did not stop there. In his 1968 article, *The Computer as a Communication Device*,<sup>49</sup> he offers a detailed preview of what we have come to call

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<sup>47</sup>J. C. R. Licklider, “Memorandum For Members and Affiliates of the Intergalactic Computer Network”, April 23, 1963. Published on *KurzweilAI.net*, December 11, 2001, <http://www.kurzweilai.net/memorandum-for-members-and-affiliates-of-the-intergalactic-computer-network>.

<sup>48</sup>J. C. R. Licklider, *Libraries of the future*, The MIT Press Cambridge, Ma., 1965.

<sup>49</sup>J. C. R. Licklider, “The Computer as a Communication Device”, *Science and Technology*, April 1968.

the *web 2.0 infrastructure, social network, virtual community*. Licklider called these “on-line interactive communities.” These communities contained people who wished to collaborate “face to face, through a computer.”

“What will on-line interactive communities be like?” Licklider wondered. “In most fields, they will consist of geographically separated members, sometimes grouped in small clusters and sometimes working individually. They will be communities not of common location, but of common interest.” Licklider also points out that “in each field, the overall community of interest will be large enough to support a comprehensive system of field-oriented programs and data.”

We must still hope that this concept will come to fruition because, in the mid—1980s, Winograd and Flores affirm the dominion of the Designer, who constructs programs and data from the Sky and not from within the interactive communities. It is for this reason that even 50 years later, interactive communities are largely constricted to Facebook and other similar contexts and subject to a system of rules.

For Licklider, the threats and opportunities are already quite clear. The threat comes from a new Social inequality: Digital divides. Hope appears in the form of a Digital Democracy, a New Economy founded on Knowledge Sharing.

For the society, the impact will be good or bad, depending mainly on the question: Will “to be on line” be a privilege or a right? If only a favored segment of the population gets a chance to enjoy the advantage of ‘intelligence amplification’, the network may exaggerate the discontinuity in the spectrum of intellectual opportunity.

On the other hand, if the network idea should prove to do for education what a few have envisioned in hope, if not in concrete detailed plan, and if all minds should prove to be responsive, surely the boon to humankind would be beyond measure.

Licklider’s mentioning of ‘intelligence amplification’ is a direct reference to the work of Doug Engelbart. Licklider, in his role as IPTO of the ARPA financed—along with NASA and RADC (Rome Air Development Center’s Research and Development Laboratory, part of the U.S. Air Force)—The Augmentation Research Center (ARC) of the Stanford Research Institute, Menlo Park, California, which was Engelbart’s laboratory. Engelbart, an electrical engineer, is also a technician, machine builder and implementer. He is also a visionary. He thought of Augmenting Human Intellect through human interaction with machines.

The 1962 request for funding was the chance to describe the *Conceptual Framework* of the work.<sup>50</sup> At work, and even in one’s personal life, everyone has to deal with “complex situations,” without clear or linear solutions. “By ‘augmenting human intellect,’” wrote Engelbart, “we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems”. For Engelbart, increasing one’s

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<sup>50</sup>Douglas Engelbart, *Augmenting Human Intellect: A Conceptual Framework*, Summary Report Prepared for Direction of Information Science Air Force Office of Scientific Research, Stanford Research Institute, October 1962.

capabilities means a mixture of “more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble.”

Engelbart points out that, faced with all of these complex problems, one needs more than “isolated clever tricks that help in particular situations.” One must completely change his “way of life.” People need to prepare to live in an “integrated domain,” where “hunches, cut-and-try, intangibles, and the human ‘feel for a situation’ usefully co-exist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids.” This is the digital world: a world where human beings and computers, connected by “man-artifact interfaces,” make up one system.<sup>51</sup>

In order for the system to be effective, the machines cannot resemble the Mainframes or the Infrastructure, both far separated from people; the machine must be a ready-to-hand tool that is easily manipulated by people and that can help people face complex problems.

At this point, we must ask ourselves how we can imagine and build ready-to-hand tools. In the mid-1980s, we saw how Winograd and Flores, perhaps guided by the best intentions, described a world with a Designer, and everyone else existing only as users. In doing so, they created a world in which the Designer’s tools were necessarily different from the users’ tools.

In October 1962, Engelbart wrote about a very different approach:

(1) Our researchers are developing means to increase the effectiveness of humans dealing with complex intellectual problems, and (2) our researchers are dealing with complex intellectual problems. In other words they are developing better tools for class to which they themselves belong.<sup>52</sup>

Engelbart’s Research does not live in a separate world, like the Designer’s Sky proposed by Winograd and Flores; the Research, instead, lives in the *throws*—as Heidegger tells us—in the same world, the same environment as the human being. The Researcher, as a human, can work effectively only if he always remembers that the tools he uses can also be used by any other human being. Each human being who performs the job of Researcher, or any other job, faces complex problems: he can therefore take advantage of digital tools.

Thus, two different attitudes exist. Each CIO must decide which attitude to assume, either the Designer of Winograd and Flores, or the Researcher of Engelbart.

December 9, 1968, San Francisco, Monday Afternoon, 3:45.

The afternoon session of the Fall Joint Computer Conference begins, held at the Convention Center in San Francisco. More than 1000 computer professionals are in attendance.<sup>53</sup>

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<sup>51</sup>Douglas Engelbart, *Augmenting Human Intellect*, cit., p. 1.

<sup>52</sup>Douglas Engelbart, *Augmenting Human Intellect*, cit., p. 118.

<sup>53</sup>Available at: <http://www.youtube.com/watch?v=yJDv-zdhzMY>.



Six years have passed since Engelbart wrote *Conceptual Framework*, six years of technical work in a laboratory. The conceptual framework has not changed and the visionary hope persists, but now everything has been brought to life by practical experience. Not the pure and abstract experience of the researcher, but a type of completely human experience, connected to man's daily life, for each man in the world who has chosen not to submit to the will and orders of others.

Instead of studying how tools could enhance the operations of the human mind, years have been spent just *using tools*. In their use, tools refine and the mind finds ways to work better. The practice feeds the theory and theory, in turn, feeds into the practice.

Smiling, though not without worry, Doug Engelbart starts to talk.<sup>54</sup> He had a strange machine in front of him, “a computer-based, interactive multi-console display system”, a machine that is completely at man's disposal, his mind's prosthesis, a machine connected to other machines, a knot in an infinite network. Today, we call it the Personal Computer.

Engelbart showed how the Word processor worked. This way of writing that is commonplace now, was so different from writing on paper. “Word processing beginning with a blank piece of paper,” Engelbart says. Engelbart writes on the screen and explains “An instrument/vehicle for helping humans to operate within the domain of Complex Information Structure”. *Operate*, he tells us, is “compose, study and modify.” The Complex Information Structure is—he shows us while tracing a graph on the screen—a representation of links between concepts. The structure that we have in mind “is too complex to investigate in linear text,” and so we need more than a machine that just processes texts made of sequenced words. Engelbart uses the mouse, and talks about it. The first mouse ever seen. “I don't know why we call it a mouse,” he says. “It started that way and we never changed it.” He and his collaborators invented the tools and gave them names.

Engelbart connects his machine with his collaborators' machines, who are at the Menlo Park laboratory: we see their images on the screen, on Engelbart's shoulders while he speaks with them. The infrastructure of Engelbart, named NLS, on-Line System, couples two types of work: off-line workflow and online cooperation.

The description of what is now called the Personal Computer was already clear in the Computer Display Control Report, given to the investors—ARPA, NASA, and RADC—in 1965: a workstation with a cathode ray tube screen, keyboard, pushbuttons, mouse, and a joystick. Human beings interact with the machine through convenient interfaces. “A user soon finds it very easy to keep his eyes on the screen and cause the bug to move about upon it as quickly and naturally as if he were pointing his finger (but with less fatigue).<sup>55</sup>” Tools ready-to-hand. Someone mentions the possibility of failure, as the tools developed by Engelbart's Augmentation Research Center never resulted in the creation of a business. For

<sup>54</sup>The Mother of All Demos, <https://www.youtube.com/watch?v=yJDv-zdhzMY>

<sup>55</sup>W. K. English, D. C. Engelbart, *Computer-Aided Display Control*, Stanford Research Institute, Menlo Park, July 1965, p. 6.

various reasons, the tools were never patented, or else the patents were never defended. The Augmentation Research Center, due to a loss in funding, entered a period of crisis. Taking advantage of the ARC's difficulties, Xerox was able to open a new research center in Palo Alto, a few miles from Menlo Park, in 1970. The Palo Alto Research Center, PARC, is considered the cradle of digital technology, but only because they received many of the researchers who originally worked for Engelbart.

The vision of "the digital computer as a tool for the personal use of an individual," offered by Engelbart is strong, because it comes from a solid thought process. Engelbart, an electrical engineer, was actually a philosopher, and, like Leroi-Gorhan and McLuhan, was capable of understanding how technique led to the "natural evolution in developing the basic human capabilities." Therefore, "in a very real sense, as represented by the steady evolution of our augmentation means, the development of artificial intelligence has been going on for centuries." That which Engelbart called "augmentation mean" was what McLuhan called "media, extension of man." A trick on nature carried out by man.

Engelbart, writing in the late 1960s, reminds us that the word processor and the mouse are augmentation means. But he does not limit himself to philosophy, he builds tools.

The CIO is not asked to build tools. He is, however, asked to choose tools. He must choose them in a way that gives all people the possibility to expand their intelligence and mindfulness.

Ted Nelson was born in 1937. His parents were film actors in their 20s. His father became well-known as a director. His mother, actress Celeste Holm, became even more famous and won an Oscar. They did not have much time for their son. Ted grew up with his maternal grandparents: his grandmother was an eccentric artist.

Ted spoke without hesitation of the "sickness" that accompanied him in his youth and, in different ways, into adulthood. Little Ted was dyslexic, unable to read printed texts at the speed that his teachers expected. It ended up that the "sickness" was more than just dyslexia: Ted suffered from Attention Deficit Disorder. In medical and psychiatric jargon, two conditions are universally known, yet subtly different: ADD: Attention Deficit Disorder; ADHD: Attention Deficit Hyperactivity Disorder.

"Attention Deficit Disorder," explained an older interviewer, "was coined by regularity chauvinists. Regularity chauvinists are people who insist that you have got to do the same thing every time, every day, which drives some of us nuts. Attention Deficit Disorder: we need a more positive term for that. Hummingbird mind, I should think."<sup>56</sup>

From early childhood, for Ted, the traits typical of written text posed insurmountable difficulties. They impeded his learning. A sheet of paper was a weak support that lacked a third dimension. Indeed, writing has just one dimension: sequenced characters on a support, in rigid order, letter after letter, word after word,

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<sup>56</sup>Gary Wolf, *The Curse of Xanadu*, *Wired*, 3.06, June 1995.

sentence after sentence, line after line. Sheets of paper are bound in notebooks or books, and books are often found, in some order, in libraries.

Teachers and doctors consider dyslexia and ADD to be defects, sicknesses. The Hummingbird mind needs to be corrected and brought back to a normal rhythm. But Nelson thought otherwise: “It was just another way of cognitive processing. A different mode of thinking.”

Young Nelson, dreamed of a way that learning that was less harmful. He dreamed of a type of technology that, instead of being critical of his deficiencies, would help him and value his individuality. What I feel so strongly, Nelson thought, must also be felt by others. Anyone could benefit from a new way of learning that did not force learners to rigidly follow a set structure, a way of learning that was not limited to closed blocks, book pages, and libraries.

He dreamed of a type of fluid knowledge that created new pathways, in which each place written about by people throughout history was connected to all other places.

We must also point out that it was not only sequential writing, pages, books, and libraries that Ted struggled with. He also struggled with the order imposed on all Information Systems. Records management, Data modeling, Data Base Management Systems are all attempts at putting data in order. These were just a new twist on the sequential ordering systems that were already noticeable in writing, pages, books, and libraries. Nelson was not trying to say that all of this was useless. But he did feel that alternatives existed. The data in all Information Systems are not on paper, but rather on digital supports. But Nelson points out that this transition was not the real cultural shift. The shift was a change in how people read and wrote: writing on a word processor liberates us from having to write sign after sign, liberates us from cutting and pasting. The shift was in imagining the fruit of all human writing as one lone text—here, we think of the word ‘seamless.’ A text that was not on paper, but rather, was multidimensional. Today, we often use the word *hypertext*. It is a new word invented by Ted Nelson in the early 1960s.

In his 20s, Ted Nelson, having extensively studied literature, comes face-to-face with his childhood need for inclusion while reading the poetry of Coleridge. Coleridge presents a dream—“A vision in a dream”—Xanadu, a palace on a river in the Orient, a magnificent world.<sup>57</sup> Ted Nelson imagines his own Xanadu. He dreamt of a different way of “reading.” A way that did not involve printing. A way that did not even go through Structured Information Systems.

Starting in the early 1960s, Nelson would spend his whole life trying to realize his dream. A form of technology that would allow for a new type of literature, in which all texts would be connected to all other texts, in full transparency; a type of literature in which the contributions of all authors are weaved together in a big, collective text.

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<sup>57</sup>Samuel Taylor Coleridge, *Kubla Khan. Or a Vision In a Dream. A Fragment* (1816), in Samuel Taylor Coleridge, *Christabel, Kubla Khan, and the Pains of Sleep*, John Murray, London, 1816, pp. 51–58.

Some say that Nelsons projects did not end in failure. Even today, Nelson, now much older, continues to advance his projects, and is still facing new challenges. He considers the World Wide Web a “draft” of his project. But the World Wide Web would have never existed if Nelson did not have the vision of a new culture, a new digital culture. Tim Bernes Lee, who we know as the inventor of the World Wide Web, refers to Ted Nelson as his first role model.

Similarly, several others refer to Ted Nelson as their role model, people such as Bill Gates, Steve Jobs, and all the young, enthusiastic Programmers, those who became adults in the 1960s, to whom we credit with creating the tools that started the Digital Revolution. All were inspired by a book published by Ted Nelson in 1974: *Computer Lib/Dream Machine*.<sup>58</sup> A book that is the coming-of-age story of this generation of innovators. A book without pagination, written by hand and illustrated by the author, made up of a collection of typed texts glued together. It was an Underground text, an artists’ book similar in form to the work of cartoonist Robert Crumb.

The book’s cover alone was provocative and suggestive: a human hand, closed in a fist, with the word Lib on the write and, higher, the word Computer. At the top, the following sentence was written: “Can and must understand computers. NOW.”

EVERYBODY SHOULD UNDERSTAND COMPUTERS, Nelson wrote in the introduction, in all capital letters. This book “is intended to fill a crying need. Lots of everyday people have asked me where they can learn about computers, and I have had to say nowhere.”

“I was a very junior computer programmer and occasional teacher of Transcendental Meditation,” recalls Mitch Kapor, Designer of Lotus 1-2-3. “I stumbled upon Computer Lib on a nocturnal excursion and was instantly bewitched. Here was a man who dreamed my dreams before I did, who gave voice to a radically different concept of computers as other than giant calculating machines.”

Ten years later, in the early 1908s, in Literary Machines, Nelson spoke of two hopes:

Hope 1. To have our everyday lives made simple and flexible by the computer as a personal information tool.

Hope 2. To be able to read, on computer screens, from vast libraries easily, the things we choose being clearly and instantly available to us, in a great interconnected web of writings and ideas.<sup>59</sup>

“The immensity of the coming revolution is not clear yet,” Nelson writes. Perhaps the immensity of the Digital Revolution is still not clear today, thirty years later.

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<sup>58</sup>Ted H. Nelson, *Computer Lib/Dream Machines*, Self-published, 1974. Second Edition: Tempus Books/Microsoft Press, Redmond, Washington, 1987.

<sup>59</sup>Theodor Holm Nelson, *Literary Machines*, Self-published), Swarthmore (Pa), 1981, 1/2. (Editions as listed in the 93.1 (1993) edition: 1980, 1981, 1982, 1983, 1984, 1987, 1990, 1991, 1992, 1993).

According to Nelson, this immensity remains unclear because “two cultures have united on a false, agreed-upon definition of what computers are.”

On one side are the technicians, who Nelson calls *Technoids*, or, *Noids*. They “have an exaggerated and caricatured notion of what constitutes clear-minded thinking, and never miss a chance to denounce other cognitive styles as ‘illogical.’” Nelson acknowledges the irony: “Technoids are Lords of Complication.”

Still, Nelson is equally critical about members of the other culture: the *Fluffies*.

Fluffies have “a humanistic background, in literature, history, the arts, etc.” “The Fluffy cognitive style leans toward vagueness and the reduction of issues to vague idealistic terms.”

“The members of the two cultures, technical and literary—who rarely talk to each other—”, concludes Nelson, “have it all figured out, quite wrongly.”<sup>60</sup> A new culture is needed, one that can find a middle ground between these two.

“The goal of tomorrow’s text systems will be the long ones of civilization—education, understanding, human happiness, the preservation of human tradition.” “But”, adds Nelson “we must use today’s and tomorrow’s technologies.”

A new profession, a new role is needed. Nelson offers a name for this role, *System Humanist*. The System Humanist, writes Nelson, must strive for “the ideals of the humanist perspective by the best available means. This means finding the way the human literature, art and thought—including science, of course—may best be facilitated, preserved, and disseminated.”<sup>61</sup> “Means to increase the effectiveness of humans dealing with complex intellectual problems,” Engelbart wrote. Nelson and Engelbart knew each other well; already in the 1960s, they shared the same vision. Means, or media, or “extension of man.” Humanistic, digital tools.

A CIO can and must be a System Humanist: far from the attitudes of the Lords of Complication, attentive to education, understanding, human happiness, the preservation of human tradition, and ready to use today’s and tomorrow’s technologies.

## 10 The Human Being Does not Work that Way

Licklider, Engelbart, and Nelson, our trailblazers—pioneers, guides on the path to digital mindfulness—claim to closely follow a trailblazer, role model and master, who belong to the previous generation: Vannevar Bush.

It all started with an article entitled *As We May Think*, published in the journal *The Atlantic* on July 25, 1945. A second version, shortened but with illustrations, appeared two months later, on September 10, in the weekly publication, *Life*.

Engelbart read *As We May Think* in *Life*, in September 1945 while, during the war, serving in the Philippines, as a radar technician for the United States Navy.

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<sup>60</sup>Ted Nelson, *Literary Machines*, cit., 1/11.

<sup>61</sup>Ted Nelson, *Literary Machines*, cit., 1/13.

The article captivated him. The article would later be the main inspiration of one of Engelbart's projects: *Augmenting Human Intellect*. Licklider dedicated *Libraries of the Future* to Bush. Nelson showed his respect and gratitude with "an effort in counter-discipleship," an article with an emblematic title: *As we will think*. Here, at the beginning of the 1970s, Nelson argued: Bush's work is a necessary starting point for making our vision for the machine a reality, "that much of what he predicted is possible now." Nelson later republishes all of *As We May Think* in *Literary Machines*.

Bush was an avid supporter of technical innovation: science and industry together, basic research but also with tendencies towards the killer app and practical use. When he was young, Bush worked for General Electric. Then he graduated from MIT with a degree in Electrical Engineering. He became a researcher there in 1919, then a professor in 1923, and between 1932 and 1938, he was Vice President and Dean.

During this time, he was also an entrepreneur. In 1922, he was one of the founders of Raytheon. Initially, the company produced electron tubes to supply power to radio-receivers, making it possible to convert alternating current to direct current. The electron tubes would next be used during World War II in the construction of radar. Today, the Raytheon Company is a major U.S. defense contractor.

Starting in 1927, Bush directed the MIT laboratory in which the *differential analyzer* was constructed, designed to solve differential equations by integration. Bush was quite familiar with punch card technology, through which information could be digitized: represented by a series of numbers. Bush was also quite familiar with electron tubes. Still, the differential analyzer was neither digital nor electronic. It was a mechanical engine, using wheel-and-disc mechanisms.

In the 1930s, experiments were conducted on the use of electronic components: electron tubes, relay contacts, and switches. Through these experiments on analytical engines, Claude Shannon, a twenty-year-old student, conceived an essential core of the digital computer. It was a structure composed of two layers. The Logic layer: information was expressed as a numeric code to the second base: a binary digit: a bit. The Physical Layer: each bit corresponded to an electronic circuit, either an open or closed state. This description was the main idea of the thesis for Shannon's Master of Science.

In the second half of the 1930s, in a time of global crisis and impending war, Bush fostered a government agency aimed at coordinating and directing the technological innovations of universities and private businesses, which could be used for military purposes.

In an early 1940 Congressional meeting, the discussion regarding the National Defense Research Committee (NDRC) was proceeding slowly. In May, when Germany invaded France, Bush used lobbies and private contacts to organize a meeting with Roosevelt. On June 12, 1940, the president approved and supported Bush's vision.

In 1941, the NDRC was absorbed by the Office of Scientific Research and Development (OSRD).

Bush, as director of the OSRD, coordinated more than 200 scientific, military projects. Radar, sonar, computer-based spotting devices, mass production of penicillin and sulfonamides. Until 1943, when the OSRD was taken over by the army, Bush also led the Manhattan Project: the atomic bomb.

On April 12, 1945, Roosevelt died. Harry Truman took his place, though he knew little about the work on atomic bombs and was relatively unknown by Bush. On August 6, the B-29 Super fortress dropped the Little Boy on Hiroshima.

The short, informative article *As We May Think*, was published in *The Atlantic* on July 25, 1945: a few days before the bombing of Hiroshima. The second version appeared in *Life* one month after the bombing.

Bush was a master of Public Relations and Cultural Politics. The article had a precise intent. Bush, who was often at odds with the Harry Truman, was trying to convince the president of the need to focus on new research projects that could be useful in peacetime, rather than focusing only on projects for the Military-Industrial Complex. Bush wrote extensively, always avoiding technical terms, so as to connect with the masses. He considered Information Technology central to post-war society. His work focused on how computers could assist research projects. We could easily suppose that Bush was thinking about mediating platforms that could share advances and knowledge. But, on the contrary,—perhaps as a reaction to the large dimension of military/industrial research projects, in which the researcher, deprived of a vision of the whole project, risked being reduced to the position of ‘skilled worker’—Bush imagined a desk-machine, a personal machine, for individual use, for the purpose of asking questions and looking for answers.

Bush and Licklider both pointed out that we will become increasingly overwhelmed by a large mass of information. In 1945, Bush already saw the solution offered by Information Technology to the problem posed by this mass of information; it was in the same vein as what was proposed by Descartes five hundred years prior: look for an ordering system, a type of classification. Information can be broken down into data, data can then be selected and conserved in predefined spaces, then stabilized with a map or model: essentially, the Data Base Management System.

“Our ineptitude in getting at the record is largely caused by the artificiality of systems of indexing. When data of any sort are placed in storage, they are filed alphabetically or numerically, and information is found (when it is) by tracing it down from subclass to subclass. It can be in only one place, unless duplicates are used; one has to have rules as to which path will locate it, and the rules are cumbersome. Having found one item, moreover, one has to emerge from the system and re-enter on a new path.<sup>62</sup>”

Bush raised one simple, humanistic exception: “The human mind does not work that way.” This brings us to a crossroads. On one hand, it would be possible to institute machines that guarantee order and impose rules. On the other hand, it

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<sup>62</sup>Vannevar Bush, *As We May Think*, cit., 1945, § 6.

would also be possible to construct machines that more closely mirror a human way of thinking.

“The human mind [...] operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. [...] The speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature.<sup>63</sup>”

With this remark, Bush forces us to face the principal issue with digital culture. The Digital Revolution forces people to live in a world characterized by an “enormous mass” of data, a world made up of data, information, and bits.

Here is a new divergence: “Being digital” can mean two opposing things. On one hand, it means belonging to an Infrastructure that reduces us to the role of user, limited to certain behaviors, defined by the Designer. On the other hand, it means being thrown into the world alone to face different problems, but equipped with a machine that can help us in our personal journey: from question to answer; from a mass of information to the discovery of new ways of solving problems; from ignorance to knowledge.

An open question. A question posed by all CIOs. Bush, Licklider, Engelbart, and Nelson suggest a humanistic stance. Bush, engineer, machine builder, elects to view machines not as a builder, but from the perspective of the person who needs a tool for personal empowerment.

As a result, during the wartime of the 1940s, Bush imagines a device, a group of tools for peacetime, prostheses of our body and mind. Bush called it *memex*. Now, we say *Personal Computer*, *tablet*, *smartphone*.

“Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and, to coin one at random, ‘memex’ will do. A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.<sup>64</sup>”

By moving our hands across the keyboard or a mouse across the screen, we are enlarging the capacity of our minds; it is our minds’ way of moving “on the intricacy,” “on the web of trails.”

Bush attached a special importance to the word *trail*. For Bush, *Trail* refers to both the connections that are activated in our brains, our personal neural networks, as well as the connections—now called *links*—that connect documents, texts, and the information at our disposal—now called the World Wide Web. Bush suggests viewing the World Wide Web and our own minds as mirrors of each other.

The verb *trail* is derived from the word *trahere*: to ‘draw’, ‘to drag’, ‘to haul’, ‘to get’, ‘to derive’. Starting in the fourteenth century, it also meant ‘to follow the traces or scent of, as in hunting’, ‘to track’. Consequently, the noun *trail* means ‘a

<sup>63</sup>Vannevar Bush, *As We May Think*, cit, 1945, § 6.

<sup>64</sup>Vannevar Bush, *As We May Think*, cit-, 1945, § 6.



mark, trace, course, or path left by a moving body’, ‘track or smell left by a person or animal’, ‘a marked or beaten path, as through woods or wildernesses. It also refers to ‘an overland route’: the pioneers’ trail across the prairies.

In the same period that the Digital Revolution seemed imminent, that is, the final years the twentieth century, the years in which Negroponte wrote *Being Digital*, Peter Drucker affirmed that “The most important contribution management needs to make in the 20th century is [...] the increase the productivity of ‘knowledge work’ and ‘knowledge workers’”.<sup>65</sup> Vannevar Bush had spoken about all of this fifty years earlier and had said it with greater clarity. Bush did not speak only about the work, just as he did not speak only of the user of an Infrastructure or platform. Bush discussed the citizen. He did not speak only about productivity, he spoke about how each human being lives in a new environment: a digital environment. Bush insists that we “find delight in the task of establishing useful trails through the enormous mass of the common record.”

The vision is clear: “Wholly new forms of encyclopedias will appear, ready-made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified.”<sup>66</sup> This means we must fully embrace this world—not just limit ourselves to using Facebook. Thus, we are all called to be trailblazers: pioneers exploring new terrain. To do so, however, we need someone who has already started this journey and can guide us.

## 11 Conclusions

Such is the role of the Digital Humanist CIO. Exploring the digital land. Experimenting with different ways of living this new environment.

Digital technologies offer people a new possibility: redesigning one’s entire life, from daily life to work life, from homes to businesses. Of all managers, the CIO is best equipped to understand this change. He will be the one to guide businesses and organizations through the Digital Transformation.

This task implies certain technological decisions. The easiest choice, the choice that is closest to the historical role of the CIO consists in establishing infrastructures and platforms, where each person, citizen or worker, is reduced to the role of user, whose actions are limited by certain rules. Infrastructures and platforms are necessary, but for another reason: offering all citizens and workers tools for constantly enlarging their work spaces: only in this way can we fully take advantage of the implicit richness of the Digital Revolution.

The other option, however, requires the CIO to tap into his own knowledge of ethics and the human condition. The CIO, as an expert in controlling machines, is

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<sup>65</sup>Peter F. Drucker, “Knowledge-Worker productivity: The Biggest Challenge”, in *California Management Review*, vol. 41, n. 2, Winter 1999.

<sup>66</sup>Vannevar Bush, *As We May Think*, cit-, 1945, § 8.

called to reflect on his own experiences with digital innovations and be in constant contact with the people with whom and for whom he works.

Millennials, digital natives, citizens, workers, Designers, and CIOs—we are all like Robinson Crusoe. We must learn to get by in a new world and use new tools. To do so, however, we need someone who has already started this journey and can guide us. This is the role of the humanist CIO. The best trailblazer is the person who has ventured into the forest, risked being lost, and ultimately found his way.

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