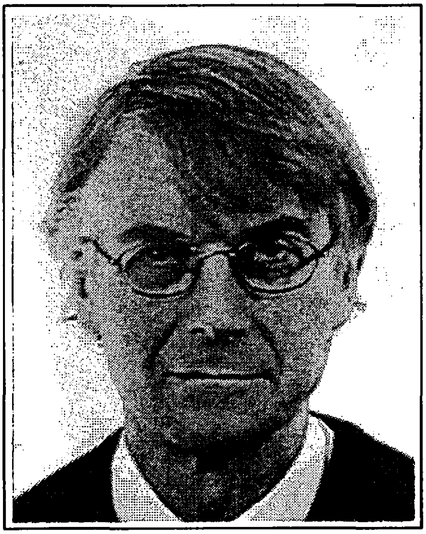

EXACT CIVILISATION. THE EMERGENCE OF A TECHNOLOGICAL CULTURE, 1850-1900

Auke van der Woud

'Technological civilisation' is a conjunction that raises questions. We use it more or less thoughtlessly for peoples from ancient times. The Incas and the Romans, for instance, had a technological civilisation. We would not apply the term to our own society quite as easily. Not only because the word 'civilisation' has become somewhat obsolete these days, but also because we seem to feel that a civilisation that is designated as 'technological' is lacking in some way or other. In general, there is some resistance to the idea that technology could be 'cultural'. I do not use the term 'cultural' in the sociological or anthropological sense, but in the strict sense, in reference to art and culture. In common parlance, art and culture belong together. The list of 'technology, art, and culture', however, is not perceived as a similar close unity, but rather, as a discontinuity. There is technology on the one hand, and art and culture on the other. It is this segregation, this perception of two distinct domains, that I would like to investigate today, in a historical perspective and with an emphasis on the 19th century.

The term 'technological civilisation' sounds strange as a description of our society. Isn't it remarkable that, although we are well aware of our dependence on technology down to the smallest details of our daily lives, members of the cultural elite and opinion-makers have the greatest difficulty appreciating technology as our culture? A few examples from the sphere of nature conservation in the Netherlands can serve to illustrate this point. The protection of nature incontestably belongs to the domain of culture. In the Netherlands, it has great public support. A spokesman of the association Het Zeeuws Landschap (The Landscape of Zealand) recently stated, in a radio programme, that he has 'mixed feelings' about the Schelde area, because the landscape there is magnificent – he called it a 'primeval landscape' – but the docks are always visible at the horizon, as is the Borssele nuclear power plant.

Mixed feelings, two non-integrated realities: unspoilt nature as opposed to technology that spoils everything. Another example is also taken from a recent radio programme. The warden of Oostvaardersplassen, a nature reserve in one of the polders of IJsselmeer, praised the 'completely natural' and consequently always 'unexpected' water level in his reserve, claiming it depends entirely on rainfall. What he conveniently omitted to mention was that not a single water level in the Netherlands is really natural, because if the pumps were to stand still, 65% of the national territory would be flooded. Actually, the Dutch are generally quite aware of this fact. Without these great technological efforts, Holland would cease to exist. Without a car, the nature lover cannot get to his primeval landscape. Why is it that we idealise an environment from which technology is absent?

Art and culture belong together, and technology stands apart, and, it seems, further in the background, and at a lower level too. This is a convention that is familiar to all of us, that need not be defended and is not seriously challenged. The distance between art and technology has a long-standing tradition. It is evident in 19^{th}-century manuals on aesthetics, where it is phrased in concise terms. In aesthetics, art, after religion, was the most lofty pursuit of mankind. For through art, man was able to express and convey the highest ideals, such as piety, heroism, nobility, self-sacrifice, and, of course, love of one's neighbour and one's country. In this 19^{th}-century vision, then, religion and art stood right at the top. Below them stood science, and then came technology. Art derived its high position from its lofty ideals, which were mainly expressed in monumental art. Within the arts, of course, there was also a hierarchy. Monumental art ranked highest, as it was dedicated to eternal values. The more practical the purpose of a work of art, the lower its status. Science was predominantly utilitarian, which is why it ranked lower than art. The most ideal sciences stood at the top: first theology, then philosophy. After science came technology. Technology was entirely devoid of ideals. It aimed not at higher things, but at practical matters. Technology was merely utilitarian. This hierarchy in which the ideal ranked higher than the material can be traced back to a Platonic origin. It had been passed on and adapted by Christian and Humanist philosophers for centuries, and was disseminated on a large scale in 19^{th}-

century education. In this idealist aesthetics, it was self-evident that art was closely connected with the idea of civilisation, on account of its higher aspirations. Art was the means for visualising the Beautiful, the Good, and the True. By its beauty, it could transport and uplift the spectator. Technology, on the other hand, could not uplift at all. It could only solve practical problems, and in the concept of civilisation, therefore, it could only play a subservient role.

Around 1850, however, a new artistic programme emerged to compete with this idealism: realism. This was the art of artists who saw that the exalted ideals of beauty suited an orderly, bourgeois world, but remained theoretical in the daily reality of the common people. These artists drew their subjects from that everyday life. Although realist authors such as Emile Zola had a large readership, their work was strongly rejected by the guardians of civilisation. The artistic avant-gardes of the 20th century also remained marginal with their subjective and often ugly reality.

All this changed in the second half of the 20th century, when the museums and art schools elevated the pre-war avant-gardes to the artistic standard. The idealist aesthetics with its classic harmonies of the Beautiful, the Good, and the True became obsolete. With it, the foundation supporting that old and self-evident relationship between art and civilisation disappeared. The new artistic concepts were too individual, and often also too ephemeral or unintelligible, to be able to make any collective claims. Besides, the traumas of World War II had robbed the concept of civilisation of much of its lustre and force.

Thus, in the space of just a few decades, an age-old tradition was lost. These days, the cultural ideals of heroism, nobility, self-sacrifice, and patriotism are hardly ever a subject of public discussion anymore. To our sensibility, those ideals belong to the 19th century. And yet we still cultivate our collective ideals of beauty, virtue, and truth. However, the monuments that exemplify these ideals are no longer produced in the domain of art and culture, but by technology. They are the images of the latest car models and mobile phones, the billboards for the healthiest yoghurt, the architecture of the most recent shopping malls. For a millennium and a half, the word 'icon' referred to a man-made image of the Most High: Christ, the Virgin, or a saint. Since about 1990, hundreds of millions of people have understood the word 'icon' to mean a small picture on a computer screen that represents a program, file, or function. The need for collective images of progress, of higher things, has not disappeared. However, it is now being fed by the practical metaphysics of technological miracles.

The assertion that technology is a form of culture is incontestable. Anthropologists, archaeologists, sociologists, and historians have observed and described this in all manner of ways. But in these cases, as we have remarked, they use 'culture' in the sense of the way a society perceives and organises itself, and of its motives and goals in these processes. In that sense, of course, technology undeniably qualifies as culture. At present, we can almost say it is our global, 'universal' culture. Exact science, the mother of technology, is claimed to be above all cultural differences, on account of its exactness. But is this science as universal as it is made out to be, and is it really so far above cultural discussions?

In 1998, the controversial British biochemist Rupert Sheldrake postulated that the 'exact' sciences are anything but exact. He showed that even the fundamental constants of nature, such as the speed of light and the force of gravity, on which the whole construction of the natural sciences is based, are not constant at all, but variable in time and across space. It is the corporate culture of these sciences that is keeping the ranks closed, on pain of excommunication, and that affirms the image of absolute constant exactness over and over again, even though research findings indicate the opposite.[1] Gender studies have shown that much technology realises the fantasies of men – and not those of women. Cultural differences, it seems, can give rise to two very different solutions to the same problem. I would like to cite an interesting example from the 1997 study by Eda Kranakis on the technological development of the suspension bridge. The American farmer and justice of the peace James Finley, who lived in a sparsely populated part of Pennsylvania, designed a bridge suspended from chains and patented it in 1810. All its parts could be made and repaired by any capable smith and carpenter. The design of the bridge was very simple and purely functional, without any aesthetic ambition. Kranakis compares this bridge to Claude Navier's designs for the Paris Pont des Invalides from a few decades later (1830). Whereas Finley was an inventor without a technical education, Navier was a scientifically trained engineer. His plans were submitted to the experts of the Corps of Bridges and Roads, the technological elite of France, whose approval was required prior to execution. These judges praised Navier's design for its beauty and elegance, not just of its visual appearance, but also of its mathematical reasoning and calculation. Finley had arrived at the elements of his bridge by experimental means and with a view to the abilities of the village smith. Navier applied the latest theories in mathematics and physics, catered to the most up-to-date architectonic taste, and designed it in view of the state-of-the-art production possibilities of his day. His bridge has a free span of 170 metres. The bridge type of the Finley system could span 75 metres at most. Thus, two different types of suspension bridge were developed; two completely different solutions to the same technical traffic problem; two technological cultures. Kranakis describes how they both fared. Almost thirty bridges of the Finley type were built, some of which remained in use for a very long time. Navier's bridge was never even finished. Shortly before its due completion date, a burst water pipe adjacent to an abutment foundation caused one of the two pylons to subside a few centimetres, which in turn dislocated the suspension of the bridge to such an extent that the bridge had to be demolished. Two bridges, two cultures: the unwieldy but efficient DIY system of Finley versus the advanced but vulnerable technology of France. Navier's bridge was, first and foremost, meant as a monument in the classical sense, which, according to a 19th-century source quoted by Kranakis, 'let its disposition be calculated with the idea of forming an edifice approved by artists, agreeable to the public, honorable to the administration' [a monument that ....] 'interest and movement to all the magnificence of this part of the capital.'.[2]

These words cause us to shift our perspective. It seems that in 1830 Paris, engineering technology was a cultural domain that belonged in the sphere of art and culture. Navier and the authorities who judged his design considered the bridge both as an expression of monumental art and as a splendid product of technical science and utilitarian technology. We have just seen that technology was on a lower rung than the arts in 19th-century aesthetic theory, but there was one exception. That exception was architecture. Architecture integrated technology in the domain of art, as it drew on traditions and conventions with which it was able to convey cultural ideas and ideals to the public.

This exceptional synthesis in itself was part of a long tradition. In fact, the very first textbook on architecture that has come down to us, De Architectura Libri Decem by the Roman Vitruvius (ca. 20 B.C.), already classified the work of the engineer under architecture. In the Italian Renaissance, this book and this view inspired a long series of treatises which were used all over Europe as references for monumental architecture. In the 17th and 18th centuries, the French Academy continued this tradition with new normative works. In many places in Europe, 19th-century architectural training was organised according to the classic academic ideas. In Belgium too, where the connection between architecture studies and engineering science remained close, architecture was conceived as an art, and in particular, as an art that does not just manifest itself as a visual play, but also as a corpus of theory and reflection and a corpus of a magnificent history; an art that is simultaneously connected, both materially and psychologically, with the needs of everyday life. In the Netherlands, things developed differently. In contrast to Belgium, this classical breadth and depth did not become institutionalised in Dutch architectural education in the 19th century. As a consequence, although architecture in the Netherlands is highly developed, both from the technological viewpoint and as an attractive economic product, its intellectual or explicitly cultural dimension lags a bit behind.[3] I am aware of using the term 'culture' in its 19th-century meaning now, namely, as the verbal culture of lofty ideas about the Beautiful, the Good and the True.

The 19th-century tradition to which Navier belonged was carried on in the next century. The 20th century also produced examples of this interconnection between technology, art, and culture. Prof. David P. Billington, who held the Sarton Chair in 1999-2000, argued, in his lecture in this auditorium, that the engineer Robert Maillart, trained at the Zürich ETH, developed his famous highly original concrete constructions inspired by his integral aesthetic ideas, and that his calculations were only of secondary concern to him. To quote Prof. Billington: 'His art dictated his science.'[4] In the past century, there were in fact quite a few designers who gave shape to this unity in their work, even in the Netherlands. However, to this day, the Rotterdam architect Hugh Maaskant, who built up an impressive oeuvre in the post-war decades in which building technology manifests itself proudly as art, never played a significant role in the Dutch discourse on architecture.[5] This discourse concentrated on architecture as a mass-produced article, with publications such as John Habraken's book 'Supports: an alternative to mass housing' (1972, first edition in dutch 1961*)*, in which the art of building was reduced to designing an efficient and economical building system.[6]

With these examples, we see the two sides of the matter we are investigating now. One side is that of the centuries-old tradition in which Architectura is the art that does not make technology subservient, but fully integrates it and elevates it in its realisation of beauty, a beauty that is also intended to cultivate and uplift the spectator. On the other side, we have architecture without any higher ambitions, the architecture of realism, aimed only at concrete, material functions and conditions. In this architecture, beauty is less important that affordability and utility. In the first case, there is an integration of technology, art, and culture; in the second, there is much attention for technology, but the discourse about art and culture is almost trivial.

These two fundamentally different notions both came to the fore from the mid-19th century onwards. That they did so in that period is no accident, because this was also when the natural and engineering sciences and their applications started celebrating their unequalled triumphs. In scientific literature on the history of technology it is customary to describe these triumphs in terms of the Darwinistic evolution model, i.e., an evolution that starts with simple techniques and gradually, through adaptation, separation, and specialisation, presents a picture of increasing complexity and sophistication. When discussing the effects of these developments on society, this is usually done in quantitative and material terms, such as greater production, cheaper products, more traffic, and better living conditions, especially as regards food and health. But the technological revolution of the 19th century must also have caused a profound mental shift. The effect of a technical innovation is much greater than the change it brings to the material conditions of our existence. The studies of Jonathan Crary (Techniques of the Observer, 1990 and Suspensions of Perception, 1999) have shown that the enormous – because rapidly industrialised – audiovisual inventions such as photography and film, and sound recording media such as the gramophone, produced profound changes in the perception and the reproduction of reality. Stephen Kern presented similar observations in his The Culture of Time and Space (1983). Both researchers argue that the great artistic innovations of the second half of the 19th century, such as Impressionism, Cubism, and Symbolism, were the direct consequences of the invention of photography and film. These technological discoveries changed the reproduction of the visible world, but also the perception of reality.

I would like to take this one step further and pose the question whether the technological revolutions of the 19th century changed the old concept of civilisation. In other words, whether they ousted the idealistic ideal of civilisation, filled with Christian and Humanist metaphysics, and supplanted them with the ideals of a technological civilisation. It is important not to define that idea of technological civilisation too narrowly. It will not do at all to think only of a collective desire for a car, a DVD player, or shopping via the Internet. These are merely exterior characteristics. Technological civilisation is embedded in our lives much more deeply and structurally. It is also important that we reflect on this idea of technological civilisation with as little prejudice as possible and that we avoid almost subconsciously rejecting it for being base. For when we do that, our judgement is inspired by the old ideal of civilisation that posits lofty ideas. When we reject it for that reason, from that higher standpoint, we will fall victim to that familiar inner conflict expressed by the warden of Het Zeeuws Landschap, whose exalted idea of pure and innocent nature collides with his perception of base technology at the horizon and with the low and guilty reality of the polluting motorist he would become once again after the interview.

The technological civilisation we are thinking about now is not just simple, base, or coarse. It also has its own richness, completeness, high and low points, its own metaphysics, its own collective values and standards, its own ideals for the future. But the technological civilisation has little or no need for history. Of course, there is a past, but reflecting on it is useless and superfluous. Technology looks forward, not backward. It is common knowledge that the young generations are losing their interest in history at a high rate. They feel it has no bearing on their daily lives. This development is not limited to young people. In an interview, the Dutch prime minister stated that we could no longer close our eyes to the fact that Western society, in very many respects, was shaped by Christian concepts and institutions. This drew scornful criticism from journalists who did not recognize the prime minister's remark for the statement of historical fact that it was, but took it as an expression of political arrogance from a Christian Democrat. I suspect that it was not postmodernism that made history obsolete. Postmodernism is a description of contemporary culture rather than an explanation. The marginalisation of history was probably the result of the second wave of technological revolutions that changed our lives after 1950. The first wave was much smaller, but just as fundamental. It started a hundred years earlier.

One of the foundations of this technological civilisation is the idea of exactness. Perhaps that is its only essential fundament. Exactness is dependable. It dispels doubt. The facts don't lie. How and when were these notions so structurally embedded in our collective consciousness? Revolutions in the fields of mobility and communication, new and exact coordinate systems of place and time, and an enormous increase in calculating power changed the world after 1850 as much as they did in the late 20th century. I would like to cite a few examples from that early era, first to give an impression of the scope and extent of these innovations. Similar to the way the computer changed our mental and physical world in the last century, the railroads and the closely connected telegraph changed the structure of the 19th-century world as people knew it then. They changed not only its physical characteristics, but also the world as a mental construct. Then, too, the media played a major role. The examples I give below are taken from Dutch 19th-century sources. The news coverage of the European railroads started up in the forties. Through the media, the public saw the railroad network grow year after year, gradually connecting all parts of the globe. Let us look, for instance, at the reports that were printed around 1870. Most of the major rail connections in Western and Central Europe had already been built by then. In Northern and especially in Eastern Europe, however, the work had only just begun. In 1870, an article in the magazine De Opmerker, a weekly journal for architects, engineers, contractors, and manufacturers, reported that the US were working on 300 railway lines at the same time. Some of those lines were the super railroads that would soon open up the continent that was still so unknown, such as the Union Pacific, the Great Western Railroads, and the tracks that were finished in 1871 that connected Hudson Bay in Canada directly with the Gulf of Mexico. Around 1870, new lines in the Americas, not just in the US but also in Mexico, Honduras, and Panama, achieved very fast so-called 'transatlantic' overland connections between the Atlantic and Pacific Oceans. In South America, at the same time, new railroads connected the gold and silver mines of the Andes and the economy of the interior with the oceans. In 1869, the Shah of Persia (Iran) granted a British company the monopoly on building and running the Persian railways. Shortly after 1870, railways were built in Turkey. In vast British India, that comprised the current Pakistan, India, Sri Lanka, Bangladesh, Burma, Malaysia, and Brunei, the great railways were largely finished by around 1870. Even the very sparsely populated Australia and New Zealand, both also British territories, had their own railways. Only Africa, the largest continent, remained insignificant and peripheral in this new global network. Around 1870, our reference year for this example, the total combined length of all the railways on all the continents amounted to three times the circumference of the earth. Twenty years later, around 1890, it had grown to fifteen times that circumference.[7]

The electromagnetic telegraph developed by the American Samuel Morse was presented to perplexed scientists for the first time in 1837. It caused a furore. In 1840, Britain started building its network, at first national but soon international, with London as its nerve centre. The telegraph network was organisationally and physically integrated with the railways. Every railway station doubled as a telegraph station. The railroads reserved a few telegraph wires for their own use and made the others available to the public, at a fee. Germany and the US had their first commercial lines in 1843, soon followed by France, Belgium, and the Netherlands (1845-1849). Via a submarine cable across the Channel, England was connected to the Continent in 1852; by 1857, there were already six of these cables. In the same year, a cable was laid across the Mediterranean to Tunis. To the East of Europe, the telegraph reached St.

Petersburg and Istanbul. In 1858, almost all European capitals were connected to the network. The British had also connected the capitals of British India and were planning to connect Turkey with London via that network.

By 1857, the speed at which the telegraph had spread across the world since its invention was twice that of the railways earlier. In America, it spread even faster than in Europe. In that year, when 'both the Old World and the New [were] spanned by this magical network of civilisation' ('zoowel de oude als de nieuwe wereld met dit toovernet der beschaving overspannen'), its length was estimated at approximately 220,000 km, more than five times the circumference of the earth.[8] This was on the eve of the great breakthrough, i.e., the line that connected Europe with America across the Atlantic. After repeated setbacks, this communication was finally achieved in 1866. This line would be a tremendous success. After 1866, sending a message around the world was a matter of minutes.

The way people determined their position on earth changed too. New forms of cartography and large-scale international surveying projects yielded an exact system of coordinates. In 1874, the Netherlands started a large-scale project of precision levelling to determine the contours of the land. They were combined with the levelling surveys of Belgium and Germany, and through these, with geodetic surveys of France, Switzerland, and other countries in Central Europe. A similar operation took place with regard to measurements of the length, breadth, and surface area of the land (the technical term is triangulation). As with the international precision levelling project, it was Germany that took the initiative for the international triangulation, in 1861. In order to get results as complete as possible with regard to the true form and size of the earth, a network of triangles between Oslo and Palermo and between Brussels and Warsaw would be measured. The Netherlands was also invited to take part in this 'Central European Arc Measurement' project. After Russia joined in 1867, its name was changed to 'European Arc Measurement'; almost twenty years later, the operation became global, when the United States and the South-American countries joined in 1886.[9] In these decades, the world became a system with networks and coordinates.

This new exactness greatly amplified the power and effectiveness of technology. This was demonstrated, for instance, by one of the most important public works carried out in the Netherlands in the 19th century, the normalisation of the great rivers. In the course of the 18th century, the rivers had become very dangerous, and the low-lying areas had been struck by a succession of disastrous floods throughout the 18th and the first half of the 19th century. The campaign to improve the situation was started in 1850. It entailed the systematic recording of breadth and depth measurements of all the rivers. In 1850, there were still very few facts to go on. Many decisions were based on practical experience or intuition. The enormous task of taming the wild rivers commenced with the building of an equally enormous collection of facts. This comprised systematic measurements of the water levels, flow rates, and ice movements, the duration and effects of the tides, depth soundings, and observations of silt content and sedimentation. When the results of the national and international triangulations became available, the rivers acquired an integrated system of coordinates. All the figures collected on any aspect of the rivers and anything that could be useful to technicians, contractors, legal experts, fishermen, or whoever else involved, could now be located immediately thanks to these coordinates. In conjunction with the exact measurements, the steadily increasing computation power enabled the virtual but exact expression of a formerly unknown technological reality. For instance, in 1873, a measurement of the water level at the German border made it possible to forecast the next day's water levels further downstream. Similar developments took place in weather forecasting. A European system of geographic coordinates and telegraphically communicating weather stations enabled meteorologists to learn how to calculate the systematic behaviour of the atmosphere and predict developments in the near future.

Exact measurement and computation changed reality. Here is one last example, from the international cargo trade, from 1891:

'Thus, it is not uncommon for the longest detours to be made. Grain from Russia that is exported from Odessa and is destined for Switzerland, for example, frequently travels not via Genoa and Trieste, but via Rotterdam.

(...) And this should not be surprising, since, according to German statisticians, the cost price of shipping by rail (per tonne and per kilometre) can be determined at 1.5 pfennig, while water carriage costs only 0.8 pfennig.'[10]

There is still the question of how this process, in which mass mobility and mass communication changed the world, related to the concept of civilisation. The first observation we can make is that the hallmarks of civilisation remained those of the past for a long time. For centuries, it was customary for purveyors of culture to make a so-called Grand Tour of the cradles of Western civilisation, Italy and Greece. In the 19th century, however, the focus of interest shifted to America. The examples of the journey made by the French nobleman Alexis de Tocqueville and the famous account he gave of it, De la démocratie en Amérique (1835-1840), were followed by many other travellers and travel reports. All marvelled at that wondrous society that was called the New World, the land of the future, and its culture in which efficiency, utility, and success were the values and standards. In America, history had at most marginal meaning. The points of reference, the coordinates of this new civilisation, were located in the present and in the future.

In Europe, this realistic civilisation emerged in Germany. Since the 16th century, Germany had been a patchwork of more or less autonomous duchies, principalities, prince-bishoprics, kingdoms, and free city-states. Under Prussia, they became united into one state in the course of the 19th century. The resulting great concentration of power revealed itself for the first time in the crushing victory over France in the war of 1870-1871. The new Germany no longer drew its strength from the intellectual force of men such as Goethe or Hegel, but from the energy of the likes of Alfred Krupp, Emil Rathenau, and Bismarck, the most powerful protagonists of the steel industry, electrical engineering, and Realpolitik, respectively. Were the fundamental features of this new Germany invented and tested in the campaign against France? Alois Geigel was certainly not a warmonger. He was an educated doctor with several publications on public health to his name. In 1877, he wrote with love and pride about the excellently trained German soldiers who were pouring out from endless trains all over France in 1870 and were given their orders via the telegraph:

'How could their forebears have had even an inkling of the ease and fabulous speed with which such masses were released onto the battlefield by the snorting iron horses, of the unique command that controlled the far-flung armies from one single point by means of an electric wire [...], moreover, of the almost even more admirable never-failing care and provisioning of such great armies and the nursing of their wounded and disabled? And all this was done while the German people calmly proceeded with their work on their own soil and in utter peace and quiet, while it was ready to fill, at any moment, the places vacated by the fallen with thousands of strong soldiers without noticeably reducing the stock. Truly, such facts make the heart swell and overflow with great admiration for the results of modern civilisation.'[11]

In a footnote, the Dutch translator of this article made it clear that he understood 'civilisation' to mean something quite different. This difference of opinion implied two antagonistic definitions of civilisation: the pragmatic concept of Geigel as opposed to the idealistic concept of the Dutch translator; the first with an ethics of success and utility, the second with an ethics of good and evil. As was said earlier, Classical Antiquity and the Bible were the primal sources of that 'ethical' concept of civilisation. It is interesting to see that the importance of the Classics was already being debated in Netherlands as early as 1855. Classical education was criticised for not offering any answers to the new demands of the modern age. The editor of the magazine Praktische Volksalmanak, a prominent economist, voiced his concerns about the education of the young people who would later have to lead the country and wrote: 'Physics and chemistry before mythology and the Greek heroes! Cotton, or indoor feeding, before the Roman emperors!' And when it came to languages, the living languages were to come first. First English, then French, and then, perhaps, Latin could be added: 'Away with all that useless ballast!'[12] This was in 1855.

In the following decades, technology became applied science, and in the process, it effectively turned into practical and realistic civilisation. In 1871, a professor at the Delft Polytechnic, the engineer D. Grothe, wrote a book on mechanics that, according to its subtitle, was intended as 'a textbook for manufacturers and industrialists' and 'a reader for civilised people'. In 1881, following foreign examples such as Nature, La Nature, and Scientific American, a popular monthly magazine on the natural sciences was launched in the Netherlands. The editors of De Natuur, as it was called, opened the first issue with their programme: 'It cannot be denied that the natural sciences play such a prominent role in this modern age that nobody can afford to remain a complete and utter stranger to their field. Whereas for many, the knowledge of nature may be considered a major aid to civilisation, that knowledge, to others, is indispensable in their undertakings.' The editors counted on it that 'our magazine will be a welcome presence in every civilised household'.[13]

These voices clearly indicated a drastic change and announced an age in which ignorance of technical matters would be considered uncivilised, a new kind of illiteracy.

More than a century has passed since then. Technology now determines, down to the smallest detail, the way we work, the way we live, our leisure, our communication, our food, our mobility, and consequently, the way we think. The New World that emerged in the 19th century in America has come to the fore all over the world and has become fully internalised in Western Europe. It is a world in which efficiency, utility, and success are the dominant values and standards, and in which the old hallmarks of civilisation have become obsolete. Last week, the Roman newspaper Il Messagiero ran a story about the official Roman tourist guides whom the incredible ignorance of the latest batch of tourists brought them close to despair. It seems there was one American who said: 'Sorry, you keep mentioning before and after Christ, but who exactly was that guy?' Or take the question they are asked almost daily about the Coliseum, which is why the Romans built such a ruin.

Our New World lacks a collective, uniting cultural programme, that is to say, 'cultural' in the old sense. Our uniting cultural programme in the new sense is called economic growth. The only advancement we aspire to collectively is material in nature. This is not a value judgement, but an observation of fact. We live in a realistic technological civilisation and are ready to defend it at all costs, quite simply because it happens to be our way of life. But at the same time, there is a sense of embarrassment about its limitations, its superficiality, and its sometime dirtiness, which are its characteristics. Is this shame not caused by the remnants of the Classical, idealistic civilisation that have lingered on in our minds, just like our bodies still contain useless traces of earlier stages of our evolution?

Perhaps there is more to it though. The history of mankind is a dynamic process. There is no reason to assume that our current technological civilisation is the final stage. Change is inherent to life. There will always be individuals in search of the essential who will manage to put their ideas on the agenda with great effect. I refer to Le Corbusier, one of the most influential architects of the previous century, and quote from his Vers une architecture from 1923: 'Culture is the flowering of the effort to select. Selection means rejection, pruning, cleansing; the clear and naked emergence of the Essential.'[14]

Le Corbusier loved Greek temples as much as he loved the latest cars; he used both to illustrate his argument. 'The Essential': the word is a reformulation of 'the Good, the Beautiful, and the True'. Perhaps that classic adage is timeless after all. Perhaps, in the end, it is even a valid guiding principle in a technological civilisation.

Notes

[1] Rupert Sheldrake, Seven Experiments That Could Change the World: A Do-It-Yourself Guide to Revolutionary Science (London 1994), chapter 6.
[2] Eda Kranakis, Constructing a Bridge. An Exploration of Engineering Culture, Design, and Research in Nineteenth-Century France and America (Cambridge, Mass./London 1997),170.
[3] Cf. Gerrit Smienk, Johannes Niemeijer (eds.), De hand van de meester. Het ontwerponderwijs in de praktijk (Rotterdam 2000).
[4] David P. Billington, 'Robert Maillart: the Engineer's Synthesis of Art and Science', Sartoniana 13 (2000), 25.
[5] On his work, see Michelle Provoost, Hugh Maaskant. Architect van de vooruitgang (Rotterdam 2003).
[6] On Habraken, see Koos Bosma, Dorine van Hoogstraten, Martijn Vos, Housing for the Millions. John Habraken and the SAR (1960-2000) (Rotterdam 2000).
[7] The totals from 1870 and 1890: G. Vissering, 'Spoorwegen in Europa en Amerika', De Economist 44 (1895), 689. A reminder: the circumference of the earth at the Equator is 40,076 km.
[8] 'De telegraaf naar Amerika', De Economist 6 (1857) I, 1.

[9] The project of 1861: G.B.H. de Balbian 'Graadmeting. Geschiedkundig overzicht', TKL 5 (1889), 200-202; the Dutch contribution: J. van Roon 'Over de officieele kartografie van Nederland na 1864', TKNAG 2nd series vol. 45 (1928), 841.

[10] 'Zoo komt het niet zeldzaam voor dat er de grootste omwegen worden gemaakt. Granen uit Rusland die van Odessa worden uitgevoerd en die bijvoorbeeld naar Zwitserland moeten, gaan vaak niet over Genua en Triëst, maar over Rotterdam.(...) En dit behoeft ons niet te verwonderen; immers terwijl men volgens Duitsche statistici den kostenden prijs van het vervoer per spoor (per ton en per kilometer) op 1.5 pfennig kan stellen, rekent men voor het transport te water slechts 0.8 pfennig.' H.A. van IJsselstein, in the minutes of a meeting of the Koninklijk Instituut Van Ingenieurs (Royal Institute of Engineers) on 10 February 1891, Algemene Verslagen KIVI 1890-1891, 67.

[11] 'Hoe zouden hunne voorvaderen ook maar een flauw denkbeeld zich hebben kunnen vormen van de gemakkelijkheid en fabelachtige snelheid, waarmede zulke massa's door de snuivende rossen op het slagveld werden geworpen, van de unieke leiding, die met de bliksemsnelheid der gedachte de wijd verspreide legers door middel van de electrische draad van één punt uit beheerste [...], hoe voorts van de bijna nog bewonderenswaardiger, nooit in gebreke blijvende verzorging en voeding van zoo groote legers en de verpleging van hun gewonden en invaliden? En dat geschiedde alles terwijl het Duitsche volk op eigen grond in den volsten vrede rustig voortwerkte, terwijl het bereid was ieder oogenblik de opengevallen plaatsen der gevallenen met duizenden krachtige krijgers zonder merkbare afname van den voorraad aan te vullen. Waarlijk, zulke feiten doen het hart zwellen en overvloeien van hooge achting voor de uitkomsten der moderne beschaving.' S.Sr. Coronel, A. Geigel Handboek der openbare gezondheidsregeling naar de behoeften en wetgeving van Nederland, (The Hague 1877), 4. Coronel adapted Geigel's Handbuch for the Netherlands and copied this passage in full ('however much the conclusion can be disputed') because, as appears from his footnote, he thought it was interesting from the 'culture-historical' point of view.

[12] d.B.K. [J.L. de Bruyn Kops] 'Wat zal men zijn jongens laten leeren?', Praktische Volks Almanak 2 (1855), 1855, 108.

[13] 'Het kan niet worden ontkend, dat de natuurwetenschappen in den tegenwoordigen tijd een zoo voorname rol spelen, dat niemand op haar gebied geheel en al vreemdeling mag blijven. Terwijl voor velen de kennis der natuur als een belangrijk hulpmiddel tot beschaving mag beschouwd worden, is die kennis voor anderen onontbeerlijk bij de uitoefening van hun bedrijf.' (...) 'ons tijdschrift een welkome verschijning zal zijn in elk beschaafd huisgezin.' D. Grothe Mechanische technologie, ten dienste van het middelbaar onderwijs, een

leerboek voor fabrikanten en industrieelen, een leesboek voor beschaafden (Gorinchem 1871, second, revised edition); 'Ons program', De Natuur 1 (1881), 1-2.

[14] Le Corbusier, Towards A New Architecture (London 1972, translation of the original French text from 1923), 128.