

Essay



Computer revolutionary: Apple boss Steve Jobs during the presentation of the iPod.

Innovations – The Sign of Progress

Around the end of 1899, the head of the US patent office in New York attracted a lot of attention when he made an extremely unusual request, especially for a civil servant with a cushy government job. In a letter to the mayor of the city, he requested closing the office: “Everything that can be invented has been invented!” The office that he headed was no longer needed. Obviously, a much higher authority did not share his opinion. His request was rejected on the grounds that even if the number of innovations does not continue, one or two more must be expected in the 20th century that require patents.

What we may chuckle at today, had a very real background at the end of the 19th century: never before had there been so many inventions in such a short time as in the period between 1850 and 1900. All types of machines replaced manual work and heavy labor. They were driven by new turbines and gas or electric engines. Contrary to every prediction of health or nervous breakdowns, people quickly moved about with increasing speed in fast trains and cars, took to the air in balloons and Zeppelins. They communicated via telegraphy and telephone, listened to music from gramophones and radios, took pictures and made videos of themselves and the world. What important things could possibly follow these innovations? There was legitimate doubt concerning the necessity of a patent authority.

However, this no doubt, well-intended request by the head of the patent office did not take into account all the never-satisfied inventive spirits who have driven the progress of mankind since the dawn of civilization. The spirits who were never content with the knowledge available to their generation, who attempted to improve imperfection in order to leverage their newly gained knowledge. Socrates irritated the citizens of Athens with his provocative claim that “I know nothing except the fact of my own ignorance.” His distinguished successor Aristotle summed it up more dogmatically: “thought alone moves nothing, only practical thought that is directed towards a purpose.”

It is impossible to want to churn out all the names of those who have since expanded the horizon of our knowledge true to these Hellenistic wisdoms. Their conclusions provided the “innovatio” with many promising perspectives. Thus, it was a bold assumption in 1899 that people of the 20th century would be satisfied with the inventions of the 19th century. Exactly the opposite occurred.

Everything can always be done better than it is being done.

Henry Ford I, 1863–1947

As industry expanded, it brought about an incredibly productive symbiosis between scientific research and technology. The founding generation of the new, increasingly automated manufacturing plants still largely recruited from the extremely gifted mechanics – self-taught inventors and engineers. However, their pragmatic approach to life quickly recognized the usefulness, the necessity, of securing the implementation and objective of their inventions with a science-based foundation. They strived to be close to renowned universities.

And science left its time-honored ivory tower to pure research and education. Exemplary networks of successful collaborations were founded in the 19th century. While industry increasingly used scientific insights, physicists and chemists increasingly helped themselves to professional, ever more precise instruments and apparatus production. Three names represent a classic example of this cooperation: Carl Zeiss, Ernst Abbe and Otto Schott.

In his optical workshop in Jena, Carl Zeiss (1816–1888) produced magnifiers, eyeglasses and, most importantly, microscopes for the nearby university. Physicist and university professor Ernst Abbe (1840–1905) improved their lens design and illumination using his analytical calculations for the microscope. Chemist Otto Schott (1851–1935) developed the special glass needed. Their cooperation revolutionized the construction of microscopes. The new instruments, which were soon to be mass produced and thus widely available, triggered a dramatic increase in biological and medical research results.

Using a microscope, Robert Koch and his employees recognized the viruses that cause tuberculosis and cholera. Their discovery helped effectively fight these epidemics. In 1890, Emil Behring developed antitoxins for diphtheria and tetanus in this manner. This enabled him to invent the principle of serotherapy for which he received the first prize in medicine in 1901 from the Nobel Foundation founded a year earlier in Stockholm. Physicist Wilhelm Conrad Roentgen was also honored with this award for his discovery of the mysterious x-rays that were later named after him.

Knowledge is not enough – you must actually apply it. Wanting is not enough – you must actually do it.

Johann Wolfgang von Goethe, 1749–1832

In addition to the traditional fields of physics and engineering, science and industry entered into new cooperation models, particularly in the field of chemistry. Vaccines from test tubes, vitamins and hormones from lab beakers, inorganic fertilizers and colors, synthetic textile fibers and rubber – doctors, biologists, chemists and physicists began deciphering and recombining the formulas of nature. Their developments led to the creation of new industry sectors such as petrochemistry and pharmaceutical production. The age of synthetic materials was born.

In those days, the buzz word was not innovation, but progress. Simply calling the results from science and technology innovations seemed contradictory to the zeitgeist. An enthusiasm extending across all social strata and forces demanded far-reaching recognition of these new insights and achievements.

In Germany, land of poets and thinkers, people praised them with quotes from well-known greats. Trade publications from the National Metrology Institute in Berlin used maxims such as progress is an “obligation of humanity” (Kant) or the “unimpeded perpetual progress to new pleasures and new perfections” (Gottfried Wilhelm Leibniz) for headlines in 1912.

In competition with aspiring industrial nations, the results of scientific research became a matter of national prestige. However, the peaceful competition lost its innocence as academics provided their knowledge for the arms build-up for two world wars. The enthusiasm accompanying progress suffered permanent damage. Leading minds were discredited for disseminating their knowledge. Sometimes even unjustly! In August 1939, Albert Einstein informed U.S. president Roosevelt about the – possible – development of the atomic bomb in Nazi Germany. The USA succeeded in building the bomb first. Einstein was not involved but repeatedly warned of the consequences. On July 1, 1946, his portrait appeared on the cover of Time Magazine next to his famous formula $E = mc^2$ and a picture of a mushroom cloud. The caption below the collage began with the words “Cosmoclast Einstein.” The genius whose theory of relativity changed all existing conceptions of space, time, energy, light and matter withdrew from public life and led a life of loneliness.

Imagination is more important than knowledge.

Albert Einstein, 1879–1955

Swiss-American physicist and Nobel Laureate Wolfgang Pauli publicly acknowledged that the power of knowledge also has “its dark side.” Carl Friedrich von Weizsäcker, German physicist and philosopher turned towards peace research and succinctly demanded in 1957 that we should not do everything that can be done.

These were the first reminders of the dedicated responsibility we all share for developments based on scientific knowledge. To what extent was the basic idea of progress still valid – the idea that free research and the application of natural sciences themselves will lead to a humanization of society? New fields became established at universities and institutes: future research and assessment of the consequences of technology. In its Human Development Index (HDI), the United Nations defined the most important indicators of progress: long life, health, self-determination, education and peace. What promotes these objectives is understood around the world today

as progress. Research, just as technical implementation, has had a great effect on this. Thanks to efficient medical care, improved hygiene and healthier eating habits, life expectancy has increased around the world by approximately 30 years since the beginning of the 20th century. Are we really aware of the value of this progress? What do we do with this gift? Do we use the extra time available to us to solve the problems that still exist and to drive progress even further?

“Real progress lies in analyzing and understanding the many mistakes made in its name – and, above all, correcting them.”

Sadrudin Aga Khan, 1933–2003

Progress is more than welcome in daily life when it deals with improving a toaster, television reception or the comfort of an automobile. It is only in its complexity that it meets with increasing skepticism. The primitive fear of everything new and unknown still exists and many innovations require more and more know-how to assess their impact. Therefore, generally rejecting all efforts at progress would be the same as taking a step back. Strictly speaking, progress is never the finite goal. The progress efforts of preceding generations assumed that energy sources and resources were unlimited, their ignorance of its impact on the climate and the environment led to subsequent damage. Should they therefore be condemned?

Nowadays, scientific research is able to recognize the mistakes of the past. It is now up to us to correct these mistakes. A well-founded therapy should follow every thorough diagnosis. Are we capable of this? Definitely, if we have the desire and will to do so. Together, science and technology offer the necessary tools – outstanding innovations that we realistically no longer immediately consider to be progress in their own right – that, as components of progress, enable sustainable innovations step-by-step in the longer term. Its still valid objective: humanization and improvement of societal living conditions. We are coming closer to these conditions everywhere on our ever smaller world.

This is the challenge for the 21st century. It is doable, however not if we are mired in self-pity and resigned pessimism towards the future when confronted by its admittedly growing amplitude. It requires self-confidence, energy and growing optimism. Let us rise to the challenge. In doing so, we will muster the necessary self-critical composure in the knowledge that current contributions are also only directional signposts on the road to further progress that will be corrected and redefined at some point in the future.

*If it is different
it is not necessarily better.
But, if it is to get better,
it must become different.*

Georg Christoph Lichtenberg, 1742–1799

This statement made in the scientific, philosophical essays of the University of Göttingen Professor, one of the leading all-round scholars of his time, is still valid today.

Manfred Schindler