IT Revolution or Evolution?

A unique exhibition entitled *IT Evolution* opened in Budapest's Óbuda University, one of the leading engineering schools in Hungary. This exhibition extends beyond the well-known revolutionary trends in IT and delves into the details of the industry's evolutionary path. Grouped into 40 categories and display cases, the more than 1000 original artifacts illustrate the development of IT components from their roots to today. The rapid pace of product development in the IT industry has led even the most popular and expensive products to become outdated and useless within just a few years. As a result, innovative features and design characteristics can quickly turn into IT dinosaurs that disappear in the dark corners of a storage room or are carelessly tossed into a landfill. The objective of the exhibition is to showcase the innovations that have resulted from the dedicated labor and creativity of the predecessors of today's technology and, through the artifacts displayed, demonstrate the increasing pace of development within the IT industry.

The exhibition focuses on four broad areas – calculation devices, data storage, electronic components, and the convergence of electronic communication and computers. The collection includes the defining innovations within each of these areas that illustrate the creativity and unique solutions of their designers, contrasting the "first" and "last" or "most recent" innovation within each category.

How is this Museum Collection Unique?
When we think of a museum, we typically think of a collection of objects that embody the customs and culture of a long-gone era, often displaying centuries-old objects that have been unearthed from their graves in the sea or the ground. Outdated IT components or products – which are often only a few years or decades old – don't easily fit the traditional definition of antiquated objects worthy of being preserved in a museum. But, similar to a traditional museum collection, the objects in the IT Evolution collection were rescued from the storage rooms, warehouses, or IT recycling bins to which they were relegated – despite having been procured just a few years earlier and often at prohibitive cost. The phenomenal speed at which the IT industry launched new innovative products with new features, increased storage capacity, and opened entire new industry segments as software and hardware converged and communications and IT were merged, made it all the more urgent to collect the objects that would serve as reminders of defining products and phases in the development of IT as we know it today.

The impetus behind the exhibition was twofold. First, to demonstrate that the history of IT is marked not only by the well-known "star" end products but by a long series and massive number of incremental innovations. Hence, the exhibition displays not only "star" products but the evolutionary steps leading up to them. Second, to demonstrate that IT artifacts also have an esthetic value that can be appreciated even without an in-depth technical knowledge of the objects. The success of any new IT component or system is typically determined by its ability to perform its function. In addition to focusing on performance, many designers also emphasized the esthetic beauty of their form as well, a quality that is showcased throughout the collection.

It is well known that IT is one of the most rapidly changing areas of science in the 20th and 21st century. It has also been determined that the speed of change is actually increasing. One of the ramifications of this trend is that the lifespan of the innovations and technological solutions in

any given period also become shorter. In earlier eras, when tools and technology were designed to last several decades or longer, value was placed on products of heirloom quality. This can usually not be said of modern tech products. Who, after all, wants to use their parents' cell phone – not to mention that of their grandparents'? The lifespan of the techniques for processing information can be measured in years – or in the case of cell phones in just months. This is due in part to the rapid improvements in storage capacity and data processing speed and the rapid introduction of new features that require and take advantage of the improved hardware capabilities. This trend has led to expectations on the part of users that new features such as speech recognition, pattern recognition, high speed data transfer, etc., will be made available. As these new applications and the operating systems on which they run cannot usually be used on earlier versions of the given hardware, this leads to even faster technological innovation – and obsolescence.

The IT Evolution exhibition in the hall of the Óbuda University's John von Neumann Faculty Informatics

The Structure of the Exhibition

The exhibition covers the technological evolution of four key areas: (I) Calculation Devices from the compass to palm computers; (II) Data Storage from punch cards to solid state and optical devices; (III) Electronic Components from the vacuum tube to single board computers; and the (IV) Convergence of IT Disciplines from mechanical devices to today's smart phones.

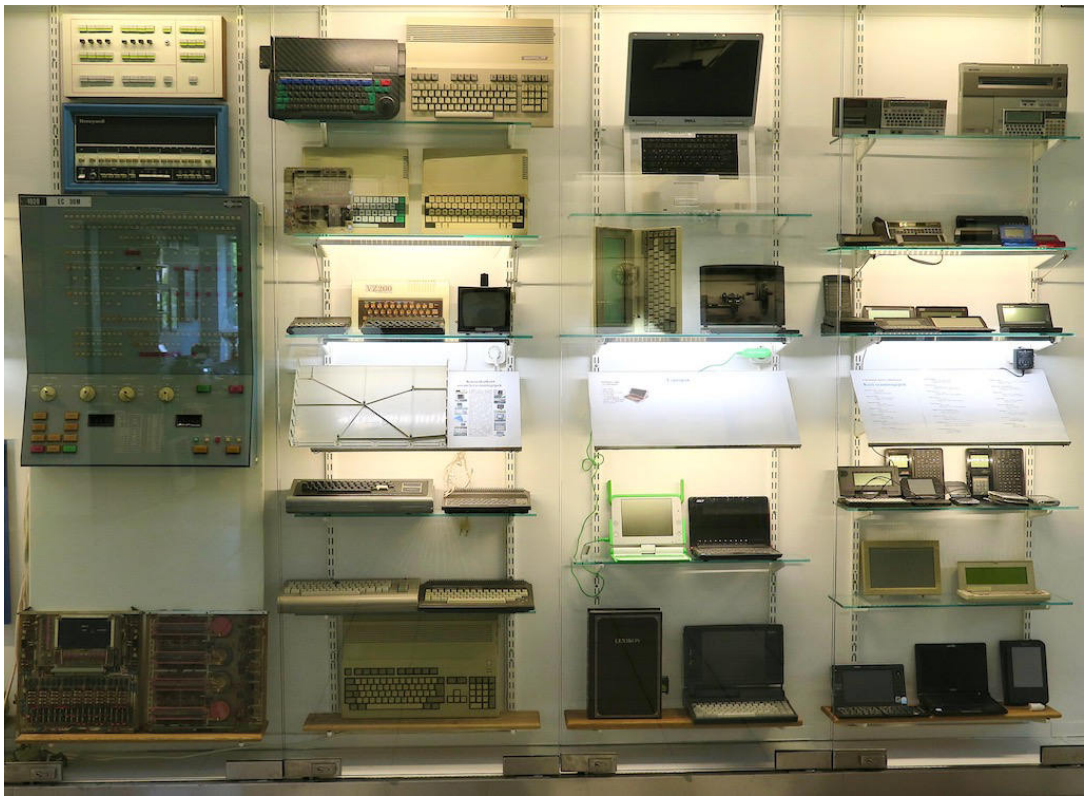
Within these broad areas, the artifacts are arranged thematically in chronological order in each of the 40 display cases. In most cases, the exhibition includes the "first" and "last" (latest) object in that particular category, as well as the incremental steps in development that form a bridge between the two. The descriptions of each of the items displayed include the name of the inventor and manufacturer whenever possible, the principles behind the design, and the common application.

I. Calculation Devices

Today's digital IT products have their roots in the mechanical tools of the past, and the collection starts with calculation devices. The path leading from simple calculation devices to computers is illustrated in the first 12 display cases. While other collections may be organized in the same

logical order, this exhibition is unusual in that it dates back to the pair of compasses. The pair of compasses were used by the great architects, mathematicians, and engineers of the past thousands of years before other tools were available. The evidence of this is clear in the ancient Greek writings and innovations. Great scholars such as Thales (624-546 BC); Pythagoras (570-495 BC); Euclid (~300 BC); and Archimedes (287 – 212 BC) all used the pair of compasses not only for drawing but for demonstrating basic mathematical operations such as addition and subtraction, multiplication, and division. The pair of compasses can in fact be considered one of the first analog calculating devices based on similarities that preceded the numbers-based world of digital calculation devices. Many of the pairs of compasses displayed were owned and used by well-known scholars.

Across the 12 display cases devoted to calculation devices, the artifacts are grouped into the following categories: **Case 1:** pairs of compasses; **Case 2:** abacuses; **Case 3**: early counting aides and devices; **Case 4:** calculation tables; **Case 5**: slide rules; **Case 6:** early mechanical calculators; **Case 7**: popular mechanical calculators; **Case 8**: electronic calculators; **Case 9**: mainframe computer consoles and circuit boards; **Case 10**: early personal computers; **Case 11**: laptops; **Case 12**: portable palm or pocket computers.



Cases 9-12. *Electronic computers from gigantic to pocket-sized*

Exceptionally interesting calculation devices and calculation aides:
Although the collection cannot be described in detail, a few items stand out in virtually every category. The evolution of pairs of compasses, for example, is illustrated with artifacts from the middle ages to recent days, including ones owned by Nandor Suss, the founder of Hungarian Precision Mechanics, and Ferenc Hopp, the founder of the East Asia Museum (1). [The numbers in parentheses refer to the specific case in which the item can be found.] Other exceptional artifacts include: roman limestone “marbles” likely used for calculus and counting tokens (2);

early planimeters, including an Adler planimeter made of horsehair; Napier counting sticks (3); old counting books and function tables (4); one of the earliest (Faber 358) and last (Faber-Castell TR3) slide rules (5); one of the first (Thomas Arithmometer) and last (Curta) mechanical calculators manufactured by Samuel Herzstark and his son Curt Herzstark (6); the most successful products of leading manufacturers of calculators (Odhner, Brunsviga, Facit, Calcorex) (7); one of the first personal computers (HP 9100), the first scientific calculator (HP 35), and the first programmable calculator (HP 65) (8); the control panels of the Eastern European clone of the IBM 360 and the Hungarian clone of the PDP 8 (9); one of the first mass manufactured personal computers (TRS 80) and the first Hungarian personal computer Homelab 1 (10); the first laptop (Toshiba 1000) (11), and the first PDA (Atary Portfolo) (12).

II. Data Storage

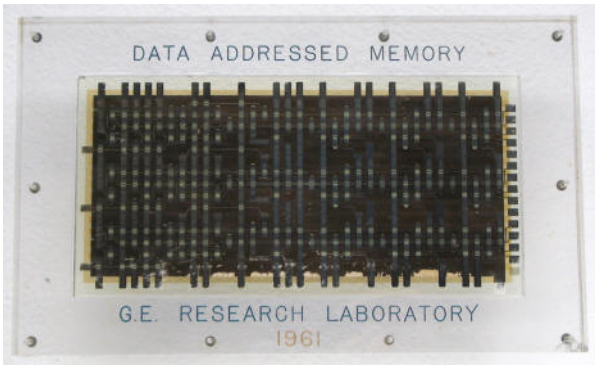
Across the 10 display cases devoted to data storage, the collection covers the entire history from the earliest punch tapes to today's optical data storage solutions. The artifacts are grouped in the following categories: **Case 13**: punch cards and tapes; **Case 14**: first sound recorders; **Case 15**: sound recording disks; **Case 16:** early magnetic data storage solutions; **Case 17**: magnetic tapes and tape drivers; **Case 18**: floppy disks and drives; **Case 19**: ferrite core memories; **Case 20**: early electronic data storage solutions Williams tubes, delay lines, magnetic bubble memory, content address memory, electronic RAMs and ROMs; **Case 21**: magnetic disks; **Case 22**: optical data storage solutions.

Exceptionally interesting data storage devices:

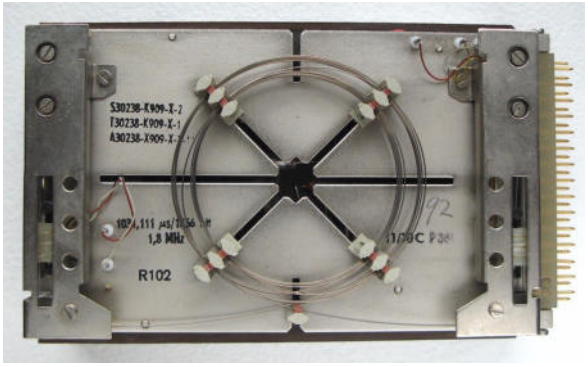
Outstanding data storage devices in each category include: a vintage large punch tape for a bell tower clock, player piano rolls, and reprogrammable wood cards (13); a tinfoil recording from the Edison Menlo Park Laboratory, the wax dictaphone of Albert Szentgyörgyi, the Nobel Prize-winning discoverer of vitamin C (14); early Edison and BBC records, music recorded on x-ray films (also known as "music on bones") (15); early magnetic drums, wire recorders, and airplane black boxes (16); popular early magnetic tapes and drives (17); the first hard boxed floppy (18); one of the first - Russian (Ural) and the last - (IBM) core memories (19); one of the first Content Address Memories (GE) (20); one of the first (RAMAC) hard drives (IBM) (21); and the first "limitless" optical data storage devices (PI 190) from the ILLIAC Computer (22).

Cases 13-16. Early data storage devices, from punch tapes to magnetic storage devices

Cases 21-22. The evolution of hard drives and optical storage solutions



The first Content Addressed Memory (GE)



Early delay line memory (Siemens)

III. Electronic Components – Defining Designs of the 20th Century

Here too, it may be surprising that the exhibition dates the development of electronic components back to the invention of the carbon filament light bulb. If we look at their function and the manufacturing techniques, it is easy to see the similarities between the definitive electronic component of the 20th century – the vacuum tube – and the electric light bulb. Hence, the collection starts by showcasing these early light sources and spans their development all the way up to single board computers – all displayed in 10 display cases that groups the collection into the following categories: **Cases 23-24**: early light sources; **Case 25**: early vacuum tubes; **Case 26**: special vacuum tubes; **Case 27**: high power vacuum tubes; **Case 28**: light sensors and displays; **Case 29**: semiconductors (diodes, transistors, and early electronic modules); **Case 30**: integrated circuits; **Case 31**: microprocessors; **Case 32**: single board computers.

Exceptionally interesting electronic components:

Outstanding artifacts from the various categories of electronic components include: a Roman oil lamp, a Davy lamp, and the oldest carbon filament light bulbs (23); early small and high pressure arc lamps, 7 000 W Xenon lamps (24); the earliest rare vacuum tubes, such as a rare 7AK7 vacuum tube from the American SAGE defense system, and a J6J tube that made the construction of the John von Neumann IAS computer possible (25); rare radar and Rontgen tubes (26); one of the largest radio tubes with a power of 250 kW (27); photo electron multipliers invented by Zoltan Bay and RCA (28); the first soviet transistors: P1 and P3 (29); integrated circuit generations: SSI, MSI, LSI, VLSI components and typical integrated circuits such as the Texas Instrument SN74XX family (30); one of the largest silicon wafers (Nehalem) from Intel and human brain slices (31); and one of the first single board computers (KIM 1) (32).

The evolution of one of the most significant innovations of the 20th century: the transistor.

IV. The Convergence of IT Disciplines

One of the defining characteristics of IT in the 21st century is interconnecting networks of IT systems. Landline telephone networks can be considered to be the earliest such system with wireless systems evolving out of radio-based communications. In today's smart devices we see the convergence of the two previously separate IT disciplines of communications and computers. The roots of today's compact designs and devices can be seen in the precision mechanics of yesterday. Hence, this part of the collection spans 8 display cases and starts by displaying the ultimate skill in precision mechanics – the age-old art of watchmaking – and ends with representative products of one of today's leading companies – Apple.

Case 33: watches and watchmaking tools; **Case 34**: early electro-mechanical communication devices such as the telegraph; **Case 35**: space vehicle computer; **Case 36**: early telephone sets and telephone exchange components; **Case 37**: early radio sets; **Case 38**: early cellphones; **Case 39**: GSM telephones and **Case 40**: defining products of the 21st century - Apple (Apple II. iMAC, smart phones, iPads, and iPods).

E***xceptionally interesting artifacts:***

Outstanding items from the most recent era of IT include: cogwheel analogue airplane computers, quality clockmaker lathes and tools (33); the first efficient electromechanical telecommunication devices (receiver, key, relay) (34); the earth reference model of a computer that controlled the landing module (Philae) of the famous Rosetta satellite (35); early telephone sets and components from a telephone exchange (rotary, crossbar, electronic) (36); the first crystal, vacuum tube and transistor radios (37); the first GSM handsets of the major cellphone manufacturers (Motorola, Ericsson, Nokia, Siemens) and the computer modules of the Nokia switching center that executed the very first GSM connection (38); a broad selection of GSM phones, which launched a new era in communications (39); and the first trend-setting Apple products (iPod, IPad, iPhone) (40).

Cases 37-40. *Wireless electronic communication from the first radio to the smart phone*

Why Visit the Exhibition?

Many believe that we can better understand the present and shape the future if we know and learn from the past. It is clear that creativity and innovation will be needed to solve the challenges of the future. Future engineers can be inspired by and build on the patterns and solutions of the past as they seek their own solutions. All of these are reasons why a university that is educating the computer engineers of the future is the perfect setting for an exhibition that showcases the evolution of IT.

However, the exhibition's intended audience extends far beyond IT professionals. As a large number of visitors have remarked, many of the items displayed evoke personal memories from the recent past that they can share with others, especially with the younger generation.
While the rapid developments of IT appear from a distance to be revolutionary, visitors to the exhibition will experience and track close up the step-by-step evolutionary development of the IT revolution.

Laszlo Kutor


Photos from the recent launch of the exhibition.

The exhibition is the result of more than 40 years of avid collecting by Dr. László Kutor, a professor at the Óbuda University. The exhibition can be seen free of charge Monday through Friday from 8 a.m. to 6 p.m.

References

1. Computer History Museum http://www.computerhistory.org
   https://www.c-span.org/video/?313763-1/computer-history-museum-part-1
2. Computer Exhibition – The past of the future
   http://ajovomultja.hu/about?language=en
3. The lessons we can learn from IT dinosaurs| László Kutor | TEDxDanubia 2014
   https://youtu.be/s65LZIvJ2ZU
4. History of Information Technology in Hungary: Laszlo Kutor
   http://www.cbi.umn.edu/about/nsl/v37n2.pdf