A Short History of Computing in Hungary

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The history of Hungarian computing science, technology, and applications is given in five movements, starting with the very roots (Prelude) and digging as deeply as the 18th century. For Hungary, a sorrowful story was the period between World War I and World War II (Preliminary Phases to Adagio), followed by the years of Stalinist oppression: persecution of prominent scientists and engineers and of the science of cybernetics. These years were, however, the beginnings of computing in Hungary (First Era of the Historic Ages, Andante). In the 1960s, a boom started in computing in the country (Allegro), followed by continuous development in Hungarian computing until the present (Largo).

Introduction

Thomas Mann started off his work *Joseph and His Brothers* with these words: “Abysmally deep is the well of the past.” The words of this great German writer are very apt. Where should one start a history? Where should one open a discourse on the origins of computing in Hungary? While I will not begin this story with a discussion of the ancient Greeks, I have at least tried to dig down to the upper layers of the abysmally deep well, following the story from its early beginnings in our century (mostly on electromechanical devices) through to the first era of the really modern digital electronic computers. The period of the “between years” is perhaps the most exciting part of computer history, with its sometimes turbulent happenings in computing and in society as well, while the Recent Past section (the time leading up to the present) gives us a rather encouraging glimpse into the future.

Hungary’s Computing Roots

In 1796, in the last years of the glorious 18th century, an extraordinarily interesting machine was displayed in the Austrian royal court in Vienna. It was a machine figure playing chess with human partners—and with excellent skill. The automaton was designed and built by the Hungarian-born Baron Kempelen Farkas (1734–1804). (In Hungarian names, the family name comes first, while Christian names follow.) Even now, nobody knows for certain how it worked, but the chess-figure manipulator was probably a human dwarf concealed in the machine. In 1826, the machine was brought to the United States, but it was destroyed in a fire in Philadelphia. Baron Kempelen, however, did not regard the chess automaton as his main work; rather, Kempelen believed his series of speech machines was most important, the first of them having been produced in 1773.

Now let us jump a few decades. A notable Hungarian physicist named Jedlik Ányos (1800–1895), a Benedictine monk, created a gadget for plotting Lissajous graphs in the early 1860s. He was also among the first (along with the German Werner Siemens) to describe the principle of the dynamo in 1861, which led to the self-acting dynamo. Sadly, he never patented his discoveries, and perhaps this is the reason why he has never been recognized as one of its first inventors.

The last two to three decades of the 19th century was a golden age in Hungary’s history. The infrastructure and basis of a modern economic system—most notably in industry, agriculture, science, and technology—were laid down in this period, and the country’s economy flourished right up to the outbreak of World War I. For instance, the first telephone manufacturing company was founded in Budapest in 1882, just six years after Alexander Graham Bell’s invention, and a research institute for telecommunications was established as early as 1891. In 1883, a telephone network was introduced in Budapest, soon followed by others in the bigger cities of the country. Just over 100 years ago in 1886, Hungary’s famous electrical and electronics company (Tungsram) was born. In 1992, the majority of shares was purchased by General Electric, and since then, GE has acquired full ownership of it.

Preliminary Phase

After World War I, Hungary had to endure terrible changes and hardships. Being among the losers of the war, it could not prevent two-thirds of its territory being seized and given to its neighbors. Much of its infrastructure was lost, and quite a number of the larger factories remained in the lost territories. After the lost war, and especially after the horrible days first of a communist and then a noncommunist terror, droves of excellent trained and educated persons emigrated abroad. That is why one commonly encounters Hungarian names like T. Karman (Kárman Todor), E. Wigner (Wigner Jenö), L. Szilard (Szilárd Leó), John von Neumann (Neumann János), N. Kurti (Kurti Miklós), D. Gabor (Gábor Dénes), and others among the best and well-known brains who lived and worked at this time—mainly in the United States, Europe, and other developed countries.

Among these people was Kozma László (1902–1983), who, as a young engineer, arrived at the Bell Telephone Labs in Antwerp, Belgium, in 1930. His talent must have been quickly recognized, since from 1934 to 1938, the company applied for 25 patents in

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which he played some part. Kozma's interests were directed to numerical computation problems, and his first electric calculator was finished by the autumn of 1938. His second calculator could be connected to several data-input devices, while a later one with a Teletype device could be attached to a telegraph center, the results being collected by a printer. This idea was protected by a patent, which the English authorities granted on 1 July 1947. In 1942, Kozma returned to Hungary. After World War II ended, he became manager for the "Standard" factory. In a kangaroo court trial, he was summarily found guilty, jailed, and not released from prison until 1954. Later, he got back his old chair at the Hungarian Technical University in Budapest.

After the failure of the revolution, a great many people (estimated to have been over 200,000), including some of the finest minds then in Hungary, left in a second wave of emigration.

Now let us return once again to the years before World War II. In 1930, Juhás István (1894–1981) was granted a Hungarian patent for his automatic air-defense control system, which he had developed during the late 1920s. (The first patent was followed by three additional ones, the last being in 1939.) The system contained an electromechanically operated analog calculator that performed all the very complicated computations needed for firing at the enemy planes and computing the exact angles needed for the antiaircraft guns. More than 1,000 units were sold to a number of foreign countries (e.g., Finland, Italy, Norway, Switzerland, Sweden, Argentina, Australia, and China). Later (1952–1955), a completely electronic version of the automatic air-defense control system was developed and manufactured by the Gamma Works until the 1970s. As before, most of them were made for export.

Soon after the war, a lively intellectual period flourished. As early as 1947, Nemes Tihamér (1895–1960), a progressive-minded engineer and inventor, published a paper in a Hungarian scientific journal about the ENIAC computer. Among other innovations, he developed a mechanical logic machine in 1954.

A quite big step in machine computing came in the data processing of the 1949–1950 Hungarian census, which was processed by a relatively large punched-card machine. A team was assembled for the Central Statistics Office, which used punched-card machines to process the census data. This team later formed the core of the coordinating authority for national electronic data processing. Actually punched-card machines had been well-known in Hungary since the 1930s, because IBM had founded a subsidiary company in Budapest as early as 1936. Astonishingly enough, this company operated during the war as well, in spite of Hungary and the United States taking opposite sides in the conflict. In 1953, the government established a company (IKV) for developing modern data-processing machines. Among other things, the company developed a card reader with a speed of 40,000 cards per hour. Despite its achievements, the IKV soon ceased to exist because of specialization in the Comecon countries, and its tasks were taken over by factories in East Germany.

A very interesting side point is worth mentioning here. Kozma (later a leader in Hungarian computer science, technology, and its applications) was not the only engineer who, though thoroughly innocent, suffered political custodial punishment (ironically, the majority of the political prisoners were communists or political left-wingers). He and scores of others were collected into a working research group in jail (similar to the "Sharashkas" of the Stalinist gulags), where they undertook serious engineering research work. In December 1953, the Mathematics-Physics Department of the Hungarian Academy of Sciences (MTA) received a letter from the director of the firm "KÖMI 401" (a pseudonym for the company that "employed" political prisoners). The director offered a possibility for building an analog or digital electronic computer. In a second letter, even a list of the necessary parts, elements, and costs for building a computer was provided. Presumably the offer came from a group of outstanding engineers in prison, like Kozma, Edelényi László, Hatvany József (1926–1987), Tarján Rezsö (1908–1978), and others. Finally, the MTA refused the plan, saying there was insufficient financial funding.

The Postwar Era

In March 1953, Joseph Stalin died, and a political thaw developed in the Soviet Union. So it was in Hungary, too, where political prisoners were released one by one and rehabilitated. Then in October 1956 came the Hungarian revolution. After the failure of the revolution, a great many people (estimated to have been over 200,000), including some of the finest minds then in Hungary, left in a second wave of emigration.

The year 1955 was an important one for machine computing in Hungary. In that year, a group devoted to studying "high-powered mathematical machines" was established within the framework of the MTA's Institute for Measurement and Instruments. The group was led by the recently rehabilitated Tarján. They developed different types of magnetic memories (e.g., ferrite, magnetostrictive, and magnetic-drum memories) and channeled their interests into the problems of cybernetics as well.

A great step forward was made in 1957, when a new organization was founded, mainly based on the above-mentioned group. The Research Group for Cybernetics of the Academy of Sciences (KKCS), whose scientific director was Tarján, can now be regarded as the real source of the country's development in modern computing. Some names of researchers and engineers of the KKCS who deserve a mention and remain leading national figures in computer science and its applications are:

- Dömölki Bálint,
- Drasny József,
- the late Frey Tamás,
- Kornal János (now a professor at Harvard University),
- Kovács Gyözö,
- Löcs Gyala,
- Németh Pál,
- Révész György,
- Sántáné Tóth Edit,
- Szelezsán Janos,
- Szentiványi Tibor, and
- Vasvari György.

The formation of the KKCS was not without its contradictions. The scientific bodies of the MTA, except for a handful, supported neither cybernetics nor computing, perhaps owing to a degree of conservatism or due to certain political biases and pressures. Nevertheless, after a time, it was decided to build a so-called modern digital electronic computer. Even in the KKCS itself, however, what exactly should be done was hotly disputed—whether to build a computer based entirely on their own ideas, experience, and developments or else to construct it along Soviet research lines. Finally, the director (Varga Sánder) agreed on the technical designs of a computer, called the M3, developed earlier at the Moscow Institute of Energetics. Its developments were taken over, and all the component parts needed for its construction were gathered. The completed model had a speed of 30 operations per second and a four-kB drum memory. Starting its operational life in 1960, the M3 proved an invaluable tool in solving scores of real-life computer problems in engineering and economics. Alongside the building of the M3, further developmental work was undertaken (until 1963–1964) on ferrite memories, connecting magnetic tape units, enlarging the instruction set, and transistorizing some circuits.

A Host of Geniuses

Sometimes a great many interesting and exciting things happen in history. In some fairly short periods, a great number of notable people can be found living and working is a small locality. This happened in the *trecento* and *quatrocento* in some Italian city-states, where dozens of giants in painting, sculpture, and poetry lived and worked at the same time; in Germany in the second half of the 19th and first part of the 20th century were gatherings of some of the best physicists and engineers in human history. Something similar happened in the Hungarian part of the Austro–Hungarian empire, where in quite a short time period (from the early 19th to the early 20th century) were born those Hungarian persons of genius whose research has been mentioned elsewhere in this article. It was a great shame for the country that, owing to political reasons, they had to leave their homeland. Those who remained home (like Kalmár and Péter) could not hope to acquire the same kind of world fame as their colleagues who left Hungary, owing to turbulent political times, interference in academic concerns, financial shortages, and so on.

Besides the valuable developments the KKCS made, other universities pursued their own research projects. Kozma, then professor of the Budapest Technical University, developed and built the MESZ-I electronic calculator. Naturally, he designed all the circuits himself. By the end of 1958, the device was operational; in 1959, it was regularly utilized in teaching and computational tasks. The MESZ-I was a program-driven, automatic digital calculator/computer, assembled from the most inexpensive Hungarian-made relays, which worked in the binary system. The machine had no stored program—the programs being stored on punched cards instead. The data output was printed on a standard typewriter, the keys of which were operated by electromagnets. After the machine was turned off for the last time, it was taken to the National Engineering Museum in Budapest.

In Szeged, Hungary, a southern university city, there lived and worked an engineer theorist named Kalmár László (1905–1976), who has to be one of the most interesting personalities in Hungarian (and world) computer history. Working mainly in the field of mathematical logic, he considerably simplified the derivations of Gödel's and Church's theorems, tried to define their maximum sphere of validity, and studied their reciprocal relationships and philosophical ramifications. He made many positive contributions to the problems of cybernetics and was a major force in spreading computer science in Hungary. The 1956 conference on automata theory, organized by the Bolyai János Mathematical Society and inspired by him and Professor Péter Rózsa (1905–1977), had a big impact on the theoretical foundations of computing science. Both of them were founders of the first university courses for programmers and were key promoters for getting computer science recognized as an academic discipline in Hungary.

In the late 1950s, some further efforts were made in Hungary to build new computers. Edelényi (who was a member of the prison think tank) together with Ladó László, an electrical engineer, had a common patent for electronic calculating machines. They designed and built the EDLA, a hybrid of electronic and electromechanical component devices. Its computing operations were electronic, while the connections between peripheral devices involved relays. They were remarkably forward for their time in making use of multiplexing techniques. Another point worth mentioning is their development of a disk store and a foil memory, the latter of which can be regarded today as a forerunner of the present floppy disks. Their work was beset with many difficulties, largely due to the obstinacy of the administrative management. By 1963, only an operating model was completed, but alas it was never made commercially available. Nevertheless, one successful aspect of it was that in the course of development of the EDLA, many young and gifted people took part who later became leaders of other computing projects in Hungary.

In the 1960s, Hungary's economy, along with the world economy, was in an upturn phase. In this extensive period of development, the state founded a number of Hungarian research institutes. The basic idea was that the fruits of science could, and should, become a force for creating new and useful products. So in 1960, the KKCS was transformed to the Computing Center (SZK) of the MTA. In 1964, a small group at the Technical University became a respectable institute, the Research Institute for Automation (AKI), which later grew to become the largest institute of the MTA, second only to the KFKI. The following year, in 1965, the Information Processing Laboratory of the Central Office for Statistics (INFELOR) was formed, which eventually became the INFELOR Company.

The Between Years in Hungarian Computing

The year 1968 was a turning point in the history of the Hungarian economy. After three years of broad preparatory work, the so-called New Economic Mechanism was begun, which introduced an artificial market into the command style economic environment of the socialist countries. This new concept of the economic system (or "mechanism" for controlling the economy) made it possible for Hungary in the 1970s and 1980s to have a slightly more liberal social atmosphere and more advanced private sector than the other countries of the region, right up to the big Hungarian changeover in 1990.

In the latter part of the 1960s, the country was still a satellite of the Soviet Union. Some top Soviet leaders, notably Prime Minister Kosygin and his political associates, recognized that the socialist camp desperately lagged behind the Western countries, particularly the United States, in electronics and computing technology. As a consequence, after a long series of lively debates, the political *natshalstvo* (top management) decided to create a development program for a whole range of computer know-how and expertise, namely, in research and development, computer-related technologies, and applications. The program involved all the socialist countries, including Hungary of course.

The displays shipped by the Hungarian firm VIDEOTON later became very widely used in the Soviet Union. Their extreme popularity led the Soviets to call them simply *videoton.*

In January 1968, an Intergovernmental Committee on Computing (SZKB) was brought to life. It should be stressed here that the SZKB was independent of the rather lame and overbureaucratized Comecon, and in its early days, it supported real efforts in computerization, i.e., it assisted in the modernization of technology and economy in the countries concerned. It is a pity, however, that after some years, the SZKB became, in most aspects of its organization and operations, much like Comecon. Perhaps caused by the eventual rapid expansion of organizations of the big programs, it is an inevitable occurrence, since fairly similar phenomena can be observed with, say, enormous Western programs and projects. The chief goals of this common computing venture of the Soviet bloc were to design and build a series of (top-down designed) computers compatible with each other, the different peripheries necessary for them, and, of course, the software needed to run and use these machines. This was the so-called Unified System of Computers (ESZR), a clone of the IBM 360 (later the IBM 370) system. Among the member-states were specific divisions dedicated to developing and building the various models and devices. Hungary's task in the cooperative venture was to produce the smallest model of the series, the R-10. (Later, other models were produced, called the R-12 and R-15.) The architecture and operating mode of the R-10 computer was based on software licensed from French companies (CII and Mitra). Besides the processing units, some peripheral devices were manufactured in Hungary, e.g., alphanumeric displays. The displays shipped by the Hungarian firm VIDEOTON later became very widely used in the Soviet Union. Their extreme popularity led the Soviets to call them simply *videoton.* This was similar to certain (English, French, and German) words that eventually became "genuine" Russians words. They call the railway stations *vokzal* after Vauxhall, the pencil *karandas* after the person Caran d'Ache, and *cigar* after the German *Ziffer*. Even "digital" is *cifrovij* in Russian. The British still call a vacuum cleaner a *hoover* after the American Hoover Company and talk about "hoovering up."

In 1969, in accordance with SZKB's national plan, the government investigated Hungarian Central Development Program for Computers (SZKFP). The program included measures for developing computing expertise in the country, from the basic research work through industrial production, education, and training people to apply computers to a wide range of tasks. In the framework of the SZKFP, and as a cooperative venture, a new institute was formed. It was the Institute for the Coordination of Computing Technology/Know-How (SZKI), which later (in 1985) became the Computer Research and Innovation Center. The founder and head of the SZKI was Náray Zsolt (1928–1994), a prominent person in Hungarian computing. SZKI's main profile as a research institute was to perform basic and applied research and development work. SZKI was also nicely complemented by two affiliates, dealing with the production, sales, and marketing side as well as support and maintenance activities. Before 1990, the SZKI had about 700 people working on the construction of computer application systems (for example, in the agricultural and food industries, energy production and distribution, traffic and transport, and electronics) and developing some hardware and software products, too. During the 1980s, SZKI had a high-level software developing workshop with products that were competitive and sold well in world markets. The SZKI became a software house with a good worldwide reputation and had markets in many developed countries, such as Japan, the United States, Germany, Canada, and France. As an instance, we mention the Recognita optical character recognition system and MProlog language used for expert systems. In the next paragraphs, I will reveal the fate of these achievements.

In summarizing the SZKFP program with its sometimes quite contradictory concepts, operation, organization and financing, it must be said to have had a beneficial effect on the computing *culture* in Hungary. Before evaluating these effects, however, it is worthwhile making two important remarks. First, one has to consider that in those times, Hungary belonged to a tightly bound alliance and had to follow the political (and economic) prescriptions and procedures the Soviets dictated to it. (Mind you, in August 1968, there was an invasion of Soviet troops and their allies into Czechoslovakia, which provoked worldwide condemnation and disquiet in Eastern Europe.) Second, these were the years of the cold war between the United States and the Soviet Union, so Hungary was strictly barred from acquiring the newest (or simply new) fruits of the modern Western technologies. In point of fact, Soviet restrictions were valid right up to 1994.

One of the most important measures the SZKFP took was to promote industrial production. In 1969, the SZKFP decided to turn and expand a medium-sized electronics factory (making radios, TV sets, and acoustic equipment) of western Hungary in Székesfehérvár into a manufacturer of computers, parts, and accessories. Within the space of a few years, VIDEOTON (also called VT) became one of the biggest companies in computer technology in Central and Eastern Europe. In its heyday, the computer manufacturing plant had 4,000 employees on its payroll and consistently made a healthy profit. Besides VT, some other medium and small-sized firms (e.g., MOM, TERTA, and VILATI) produced complementary units and peripheral devices (e.g., microcomputers, disk drivers, and controllers) but with less success than VT.

The cause of VT's great success at that time was largely due to the cold war and the West's ban of high-tech goods to the East. Owing to factors like these, one can well understand why some of the best, most advanced computing products and systems were not only developed but even serially manufactured by Hungarian research institutes whose basic tasks should have been research and not mass production. Earlier, I remarked on the SZKI, a research institute with extensive application and marketing activities and products (among other things, it designed and manufactured some smaller versions of the ESZR system like the R-12 and the R-15). The same thing happened with TPAs (an acronym for the Hungarian equivalent of Stored Program Analyzer), which KFKI (a center originally intended to investigate fundamental problems of physics) developed, manufactured, and marketed, and with the Computing and Automation Research Institute (SZTAKI), which developed and produced color graphics displays.

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In the KFKI, some young members of the staff quite early on recognized that fixed (hardware) programmed multichannel analyzers employed for data collecting and processing large blocks of measurement data in physics could, with a few modifications, be transformed into software-driven computers. But some top members of management, both in the institute and in the state administration, were vehemently against the idea of building computers in the KFKI. So computers were developed on the quiet using the above-mentioned acronym TPA.

The leading person involved in TPA developments was Sándory Mihály. He and other researchers of the TPA systems soon realized that it would be more productive if their applications went along with world computer trends, so they chose to follow certain agreed patterns. At that time, in the late 1960s, there was a recognized niche in the computer market that they knew they could fill—that of the minicomputer. KFKI staff used DEC's PDP series as the blueprint for their designs. The TPA-8 was compatible with the PDP-8 family at the level of programming and instruction set. The TPA-11 (TPA-11/100 and TPA-11/400 16-bit micro- and megaminicomputers) and the TPA-11/500 32-bit megamini families were compatible with the PDP-11 as well as the VAX-11 series. They had a modern architecture with a modular structure consisting of the most up-to-date units of the day and extended a software support system based on worldwide industrial standards. Since there was a permanent ban on most Western computer products, the TPA series met a fairly big demand from a broad range of users. Up to the late 1980s, about 600 systems were installed. Some of these systems were the following:

- three large power plants;
- liquid and gas hydrocarbon processing plants;
- transportation and storage depot companies;
- the Post Office; and
- some big factories.

All used TPA-11 computers in their measuring, data collection, and process control systems

An interesting and instructive story that deserves a mention is SZTAKI's story. As stated before, it was a research institute founded in 1964 for solving research and development problems in automation (AKI). At that time, there was another institute, mainly concerned with solving mathematical problems in cybernetics and computing (Computing Center, CC). Both of them belonged to the Academy of Sciences. Suddenly in 1972, a decision was made to amalgamate the two. The name of the newly formed institute was known as SZTAKI, which was headed by Vámos Tibor, a leading Hungarian researcher. The new institute had quite a broad range of activities, since both predecessors carried on with their former research themes. Among these, two themes should be raised, especially in the context of the Soviet restrictions. The first was the development of CAD/CAM/CAE systems; the other was that of color graphics displays. The person who spearheaded these project ventures was Hatvany, recipient of the ACM's Computer Graphics Pioneer title, the International Federation of Information Processing's (IFIP) Silver Core Award, and a Foreign Associate of the U.S. National Academy of Engineering. Projects on C technologies and systems and the graphics-based products included top-level items that the Soviets banned.

The end of 1979 can be regarded as a turning point for computer research work in Hungary. Just prior to the invasion of Soviet troops into Afghanistan, when there came newer and tighter restrictions on shipping Western high-tech products and systems into the Soviet bloc, the Hungarian Academy of Sciences was just in time able to buy a medium/high-performance computer, an IBM 30/31 (later gradually enlarged to a 40/41). The IBM system introduced and supported a new culture in the usage of modern facilities in research informatics. Its great impact can be noted by the fact that not only researchers in natural sciences and technology extensively used it but soon people (mainly the younger generation) in the social sciences (sociology, archaeology, history, linguistics, etc.) also discovered and broadly applied it in their work. The maintenance side of the computer was managed by SZTAKI, which was comprised of a host of young specialists. They were brought up in servicing the hardware, learning the computer system, dealing with users, and doing software development. Not surprisingly, they came to form the kernel of the present leaders in computer networking.

In the 1970s, the INFELOR information-processing laboratory had an important role in the field of computer applications in Hungary. (Later, in 1975, it was turned into the Research Institute for Computer Applications, SZÁMKI.) In those days, computer applications and development work were all subordinated to the same state administration, i.e., these activities were monopolized by so-called organizing institutes and computer centers like state ministries and authorities (e.g., the Academy of Sciences and the State Office of Statistics). This was a very unhealthy situation, because in such an environment, there was no competition whatsoever. However, some reformist leaders in politics and the economy tried to loosen the bureaucracy's monopolistic grip or control, in accordance with the New Economic Mechanism idea, and introduce some elements of competition into the computerization of the country. INFELOR, the successor to SZÁMKI, was given the task to create the opportunities for solving the problems of customers who commissioned the institute, without interference from their regulatory authorities. INFELOR did, for instance, significant developmental work for the Hungarian computer industry, solving data-processing and operations research problems for companies in industry, agriculture, the services sector, and state administration organizations. In 1984, it was amalgamated with two other institutions to create the Computer Applications and Service Company (SZÁMALK). An interesting point worth noting is that its creator and successful leader for 10 years was

Rabár Ferenc. About 25 years later, in 1990, he became finance minister in the first democratically elected government in Hungary since World War II.

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The 1970s was the era of a large and quickly evolving boom in the computing industry. The scores of people who used, taught, learned, and developed computer tools and know-how quickly grew and even multiplied their numbers in those years. They needed a forum to meet, get acquainted, and exchange their knowledge and ideas. This gathering place became the John von Neumann Society for Computing Sciences (NJSZT). von Neumann, one of the founders of modern computer science, was Hungarian in origin, so it seemed quite natural that the society should be named after this great man. The forerunner of the society was founded in the early 1960s by specialists who built the first Hungarian computers, along with mathematicians, economists, and engineers. The society received its present name in 1968. Then in 1975, it became an independent scientific society and full member of the Hungarian Federation of Technical and Scientific Societies (MTESZ). According to its Constitution, the NJSZT:

- brings together people who deal with computers (whether they use them professionally or as a part of their activity);
- promotes the development of computer science and diversification of applications;
- publishes bulletins and magazines; and
- organizes lectures, debates, workshops, conferences, exhibitions, and professional demonstrations.

In other words, it helps to disseminate the thriving computer culture existing in Hungary. The society has more than 5,000 individual and corporate members in its committees, clubs, and regional organizations. Some of NJSZT's individual members are also active in IFIP, as well as being members of the IEEE and its constituent societies.

Recent Past

By the 1980s, the computing culture had become well-established in Hungary, owing to the consequent state support and enterprise interests. Perhaps the most important reason for this growth was the constant and generous investments given to training and education. During that decade, more than 100,000 young people took part in computing training at universities. Naturally, the courses differed in depth and extent owing to staff and facilities. Equally significant was introducing the younger generation to a closer and more personal relationship with computers, since its effects could be beneficial in the long run. In this period, the use of home and personal computers in Hungary was not as widespread as in the late 1980s and early 1990s. So it was of great importance that in the school year 1982–1983, the state began introducing at least one (but on average more) computer into each secondary/high school and training teaching staff in computer usage. The school computers' capabilities were mainly of a home-computer level. Nevertheless, they sowed the seeds for interest in computer-aided instruction systems in the majority of schools, even in some small cities and villages far from a computer center. Gradually, pupils grew accustomed to computers, learned how to use them, and recognized their usefulness. Hence, the state-instigated school computer program paved the way to a general computer literacy in Hungary that was better than some of its neighbors and even comparable with most Western countries.

The early 1980s saw a mass influx of home computers and PCs into the country. Besides these computers, quite a large number of mainframes were put into operation at universities, research institutes, state ministries (first at their designated "computer centers"), and then in some bigger companies and organizations—mainly for data processing, office automation, and computer-aided management tasks. The more advanced jobs were high-tech applications and systems based on mathematical methods, on specialist software, and occasionally on hardware developed in Hungarian institutes.

The significance of CAD/CAM was recognized early on by Hatvany in mechanical engineering and by Uzsoky Miklós (1925–1995) in electronic engineering. Both were leading researchers at SZTAKI. They published investigations of the surfaces of sculptures and volumetric modeling. The results (primarily on curve and surface interpolation, surface synthesis, and volumetric modeling) in time gained international acknowledgment. CAD/CAM pilot projects were begun at the Budapest Technical University and later at one large machine-tools factory—these systems were employed in situ. At SZTAKI, a Free-Form Shapes–General Topology project was worked out and represented a new generation in surface modeling, since it was not restricted by topologically rectangular curve networks but used surfaces with many-sided patches. Arbitrary vertex functions could be formed as well. Another large-scale CAD/CAM development result should be mentioned in this field: the free-form solid. Here, not only were individual surfaces defined but also solids could be created and bounded by planar and quadric surfaces as well as by free-form ones. Uzsoky and his team devised an automatic system for designing and manufacturing electronic printed circuits. It was widely used in Hungary and exported to other Comecon countries. The system contained some fundamentally new ideas and solutions that were assigned patents not only in Hungary but in other countries as well.

The new company SZÁMALK was a fusion of three institutions that performed different tasks. One did research and development work, the second provided education in computing, and the third installed and maintained computer systems. As an example, here are some typical data of the training and educational activities of the company. During the 1980s, about 6,500 students per year attended SZÁMALK's training center, which provided a quality foundation training for their careers. Here, 1,100–1,200 systems analysts, programmers, and operators were annually awarded with diplomas. Being an international education center, not only Hungarian students but also foreign students from more than 50 countries received training and formed friendships with each other.

In Hungary, valuable research work was done. Good results were achieved in some of the most advanced fields of computer applications—AI and expert systems, both of which demand a combination of high mathematical knowledge and advanced programming ability. Recall the early work of Kalmár mentioned earlier, who designed a machine that could be programmed in a mathematical formula language and who also built a logic machine out of common electrical components. Both were forerunners of now-standard AI concepts and designs. In 1975, Prolog was introduced, a language intended to deal with general AI problems. Just after its appearance, a group in the SZKI devised a further development, known as MProlog. The research work in both cases was led by Dömölki, an outstanding computer specialist. MProlog soon caught on internationally, as marked by the fact that, by the end of the 1980s, more than 1,500 MProlog packages were installed in 25 countries worldwide.

Hungarian specialists recognized long ago the importance of AI. Proof comes from the fact that, as early as 1976, a section was set up within the NJSZT to deal with AI and pattern recognition studies. Soon, meetings and workshops were organized to provide a high-level forum for discussing related ideas, topics, and problems. Below, I give a brief outline of the most important AI and expert system work undertaken and the results obtained in Hungary.

MProlog

In Hungary, the first Prolog developments were in part hastened by practical demands. The first Prolog implementation was made by young workers who already had some experience in logic programming. In a creative atmosphere of researchers inspiring each other, a series of experiments were made, and a good Prolog system was developed. By the end of the 1970s, the Hungarian Prolog experts had sketched out the criteria for solving quite general, but largely practicable problems (for instance, modularity; connection with the traditional programming languages; special built-in procedures; and full compatibility with PCs, mainframes, and workstations). After summarizing the requirements, a new Prolog language and system were devised that were suitable for solving practical tasks. Its name became MProlog, because of its chief characteristic: modularity. One of the nicer features of MProlog was that it could efficiently treat a broad range of applications (3D graphics, window and menu operations, etc.) that users required.

Program-Solving Methods

A group of mathematicians and computer scientists, in the course of developing problem-solving tools, elaborated methods on the general theory of logic programming. Then they worked out the LOBO logic programming language based on these methods, which was in many ways rather different from Prolog. They used logic principles for quality simulation and cooperated with researchers of linguistics in the data representation of problems written in a natural language. They also joined forces with engineering designers at SZTAKI to enlarge LOBO's scope of application. Here I should mention two people who worked intensively on program-solving methods: Dávid Gábor and Nárai Miklós.

Speech Generation and Recognition

I have already discussed the 18th-century wizard Kempelen, who must have been one of the first scientists in the world to succeed in mechanically creating a few discerning speech sounds. In a way, one could say that since then, it has taken two centuries for Hungarian and other research groups to get to the stage where Kempelen left off. At the Budapest Technical University, researchers proved that speech identification could be improved so much that it was possible to distinguish between identical twins who read the same short text. It was also shown experimentally that hearing defects could be diagnosed more safely, particularly in young children, with artificial speech than with traditional examinations. Another breakthrough in this field was in speech generation. Speech synthesizers with a natural sound (LIAVOX) developed in the Budapest Technical University had a fixed vocabulary based on linear estimation. A text-to-speech converter was assembled in cooperation with the Linguistics Institute. Yet another development was made at SZKI for reading texts and documents and for inputting them directly into a computer. The system, named Recognita, has gained an international reputation, and subsequent product versions in languages other than Hungarian continue to be marketed all over the world.

Image Processing

Hungarian studies in image processing stretch back to the early 1970s. In the 1980s, a number of research groups exclusively devoted to image processing formed at universities and in some institutes. In the first phases, they dealt mainly with image processing tasks in scientific research fields like those in biology, molecular chemistry, physics, and astronomy. Later, some directed their attention to industrial and commercial applications, such as computer graphics, computerized evaluation of real-life images (normal, infrared, and X-ray photos), and processing data and pictures gathered from space research and remote sensing. Other important directions of research included texture analysis, image-recognition systems implemented in industrial robots, and evaluation of optical microscope images. In the KFKI, successful programs were carried out within the framework of the so-called VEGA project, whose quest was to seek out Halley's comet before it passed the Earth once more. KFKI also developed facilities for evaluating photos made by Soviet cameras and equipment that were later borrowed and used in U.S. space experiments. Besides the above-mentioned studies, a number of other developments were undertaken by smaller groups in Hungary, but they did not survive the socioeconomic transition of 1990. Nevertheless, they served as good groundwork for more recent high-tech activities and developments in Hungary.

Expert Systems

Knowledge-based systems were developed and implemented in the following fields:

- medicine (e.g., the diagnosis of gastroenterological complaints, ischemic heart diseases, and advice and consultation of choice of therapies for different diseases);
- chemistry (in analysis, prediction, intelligent monitoring of measurements, estimation of hazardous effects, etc.);
- the economy (strategic planning, statistical decisions, insurance, etc.);
- construction; and
- other industrial applications (design support, diagnostics, environmental evaluations, optimal load-and-resources allocation in power plants, etc.).

I have already touched on SZKFP that the Hungarian government launched in 1969. Another state-backed program related to it was begun in 1981: the Development Program for Electronic Parts and Subassemblies. Though there is insufficient space here for assessing the outcome and successes of the Hungarian state programs in electronics (namely, in telecommunications, computerization, and associated parts and subassemblies), it should be pointed out that most were, to a large extent, useful and effective. Other programs, like the one for manufacturing electronic parts, ate up large sums of money without much to show for it. Two key factors in the folding of the latter were that the program had been launched too late and that the investments were not given time to bear fruit.

By this time however, information technology, including computerization, had already taken root in virtually every branch of Hungary's economic and social activities

During 1990, the State Development Programs, controlled and approximately half-financed by the government, were phased out and ceased to exist. By this time however, information technology, including computerization, had already taken root in virtually every branch of Hungary's economic and social activities, from research work and education to the infrastructure and services sector. In particular, members of the younger generation adopted and utilized computers in their everyday lives, though it should be admitted that many of them became hooked on entertainment software famous for its fun and aggression rather than its educational value—much like youngsters in Western countries.

Later Years

Now let us return to the 1980s. In 1983, the government assessed the results and effects of the SZKFP and decided to restructure it in a way intended to focus "*on computer applications with an aim to increasing their effectiveness in socioeconomic processes, and providing favorable conditions for their extensive introduction into society*." Thus, in 1985, the government approved the transformation of SZKFP into the Central Economy Development Program for "Electronization" (EGP) to help encourage the nationwide introduction of electronic devices. Here the emphasis was on "electronization," i.e., not merely the aim of computerization of the country but, more broadly, that of greater automation and better telecommunications as well. Alas, the SZKFP program went into oblivion after 1990. Its aims, however, were mostly fulfilled and served as a catalyst for the present computer-usage boom in Hungary.

The year 1987 was an interesting one for computing in Hungary, for it marked the start of a successful activity plan for "electronization/computerization" of the country. In that year, the MTA and the National Committee for Technical Developments jointly launched an intensive program to this end. The Information Infrastructure Development Program (IIF or I^2F in Hungarian) served as the basis for modernizing the information infrastructure in the research and development and academic communities. Four years later, other ministries and organizations also participated in the program. At the time of launching the program, research and development and university members of staff and even engineers in industry had a relative shortage of computers. Hence, wide area networks could not evolve until the late 1980s. On the other hand, cooperation between Hungarian and foreign organizations rose markedly, prompting a call for better and more efficient means of communication. The lack of any effective medium for communication initiated a well-backed joint action, by the potential users of a newly emerging service, to provide a new networking system for domestic and international computer users.

Although the development started almost from scratch, the infrastructure and support services in time achieved a technical and organizational level commensurate with those of most European countries. The purchasing of any type of modern telecommunication systems and parts, however, was impossible then because of Soviet restrictions. Thus the majority of the available resources was spent on the acquisition of intelligent terminals and local area networks. Before the close of 1990, a network-based information system was already at the disposal of several thousand domestic users. Among the services the system provided were national email (linked to EUNET), bulletin boards, file transmission services, and full-screen database access. Thanks to certain sociopolitical changes in Hungary since 1990, EARN and ASTRA services are also now available.

Between 1991 and 1993, the total number of interconnected end systems has tripled. As for 1994, the services on offer began including:

- email and message handling;
- file transfer;
- remote job entry;
- remote interactive processing;
- directories;
- bulletin boards; and
- distribution lists.

In 1994 and 1995, a complete service portfolio evolved, covering higher-level information services, such as gopher and later the World Wide Web. By 1994, almost 1,000 organizations had became partners in the program. Halfway through 1994, all the major research institutes and smaller groups—along with all the larger universities and higher education institutions plus important public collections and libraries—had become hooked up to the network. In early 1996, about 80,000 users had access to the services through 17,000 Internet hosts and another 10,000 users to the domestic email/ftp/bbs gateway/client facilities. It should be added, too, that since 1995, the IIF Program has been replaced by the National IIF Program, continuing where the IIF left off and having additional ideas and objectives.

Epilogue

The reader now has on outline of computing in Hungary almost up to the present. For the artistic-minded, the whole process may seem like a great symphony, with a glorious movement at the end and with an optimistic future, at least as far as the spread of information technology (IT) throughout the country.

While the perspectives are encouraging from an IT point of view (computing included), the present situation has a few contradictory aspects associated with it:

- A positive fact is that the country became independent in

1989 (when the occupying Soviet troops pulled out of Hungary), and free elections followed in 1990 and again in 1994.

- A positive fact is that so many opportunities have been created by a competition-driven (free enterprise) economy based on private capital and ownership, reacting to and operating in harmony with the demands of the market.
- A positive fact is that after Soviet restrictions on high-tech products and systems ceased to exist, Hungary began participating in some international research and development programs, and its currency became partly convertible.
- A positive fact is that foreign capital has flowed into the country, and an influx of foreign-based multinational corporations has helped boost the Hungarian economy.
- A negative fact is that the country has lost her traditional markets, which had assured a beneficial trade import/export balance, and now has had to enter a fierce world market, where the supply for most kinds of goods is much greater than consumer demand.
- A negative fact is that scores of industrial companies, mostly in engineering, electronics, and metallurgy, collapsed or went close to bankruptcy during the changeover. Along with the loss of many foreign markets, the internal market has noticeably shrunk as well (the gross domestic product in 1995 was about 80 percent of that achieved in 1989).
- A negative fact is that research and development activities have contracted because of a coincidence of some components. The multinational corporations acquired many markets, established subsidiaries rather than stand-alone companies, and did research and development and engineering design work in their home countries. As a consequence, research institutes and universities have not received many new orders from the declining, downsized, industrial companies. In addition, state expenditures on research and development have been steadily cut year after year, owing to the big national budget deficit.

Weighing everything, that Hungary once again became a free, competitive, and open society is considered a positive thing, while a number of socioeconomic phenomena and processes in the past few years have definitely had a detrimental effect on the country and are counted as negative factors. Nevertheless, there are some very encouraging enterprises in IT fields that have had their roots outlined in this essay. They are mostly spin-off effects of research institutes and research and development companies that the state established. Most of them started modestly. A handful of them, however, grew dramatically in the late 1980s to early 1990s and are now respectable-size firms. These enterprises gained higher profits mainly from hardware (like PCs assembled from kits), having duly noted and exploited the legal gaps in currency restrictions and Soviet prohibitions. But the majority of these erstwhile companies shrank or disappeared altogether with the lifting of restrictions, largely because of the massive influx of cheap IT products from the Far East.

During the last few years, the commercial survivors of Hungary have, broadly speaking, consolidated and built up enterprises that make added-value products. This "added value," incidentally, is generally the result of their own mental and research efforts. There are now some companies in Hungary that are totally or partly in foreign hands and have well-established products and services in today's world markets. We also should not forget that there are now some multinational corporations undertaking high-level research work in their subsidiaries in Hungary. In the last couple of years, foreign enterprises have became more prevalent in Hungary, bringing research orders to academic groups, bringing state-of-the-art equipment, and even establishing complete laboratories. Besides this, it should be remarked that along with a gradual change of the telephone network over to digital circuitry, the country's infrastructure has changed to a beneficial degree.

It should be said that IT (and computing) is not a state but is really a process, so IT is never ending unless it is interrupted. Now let me round off the essay with one final remark. While history can test a nation or people (as has been the case many times in Hungary), a country's survival usually depends on what it holds most precious, on the most valued parts of its culture, education, and high-level knowledge. I hope that with this essay, I have been able to demonstrate this basic truth to the reader's satisfaction. Indeed, what is any sophisticated society without its literature, music, science, and technology?

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The Roots of Computing in Hungary

Year	Product, Discovery, or Event	Name*	Remark
1773	Speaking machine	Kempelen Farkas	Lived in Austria
1796	Chess automaton	Kempelen Farkas	-
1861	Discovery of the dynamo principle	-	-
1860s	Automaton for Lissajous graphs	Jedlik Ányos	-
1882	Founding of the first telephone manufacturing company in Budapest	-	Six years after Bell's discovery
1891	Telecommunications research institute	-	-
1893	Telephone network	-	-
1896	Founding of the Tungsram factory (now General Electric-Tungsram)	-	-

** In Hungarian names, the family name comes first, while Christian names follow.*

Preliminary Phase of Computing in Hungary

Year	Product, Discovery, or Event	Name	Remark
1930-1939	Automatic air-defense fire-control system	Juhász István	-
1930	First patent system	-	-
1936	Subsidiary of IBM in Hungary	-	In Budapest
1938	First patent of an electronic calculator	Kozna László	Worked in Antwerp
1947	Paper about the ENIAC	Nemes Tihamér	In a Hungarian scientific journal
1949/1950	Hungarian census processed by punched-card machines	Central Office for Statistics (KSH)	
1953	Founding factory for punched-card machine series	IGV Co.	-
1952-1955	Fully electronic air-defense fire-control system	GAMMA Co.	-
1953	Proposal for building an electronic digital computer	Hatvany József, Edelényi Lászlo et al.	By a group of political prisoners
1954	Mechanical logic machine	Nemes Tiharné	Four basic operations

The Postwar Era of Computing in Hungary

Year	Product, Discovery, or Event	Name	Remark
1955	Group for studying high-power mathematical machines	Tarján Rezsö et al.	Developing ferrite memories
1956	Automata theory conference	Kalmár László, Péter Rózsa	Organized by the Bolyai János Mathematical Society
1956	Research Group on Cybernetics of the Hungarian (KKCS) Academy of Sciences (MTA)	-	Birth of Hungarian computer science
1957-1959	Building of an M3, first-generation electronic computer	Scientists in the KKCS	Based on Soviet design documentation
1959	The MESZ-l computer	Kozma László et al.	Made of signal relays
1960	Logic machine in Szeged	Kalmar László et al.	Presented in the Budapest International Expo
1959-1963	The EDLA digital computer	Edelényi László and Ladó László	-
1960-1961	First university courses for programmers	Kalmar L., Peter R., Kreko B., Bekessy A.	In Budapest and Szeged
1958-1963	Electronic nuclear analyzers with stored program	KFKI	Ancestors of TPA-type computers
1964-1966	The Hunor calculator family and the EMG-830 computer	EMG Co.	Made from Germanium transistors

1960s	Procurements of “big” computers (e.g., Minsk, ICL, CDC, Bull, and Elliot)	-	For industry, R&D and state administration
1960	KKCS turned into the SZK of the MTA Computing Center	-	-
1964	Founding of the Research of the MTA Institute for Automation (AKI)	-	-
1965	Founding of the Inforrnation of the KSH Processing Laboratory (INFELOR)	-	-

The Between Years in Hungarian Computing

Year	**Product, Discovery, or Event**	**Remark**
1968 January	Start of the New Economic Mechanism in Hungary	Quasi market-driven economy
1968 end	Intergovernmental Committee for Computing in the Socialist Countries (SZKB)	Independent of Comecon
1968	Cooperation of Comecon countries on Computing, start of the Unified System of Computers (USC)	IBM clones
1968	Founding of the Institute for Coordination of Computing Technology (SZKI)	For coordinating USC in Hungary
1969	Central Development Program for Computers (SZKFP)	
1969	TPA-1100 Hungarian minicomputers developed in the KFKI	~30 were produced
1969	Founding of the VIDEOTON (VT) electronics company	Biggest in CCE
1970-1972	Production of R-10 minicomputers in VT	Smallest model of the USC
1970-1972	Founding of the International Training Center for Computing (SZÁMOK)	Supported by UNDP
1970	TPA-1140 model in the KFKI	One of DEC’s PDP-11 clones
1972	Setting up of the Computing and Automation Research Institute (SZTAKI) of MTA	From the fusion of AKI and SZK
1972	TPA-i IC-based Hungarian-developed minicomputer in the KFKI	Compatible with DEC’s PDP-8
1975	Transformation of INFELOR to Computer Applications Research Institute (SZÁMALK)	-
1975	Setting up of the John von Neumann Society of Computing Sciences (NJSZT)	As a full member of the Federation MTESZ
1976-1980	Founding regional organizations of NJSZT	-
1979	Procurement of an IBM computer for the MTA	Just within the COCOM restrictions
1975-1980	Founding computing centers in state organizations and some universities	-

Recent Past of Computing in Hungary

Year	Product, Discovery, or Event	Remark
1981	Development Program for Computer Electronics and Subassemblies (EGP)	State program for five years
Early 1980s	Mass influx of home computers and PCs	Mainly clones from the Far East
Early 1980s	Hungarian PC developments	Aborted because of foreign imports
1980	Computing informatics courses in the whole training system	-
1982	State computerization program in secondary schools	"At least one computer in each school."
1980s	Original hardware and software R&D results and applications	-
1980s	Graphical display	Simultaneously with the first models in the West
1980s	Pilot FMSs	Four systems
1980s	CAD/CAM/CAE systems	Mainly in electronic and mechanical manufacturing
1980s	3D modeling in mechanical design	-
1980s	ADA compiler	The first in the Eastern bloc
1980s	MProlog, ArchiCAD, Recognita	Were the most successful products and systems on the market
1980s	Image processing systems	-
1980s	AI/expert systems	-
1984	Establishing of Computer Applications and Services Co. (SZÁMALK)	Fusion of SZÁMOK and SZÁMKI
1985	Central Economic Development Program applications for "Electronization" (widespread introduction of electronic machines)	A complex R&D, training, and production program
1987	Start of a national Information Infrastructure Development Program (IIF)	By the MTA and the National Committee for Technical Development
1990	Free elections in Hungary	Various social and political changes
1990	Joining of European R&D programs	Esprit, Cost, Eureka, Peco, etc.
Early 1990s	Transition to a market-oriented economy, collapse of traditional markets, decline in industrial output, end of most old electronics companies, new (mainly small) ones, joint ventures, influx of foreign capital	-
1990	Introduction of a network-based information system	In the IIF
1991	Joining the Internet	In the IIF
1992-1994	Number of Internet hosts grows from zero to about 5,000	-
1994	Termination of COCOM	End of political restrictions
1995	Introduction of a National Information Infrastructure Program for the whole economy and society	Based on the IIF

Hungary

Hungary lies in the heart of Europe and is situated practically in Europe's geometrical center, in the Carpathian Basin. Hungary covers less than 1 percent of the continent's territory (93,032 square kilometers), and its population is less than 2 percent of the European total.

The ancestors of the present nation came from Middle and Eastern Asia and settled here just 1,100 years ago (1996 marked the millecentenarium of the migration). The country as we know it today was founded about 1,000 years ago.

Hungary's neighbors are Austria, Slovakia, The Ukraine, Romania, Yugoslavia, Croatia, Slovenia (the number of neighboring countries has grown in the last few years since Croatia and Slovenia became free nation-states). The number of Hungary's inhabitants is presently about 10.5 million, which, contrary to the general world population growth, has had a downward trend for several years. The capital, Budapest, which has over 2 million inhabitants, is a city snugly situated on both banks of the Danube, one of the finest waterways of Europe.

The country is poorly endowed with raw materials, its mines having been largely exhausted during the last few centuries. Thus, almost everything has had to be created from local brawn and brains. In 1995, the GDP per capita was around $4,000 U.S. (one U.S. dollar is equivalent to about 150 HUF).

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