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The Origins of Computer Graphics in the Czech and Slovak Republics

Martin Šperka

ABSTRACT

The author summarizes important events in the development of computer graphics and its application in fine art and animation in Czechoslovakia up to the year 1989, when the Iron Curtain fell. The general situation and political atmosphere in the country and their influences on contemporary art are also discussed, as are scientific and technological developments in the computer industry, artists using computer graphics, and computer art exhibitions and publications. A brief summary of technological development in former Countries of the Mutual Economic Cooperation (COMECON) is included.

Pioneers of computer art in Czechoslovakia had to overcome many obstacles in order to pursue their creative activity—the negative official policy relating to the modern-art and computer-art movements, a lack of support and understanding from the art community and a lack of computers with which to work. Scientists and engineers in computer graphics received more positive official support, but they were still handicapped by a lack of communication with scientists in the West, the U.S. embargo on high-technology products, the lack of convertible money for importing high-quality devices (Western European businesses charged double [or higher] prices for embargoed machines) and the increasing technological gap between the West and the Countries of the Mutual Economic Cooperation (COMECON).

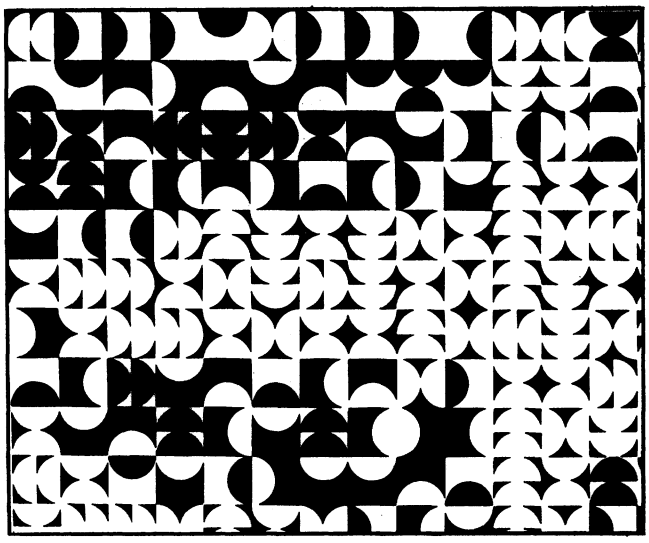
Backwardness in computer technology had its roots in the early 1950s (the culmination of Stalin's regime and the Cold War era), when official policy toward information science, cybernetics and computers could be characterized by the slogan "Cybernetics is bourgeois pseudo-science." (Research in cybernetics and information science continued under the term "automation.") The 1950s were also characterized by a negative official attitude toward modern art. Descriptive Socialist realism, celebrating the class of workers, farmers, working intelligentsia and leading communist party officials, was the only art supported by the governments of Eastern Europe. In Czechoslovakia, continuity in modern-art movements after the period between the two world wars, as well as close contact with the European avant-garde, was interrupted for many years (including war time).

The 1960s were characterized by a transition from the Stalinist era, which meant closer contacts with the West, but after the invasion of Warsaw Pact troops in August 1968, the situation changed again. Many artists and scientists emigrated, and many—those who openly refused official policy in culture and art—had no support or were persecuted through canceled contracts for their artworks and exclusion from the Union of Artists. Sculptures or other artifacts of nonconforming artists were removed from public places or even destroyed. The Union of Artists was the official—and only—professional art organization supported by the government. This organization was responsible for judging the works of artists—setting aesthetic value and price and selecting the winning artifacts in competitions. The only legal way that artists could sell their works was to take part in these competitions. The members of competition juries often misused their positions, and they were under ideological pressure from the Communist party. Even so, the situation at this time was not as hard as it was in the early 1950s.

In Slovakia, the first computer artists were part of the "unacceptable" group, and the term computer art became synonymous with their names. Perhaps this was the reason the computer was not officially recognized as a tool and medium for artists. However, in cooperation with enthusiastic scientists and engineers from research and government institutions, some artists were able to use computers, either legally or illegally.

The use of computers was the only unifying force among computer artists. There was no group of computer artists cooperating and creating in one style or movement. Everybody had his or her own expressive language. The indirect influence of Western Europeans could be seen in the works of some artists, but, in general, the main motivation for artists working with computers was an interest in experimenting with a new tool and taking part in the Czech and Slovak conceptual art movement (performed at the periphery of the official mainstream, underground and without direct or open confrontation with

Fig. 1. Zdeněk Sýkora, *Black-and-White Structure*, ceramic mosaic (detail), 530 × 350 cm, 1969. The composition of the pattern was computed with a program on a LGP-30 (German) computer.



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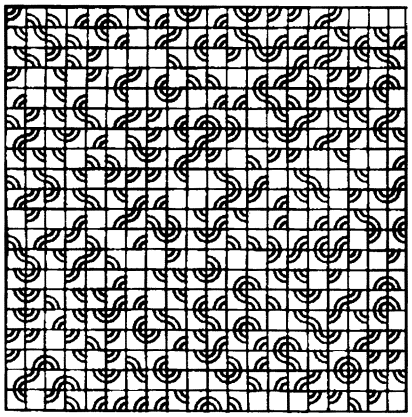


Fig. 2. Miroslav Klivar, *Structure II*, computer drawing using pen plotter, 21 × 28 cm, 1979. (Collection of the National Gallery of Prague)

Western European artists). In addition, for some artists, computers allowed a natural extension of their style.

DEVELOPMENTS IN TECHNOLOGY

The first digital computer developed in Czechoslovakia was the SAPO, based on relay technology (this project started in 1951). The EPOS computer, designed in 1963, used vacuum-tube technology. Both computers were developed by the team of Antonín Svoboda at the Laboratory of Mathematical Machines and at the Research Institute for Mathematical Machines (the laboratory's most recent name) in Prague.

In the 1960s and early 1970s, this institute developed several analog computers, the second-generation digital computer ZPA 600, analog plotters and the first Czechoslovak digital plotter DIGIGRAPH (designed with the Konštrukta company in Trenčín and produced by ZPA factory in Nový Bor), which was the most massively produced digital plotter in COMECON. In the 1970s and 1980s the institute developed several functional equivalents of IBM 360/370 computers.

The first third-generation computer in Czechoslovakia (based on semiconductor-chip technology) was developed at the Institute of Technical Cybernetics of the Slovak Academy of Sciences in Bratislava in 1970 (there is no equivalent Western model). Later the same group developed several computers (also the first Czechoslovak multiprocessor) and several interactive graphic systems for semiconductor-chip layout design (the first appeared in 1974).

With many young and ambitious engineers, new institutions began to emerge, among them the Research Institute of Computers in Žilina in 1971. This institute was responsible for the development of mini- and microcomputers as well as computer-graphics devices. Scientific research was concentrated in the Academy of Sciences and universities in Prague, Brno, Bratislava, Pilsen and Košice.

The COMECON decided to tackle their problems of backwardness in computer technology and the U.S. embargo through cooperative projects and the production of a computer based on "functional equivalents" of successful American computers. In the mainframe computer category, the decision was made to develop an IBM equivalent; the USSR and the German Democratic Republic made equivalents of the largest IBM 360/370 models, and Czechoslovakia and other countries made smaller ones.

There were big discussions about small computers. Computers produced by two U.S. companies—Hewlett-Packard Company (HP, which created the Series 2000) and Digital Equipment Corporation (DEC, which created PDP 11 and VAX 11 computers)—were preselected for emulation. The USSR and Czechoslovakia both started developing models equivalent to these computers. The official decision (approved by the Ministry of Electrotechnical Industry) was to develop DEC equivalents, which Slovak engineers did. In the Czech Republic, the experts developed Hewlett-Packard equivalents. This caused controversy between Czech and Slovak engineers, managers and even politicians.

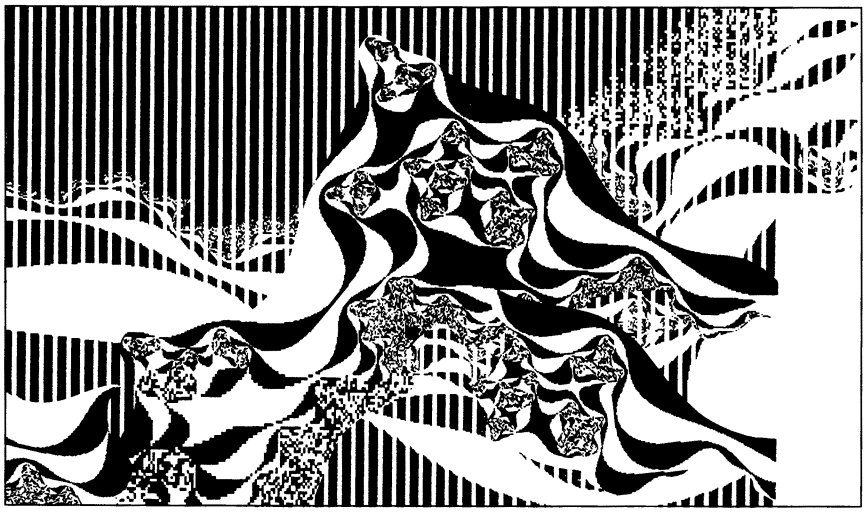
Functional equivalents were not "one-to-one" copies of the above-mentioned machines, but they were able to execute the same software as the original computers. New problems emerged with the introduction of microprocessors and large semiconductor memories. When one prototype was ready for production, Americans introduced newer models, more sophisticated and complicated. Microprocessor and semiconductor memories influenced the development of computer graphics, which was very influential in the design of new, more complicated semiconductor chips. This is a good example of a positive feedback process that accelerated innovations and resulted in increasing the technological gap between the West and the COMECON.

This situation was the source of major discussions. Some scientists defended the policy of copying Western computers, because this would result in a consistent computer culture (terminology, literature, software, methodology). Others, especially some scientists in the USSR, defended the policy of going in a separate direction in the design of computers, or at least designing some modifications.

Scientific cooperation also existed. Scientists took part in international conferences, and in the 1980s cooperative projects coordinated by the Soviet Academy of Sciences emerged.

In the second half of the 1980s it became clear that neither copying nor redesigning computer systems could bridge the technological and scientific gap. "The train is gone; we are not able to catch it," managers in computer industry and research used to say. The

Fig. 3. Zdeňka Čechová, *Sand Storm*, computer drawing, 21 × 28 cm, 1991. This drawing was printed on a dot-matrix printer using the author's program.



mass production of cheap personal computers in the West and the Far East was something like a prophecy of the near future, several years before the fall of the Berlin wall. The proliferation of high technology elsewhere accelerated the erosion of the Soviet empire.

Chronology of Events: Artists, Exhibitions, Publications

1962

Art theoretician and painter Miroslav Klivar published the article "Cybernetics and Theory of Reflexion Related to Art" in *Slovenské pohľady,* a journal on literature and culture. This article discussed basic questions involving creativity and its simulation by machines, and it was compatible with official statements of some Russian theoreticians. It also contained information on early experiments in computer art in the United States.

1966

Painter Zdeněk Sýkora (Fig. 1) and mathematician Jaroslav Blažek made their first experiments with computers in fine art. Sýkora used a computer to generate combinatorial sets of alphanumeric symbols. These symbols were interpreted by the computer as geometric patterns and then manually painted [1]. In 1969 Sýkora designed a ceramic mosaic that became part of an architectural design for ventilating road tunnels in Prague.

Klivar started using a computer to create fine artworks (Fig. 2). Compositions using random-number generators were drawn with a digital pen plotter. Later he used the computer for textile design and bookplates (ex-libris), too.

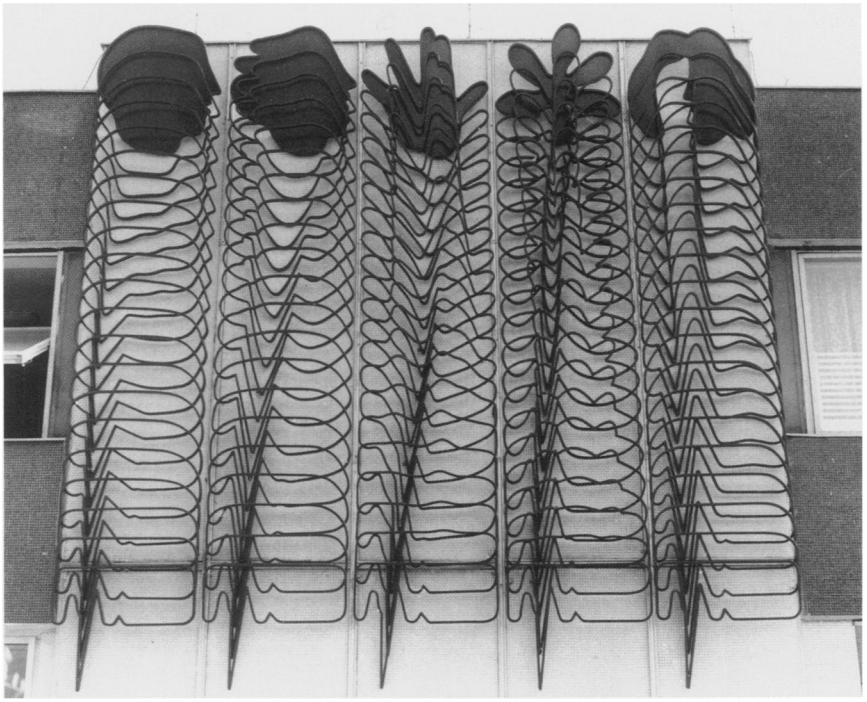


Fig. 5. Jozef Jankovič, exterior design for a general hospital in Bratislava IV, colored aluminum and epoxy, 6 × 6 m, 1981–1982. The artwork was created according to computer drawings using the PDP11 computer and the Calcomp plotter. Each column shows the morphing of an outline of part of the human body into an electrocardiograph signal.

1968

In February the first Czechoslovakian computer art exhibition in Brno was organized by artist and theoretician Jiří Valoch. The exhibition included works by Charles Csuri, Leslie Mezei, Frieder Nake, Georg Nees, A. Michael Noll and Lubomír Sochor (who was the only artist from Czechoslovakia). The selected collection was later exhibited in two other towns. Another exhibition was held that September in Prague, and included works by Klivar, Nake, Noll, Nees and Karl Strand.

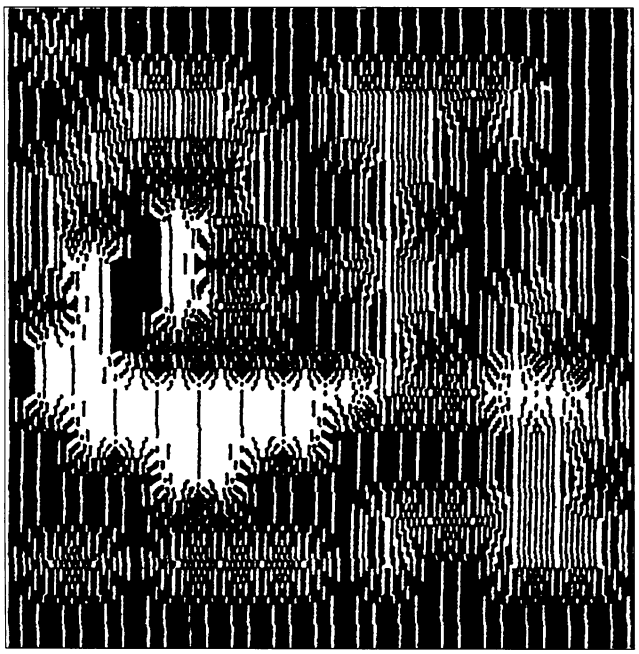


Fig. 4. Zdeňka Čechová, offset-printed design, 8.5 × 10 cm, 1986. Čechová made similar computer-generated patterns for textile designs and book illustrations.

1972

Zdeňka Čechová, from the Institute for Interior Culture (UBOK) in Prague, made her first experiments in computer art (Figs 3 and 4). Čechová, Klivar and Zdeněk Frýbl were pioneers in computer-generated textile patterns. Čechová also used the computer to design tapestries, carpets, ceramic patterns and book illustrations [2]. Her main motivation in using computers was an interest in experimenting with a new technology in art. She made prints on paper or textiles from her computer drawings.

1973

Sculptor Jozef Jankovič and computer scientist Imro Bertók made the first computer-aided artwork in Slovakia [3]. Jankovič started exploring new media and space—two-dimensional projections of three-dimensional space (Fig. 5). His works can be characterized by unifying paradigms searching for a common design formula involving man, sculpture

Fig. 6. Juraj Bartusz, retrospective exhibition in Košice, aluminum art objects from 1973–1974. (Photo: Milan Bobula) The objects were made according to computer drawings utilizing boundary curves generated by the HP 9030A computer.

and architecture [4]. In the early 1970s some of his monumental sculptures were removed from public spaces, and he was denied the possibility of creating official work. He started to make graphic art with the theme of abstract architecture. He created serigraphs based on transparencies taken from computer-graphic displays or line plotters. Later he used the computer to design relief or metal constructions for wall or ceiling decorations [5,6].

Sculptor and conceptual artist Juraj Bartusz in Košice used the computer for calculating and drawing smooth boundary curves on an HP 9030A computer (with algorithms and computer program by S. Haltenberger). The computer generated several versions of curves, and one of them was randomly selected. The goal was to eliminate subjective aesthetic factors in the selection of a particular curve. Drawings were used like stencils for processing (turning, cutting and polishing) these metal sculptures. Some of the sculptures could be adjusted by observers—an attempt by the artist to express the fourth dimension (Color Plate B No. 2). The first exhibitions of his computer-aided sculptures (which were reminiscent of works by the pioneer American computer sculptor Robert Mallary [7], even though Bartusz never saw Mallary's artworks) took place in Košice (1973) (Fig. 6), Bratislava (1974—this exhibition was closed several days after opening for ideological reasons), Warsaw and Torun, Poland (1977).

1974

The first scientific seminar on computer graphics at the Czech Institute of Technology, Prague, took place.

1975

Computers were used for textile pattern design by Orgatex company. The textile design program was implemented on a Soviet second-generation computer, the Minsk 22, with a Benson digital plotter.

An exhibition of computer art took place during the conference on software theory SOFSEM 75 in Jasná (with Jankovič and Daniel Fischer).

1976

An exhibition of computer art at the Institute of Industrial Design in Prague (with Czech artists) took place.

1977

The first scientific Czechoslovak conference on computer graphics was held in Prague. Other conferences took place every second year. Art exhibitions were part of each conference. Experts from all the COMECON and some Western European countries participated.

1978

The scientific conference "Computer Graphics '78" took place in Smolenice (near Bratislava). More conferences followed in 1983, 1986 and 1989. Exhibitions and papers on computer art were part of each conference. Major discussions took place between exhibiting computer artists and scientists on the role of computers in art. Soviet scientists strongly criticised the "misuse" of computers in art. Later they agreed with the philosophy of the exhibiting artists, who believed that the computer could be a

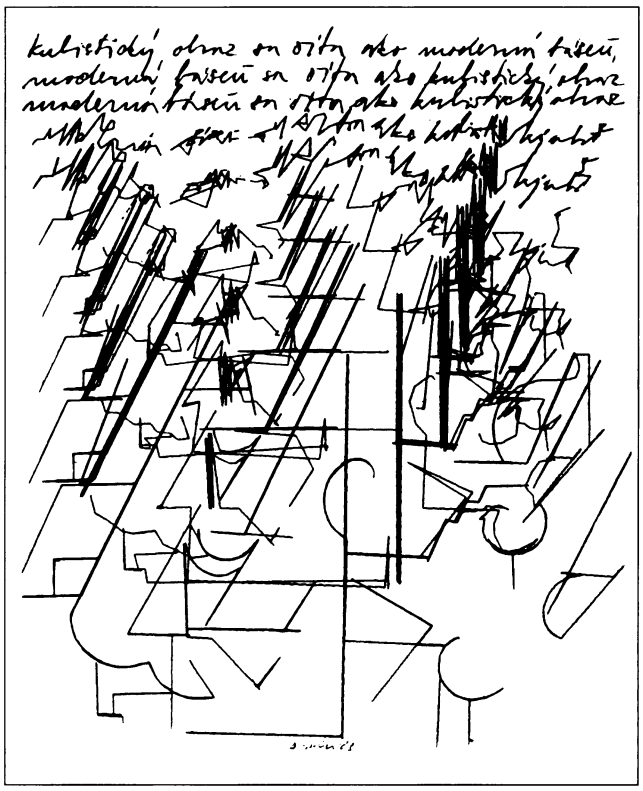


Fig. 7. Daniel Fischer, *The Cubist's Pictures Can Be Read Like a Modern Poetry*, serigraph, 1983. From the series *Images-Poems*, this artwork was generated by the CDC3000 computer and the Calcomp plotter. The artist used an earlier version of the image to create an oil painting in 1982.

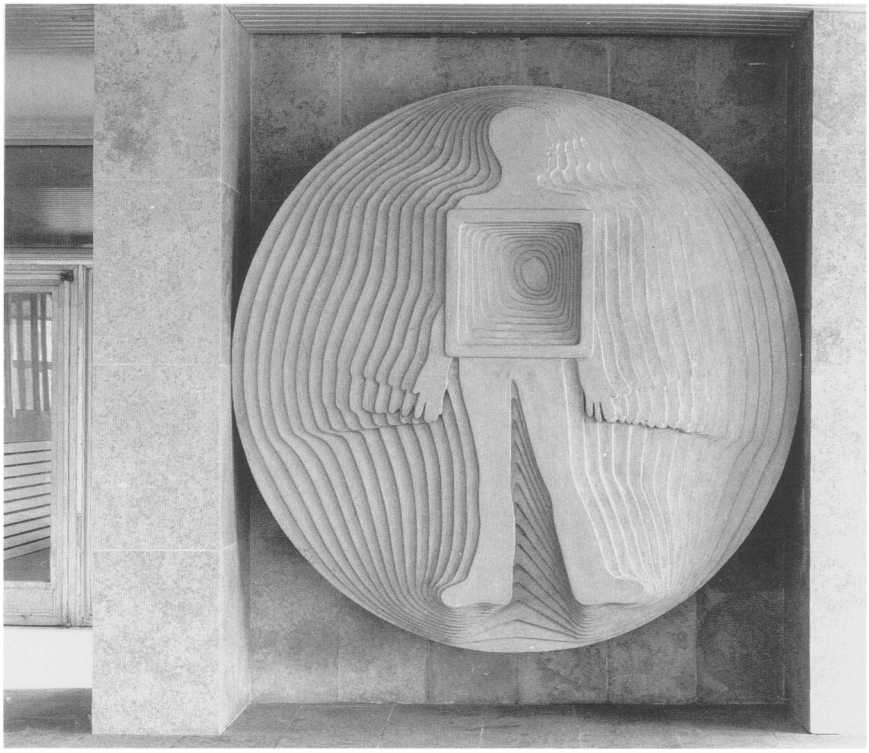


Fig. 8. Jozef Jankovič, interior design at the general hospital in Bratislava III, cast sand and epoxy, 3 × 3 m, 1984–1985. (Photo: Ivan Hoffman) The casting form was produced from computer drawings using the SM4 computer and Calcomp plotter.

tool for art in the same way that classical tools are, and that the computer does not limit the creativity of the artist. Researchers and teachers from the German Democratic Republic, Hungary, the USSR (including scientists from top research institutions), Poland, Bulgaria and Romania participated.

An exhibition featuring the work of young, conceptual and underground artists was held at the Institute of Technical Cybernetics in Bratislava. Among them, painter Daniel Fischer showed his computer graphics, programmed by computer scientists Igor Klačanský and Pavol Fischer. Daniel Fischer (see Fig. 7) used the computer for creating preliminary drawings (pen plotter). He then processed these drawings in manual paintings (canvases approximately 2 × 1 m), or he made serigraphs on paper (A4 or A3 size). He also experimented with the morphogenesis of texts, objects and landscapes—texts were transformed into the images of the objects discussed in the texts (Color Plate A No. 3).

The site of this exhibition was not chosen randomly—its choice revealed that an interest in searching for new areas in fine art existed [8]. Another reason for the choice of the site was that underground artists were not allowed to exhibit in official galleries, and cooperation with scientists in the form of exhibitions during conferences or seminars enabled artists to communicate with the public.

1980

The first technical book on computer graphics, *Počítačová grafika* by L. Granát and H. Sechovský, was published in Czechoslovakia [9].

Artist D. Fischer and film director Peter Gerža made the first computer-animated film. Every frame was drafted with a line plotter and filmed with a 16mm animation camera. The film, depicting the metamorphosis of a bull from an Altamira cave to the sign of infinity, was shown on Slovak television in Bratislava.

Fischer also used computer graphics for book illustrations—the pages of the book showed a sequence of transitions generated by morphing one object into another. By turning the pages quickly, the observer could see an animation of the images.

1981

A book by L. Drs and J. Všetecka, *With the Lens of Computers* [10], was published. This book contains artistic photos of old and modern architecture in Prague and is accompanied by computer-made line drawings that simulate particular space projections and perspectives (along with mathematical formulae and explanations) as well as listings of programs for drawing these images.

1982

The first Czechoslovak Computer Art Exhibition (part of a scientific conference) took place in Prague. Among other artifacts, designs for wallpaper (output from a pen plotter) by architect Jan Moučka were exhibited. He and another Czech architect, Jiří Eisler, used computers for imaginary and stylized architectural compositions at a time when no commercial, easy-to-use computer-aided design (CAD) systems existed in Czechoslovakia. Eisler used a pen plotter and a very simple method for eliminating hidden lines in perspective drawings. His method of using horizontal cross-sections of scenes increased the aesthetic appeal of his works.

1983

The first computer-animated titles in Slovak television were created by computer scientists Martin Šperka, Peter Briatka and film director Korol Doboš, who recorded them with a video camera from line graphic displays in real time.

1985

Jankovič was the first Czechoslovak artist to exhibit at a SIGGRAPH Art Show (see Fig. 8).

1986

Fine artist and animation film director Ondrej Slivka made an animated cartoon with several sections generated by computer (software written by Šperka and M. Sepp on an IBM XT personal computer, one of the first in Slovakia). Computer-generated sequences were taken frame by frame from a color monitor with a 35mm film-animation camera. Computing time for a single frame was a few minutes. This 7-min movie (with an environmental scenario) was honored at several international animation festivals (in Huesco, Cracow and Tampere).

1988

The first book on computer art published in Czechoslovakia (and probably in the COMECON) was released [11].

1989

At the Third Czechoslovak Computer Art Exhibition in Prague many Czech and Slovak artists participated. Foreigners whose works were shown included

Herbert W. Franke, Vera Molnar, Nake and Nees. At the "Computer Graphics '89" conference in Smolenice, scientists from the United States and West Germany took part for the first time.

The Present

Now, after the removal of the Iron Curtain between Western and Eastern Europe, computers have appeared in many artists' studios and homes. Computer-generated logos and commercials have been produced, and the first powerful graphic workstations have emerged in former COMECON countries. Computer courses are now part of the curriculum at schools of art.

Acknowledgments

I would like to thank all the people who gave me information on events in computer-graphics history in Czechoslovakia and Eastern Europe: Z. Čechová, L. Granát, M. Klivar, J. Jankovič and D. Fischer from Czech and Slovak republics; Jan Pamula and Janusz Grzonkowski from Poland; Vladimir Galaktionov and Bulat M. Galeyev from Russia; Gert Bar and Jürgen Albrecht from Germany. I also thank David Klooster, Fulbright Scholar at the Comenius University in Bratislava, for helping me with the English-language translation of this paper, and I especially thank Ray Lauzzana, who encouraged me to compile historical facts on the origins of computer graphics (art, science and technology) in Eastern Europe.

References and Notes

1. Z. Sýkora and J. Blažek, "Computer-Aided Multi-Element Geometrical Abstract Paintings," *Leonardo* **3**, No. 4 (1970) p. 409.

2. Z. Čechová, "Applications of Computer Graphics in Fine Arts," *Proč. Počítačová Grafika 86* (1986) pp. 15–20.

3. I. Bertók and J. Jankovič, "A Collaborative Investigation of the Line: Interactive Computer-Aided Drawings," *Leonardo* **19**, No. 1, 27–30 (1986).

4. M. Šperka, "Milestones of Computer Graphics in Slovakia," *Profil Sučasného Výtvarneho Umenia* **3**, No. 1, 10–11 (1993).

5. I. Bertók and I. Janoušek, *Computers and Art* (Bratislava: Slovenské pedagogické nakladateľstvo, 1988).

6. M. Klivar, "A Computer in Art and Experimental Aesthetics," *Estetika* **3** (1986) pp. 186–200.

7. R. Mallary, "Computer Sculpture," *Artforum* **7**, No. 20, 29–35 (1969).

8. T. Štraus, *Slovak Variation of Modernism* (Bratislava: Samizdat 1978–1979; Pallas, 1992).

9. L. Granát and H. Sechovský, *Počítačová grafika* (Prague: SNTL, 1980).

10. L. Drs and J. Všetecka, *With the Lens of Computers* (Prague: SNTL, 1981).

11. See Bertók and Janoušek [5].

Bibliography

Malina, F.J., *Visual Art, Mathematics and Computers: Selections from the Journal LEONARDO* (Oxford: Pergamon Press, 1979).

Glossary

analog (computer, plotter)—an analog computer exploits the analogy of numerical computing with numbers, represented by a continuous, multi-valued electric signal.

chip layout—a process similar to designing floor plans in architecture and resulting in extremely complicated structures of geometric patterns.

digital—uses two valued signals for encoding alphanumeric data.

microprocessor—processor embedded in one semiconductor chip.

morph—computer-generated special effect in which one image or figure is smoothly transformed into another.

multiprocessor—computer containing several processors.

plotter—computer-output device used for drawing.

processor—the heart of the computer. Executes program stored in memory.

relay—electromechanical switching element. It was used in telephone exchanges and computers before the advent of vacuum tubes or transistors.

semiconductor chip—basic functional building block of computers. May contain up to several million transistors interconnected and implemented on a single, small piece of a semiconductor.

semiconductor memory—memory implemented in a semiconductor chip. One integrated circuit contains up to several million elementary information units. This technology is crucial for color, raster-graphic modules in personal computers and graphic workstations.

vacuum tube—electronic switching or amplification element, predecessor of the transistor.