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Following TRACE: The Computer Hobby Movement in Canada

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Article abstract

The subject of this paper is the computer hobby movement in Canada and its role in the introduction and social acceptance of personal computing in this country. The paper offers a case study that focuses on the activities of arguably the earliest Canadian computer hobby organization named the Toronto Region Association of Computer Enthusiasts. The objective of the study is to document and analyze the first decade of the microcomputer hobby movement in Canada and its role in bringing computing into the homes of Canadians.

Following TRACE: The Computer Hobby Movement in Canada

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Abstract: The subject of this paper is the computer hobby movement in Canada and its role in the introduction and social acceptance of personal computing in this country. The paper offers a case study that focuses on the activities of arguably the earliest Canadian computer hobby organization named the Toronto Region Association of Computer Enthusiasts. The objective of the study is to document and analyze the first decade of the microcomputer hobby movement in Canada and its role in bringing computing into the homes of Canadians.

Résumé : Le sujet de cet article est le mouvement des amateurs d'ordinateur au Canada et son rôle dans l'introduction et l'acceptation sociale de l'ordinateur personnel dans ce pays. L'article propose une étude de cas qui met l'accent sur les activités de la *Toronto Region Association of Computer Enthusiasts*, probablement la première organisation de ce genre au Canada. L'objectif de l'étude est de documenter et analyser la première décennie du mouvement des amateurs d'ordinateur au Canada et le rôle qu'il a joué dans l'introduction de l'ordinateur personnel dans les foyers canadiens.

Introduction

The introduction of the first commercial microprocessors to the market in the early 1970s prompted several companies and individuals to design small, inexpensive, general-purpose computers around these novel semiconductor devices. When the first such computers (commonly referred to as microcomputers) began to appear between 1973 and 1975, they caught attention of electronics hobbyists. Their enthusiasm for the 'computers of their own' gave birth to a forceful microcomputer hobby movement that played a pivotal role in the social acceptance of personal computing.

Much has already been written on the subject of the American computer hobbyists' movement of the 1970s in scholarly literature as well as in non-scientific publications.[1] This is hardly a surprise as the computer hobby movement in the United States was the strongest, most versatile and had a significant influence on the early development of personal computing world-wide. However, the computer hobby movement of the 1970s was neither restricted to the United States nor was it homogeneous. Computer hobbyists in Asia, Australia, and Europe were frequently building and experimenting with locally designed and manufactured computers.[2] Their hobby computer activities had a considerable impact on domestic home and personal computer markets that were developing in unique ways and at a unique pace, reflecting local conditions.[3] These national and regional histories of computing require individual as well as comparative studies. "Such comparisons are important in the history of technology" historians Saarikoski and Suominen explain, "because they remind us that developments are not globally uniform and that technology is culturally dependent."[4]

The subject of this paper is the computer hobby movement in Canada and its role in the introduction and social acceptance of personal computing in this country. The paper offers a case study that focuses on the activities of arguably the earliest Canadian computer hobby organization named the Toronto Region Association of Computer Enthusiasts (TRACE). The objective of the study is to document the first decade of the microcomputer

1. See, for instance, Paul E. Ceruzzi, *A History of Modern Computing* (Cambridge, Mass.: The MIT Press, 1998); Steven Levy, *Hackers: Heroes of the Computer Revolution* (Beijing, Cambridge, Farnham, Köln, Sebastopol, Tokyo: O'Reilly Media, 2010); Paul Fresiberger and Michael Swaine, *Fire in the Valley: The Making of the Personal Computer*, 2nd ed. (New York: McGraw-Hill, 2000); Zbigniew Stachniak and Scott Campbell, *Computing in Canada: Building Digital Future*, Transformations Series 17 (Ottawa: Canada Science and Technology Museum, 2009); Zbigniew Stachniak, "Microcomputers," in *Wiley Encyclopedia of Computer Science and Engineering*, vol. 5, ed. B.W. Wah (Hoboken: Wiley, 2009), 1860-1868.

2. The list of early non-American hobby microcomputers includes the MOD-8 (Microsystems International Ltd., Canada, 1974), the TK-80 (NEC, Japan, 1976), the MK-14 (Sinclair Research, U.K, 1978), the Telmac (Telmac, Finland, 1977).

3. Petri Saarikoski and Jaakko Suominen, "Computer Hobbyists and the Gaming Industry in Finland," *IEEE Annals of the History of Computing* 31, 3 (2009): 20-33; Petri Saarikoski, "Club Activity in the Early Phases of Microcomputing in Finland," *IFIP International Federation for Information Processing* 174 (2005): 277-287; Stachniak and Campbell, *Computing in Canada*; Hong-Hong Tinn, "The Making of the Do-It-Yourself Computers, Commercial Districts of Electronics Products, and the Popularization of Personal Computers: Exploring the History of Computers in Taiwan from 1970 to 2000," presented at the Society for the History of Technology meeting, Washington, October 2007; Leslie Haddon, "The Home Computer: the Making of Consumer Electronic," *Science as Culture* 1, 2 (1988): 7-51.

4. Saarikoski and Suominen, "Computer Hobbyists," 20.

hobby movement in Canada and its role in bringing computing into the homes of Canadians. TRACE history (1976-1985), as recorded in the club's newsletter, documents, and oral histories collected by the authors, offers a unique view of a vibrant Canadian hobbyists' movement interacting with the industry and society. The organizational history of TRACE reflects and demarcates the main phases in the development of personal computing. It points to the similarities between the Canadian and the American hobby movements as well as to their distinct features. It also reveals the challenges faced by the North American hobby movement in its struggle to continuously redefine itself and stay socially relevant, a battle which it ultimately lost in the late 1980s.

The Group of Ten

In 1970, Control Data Corporation (CDC)—one of the largest American mainframe computer manufacturers—created its new R&D division in Canada.[5] The Canadian Development Division of CDC was formed in Mississauga, Ontario, with the assistance of the Canadian government which, under the Programme for the Advancement of Industrial Technology, was looking for ways to establish domestic computer and microelectronics industries. The task of the new Canadian R&D division was to develop a range of computers from the ill-fated STAR-65 mainframe to the successful line of Cyber 170s. In late 1975, several employees of the CDC's Mississauga subsidiary began their informal after-work meetings to talk about advancements in microelectronics and the possibility of designing microprocessor-based devices, including small, rudimentary computers for personal use. The person who played the central role in bringing those hobby computer enthusiasts together and who felt most strongly about forming a hobbyists' club was Harold Melanson, an American software engineer. "I was employed by Control Data Corporation (on loan to Control Data Canada) developing supercomputer software," recollects Melanson:

> I was familiar with microprocessors both from the professional journals and the hobby magazines. I had always wanted to build my own computer, and was involved with building other digital projects as a hobby [...]. I knew a handful of people at work who had like interests, and thought that there must be others in the area who wanted to build micro[processor]-based systems. It seemed like a good idea to pool our knowledge, share parts sources, have swap meets, etc.[6]

5. For more information on CDC, see John N. Vardalas, *The Computer Revolution in Canada, Building National Technological Competence* (Cambridge, Mass.: The MIT Press, 2001).
6. Harold Melanson, private communication, June 2005.

The first meeting of the Toronto area microcomputer enthusiasts took place in Melanson's apartment on January 23, 1976. Due to a snowstorm, only ten people showed up; most of them would form the core of the computer club that was to become one of the most influential early hobby computer organizations in Canada. The first one-page bulletin prepared by Melanson tentatively named the group "The ? Microcomputer Group of Greater Toronto" and announced that the next meeting would take place on March 19 on the premises of Control Data manufacturing facility in Mississauga.[7] The election of the executive was scheduled for that meeting, followed by a tour of CDC's manufacturing facility and of a flea market where electronic components were to be sold, swapped or given away. At the April meeting, the group adopted its official name—the Toronto Region Association of Computer Enthusiasts, or TRACE.

The formation of TRACE was not an isolated event on the computer hobby scene of the mid 1970s. In fact, at the time of TRACE's first informal meetings the North American microcomputer hobby movement was about one year old. It was set into motion by the Mark-8 microcomputer project published by Jonathan Titus in the pages of *Radio-Electronics* (*RE*) in July 1974.[8] To Titus' surprise, his microcomputer construction project resonated strongly with the *RE*'s readers who not only bought additional Mark-8 construction booklets and actually began to build the computer (*RE* sold over 5,000 Mark-8 construction booklets) but also started to organize dedicated Mark-8 clubs and groups. One of those groups, the Mark-8 User Group started by Hal Singer in September 1974 in Lompoc CA, published the *Mark-8 Newsletter*—a popular early publication devoted to hobby computing, later renamed as the *Micro-8 Newsletter*.

Another hobby microcomputer was offered to the electronics enthusiasts half a year after the appearance of Titus' construction project. The January 1975 issue of *Popular Electronics* contained the first part of an article by Edward Roberts and William Yates describing the Altair 8800 microcomputer as the "World's First Minicomputer Kit to Rival Commercial Models..."[9] For just $395, Roberts' company Micro Instrumentation and Telemetry Systems (MITS) offered significantly more than a Mark-8-style construction project described in a booklet. The Altair 8800 was a real microcomputer in kit form designed around a new 8-bit microprocessor from Intel—the 8080. The kit also included power supply and an

7. *TRACE Newsletter*, published in Toronto between 1976 and 1985.
8. Jonathan Titus, "Build the MARK-8: Your Personal Minicomputer," *Radio-Electronics* 45, 7 (1974): 29-33.
9. Edward Roberts and William Yates, "Altair 8800 Minicomputer, Part I," *Popular Electronics* 7, 1 (1975): 33-38.

impressive-looking blue-and-gray metal enclosure. The Altair 8800 had a profound impact on the computer enthusiasts and quickly became their hardware icon. By the end of 1975, there were a number of microcomputer clubs all over the United States and some were also forming in Australia, Canada, and the U.K. Their activities were supported by good quality magazines (such as *Byte* or *People's Computer Co*.) and a growing number of microcomputer start-ups manufacturing products ranging from peripheral cards to fully assembled computers.

The Homebrew Computer Club (HCC) was one of the most influential early microcomputer clubs. Formed in San Francisco Bay Area in early March 1975, it shortly attracted a large number of computer enthusiasts. The early membership of HCC was diverse; it included computer novices as well as people with considerable hardware and software knowledge. Most of HCC's members were interested in microcomputers, many in building them, some in experimenting with them. There were also club members who regarded microcomputers as tools for social change, and cultural and educational advancement. Some of the members had their Altair 8800s or homebrew microcomputers built even before the club's first meeting.[10]

By contrast, the early members of TRACE were mostly computer professionals and people working in academia in various positions. However other enthusiasts of computing, of little or no expert computer knowledge, soon joined the club to build their first personal computers.

> [T]hey all shared that invisible bond which ties together members of any hobby. This bond is strengthened by the unique language they use. Words such as byte, bit, nibble, Kansas, ram, rom, floppy, and five volts were heard [during meetings] at regular intervals.[11]

Similarly to HCC, some people joined TRACE having already working microcomputers to their credit. For example, a young computer enthusiast and a high school student, Howard Franklin, built his microcomputer in 1974 by studying microcomputer literature published by Intel. His microcomputer is possibly the earliest hobby computer constructed in Canada and one of the elite few microcomputers designed in the early 1970s (fig. 1).[12]

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10. For more information on HCC see Levy, *Hackers*; Freiberger and Swaine, *Fire in the Valley*.

11. Gerry Wheeler, *TRACE Newsletter* 23 (1978): 5.

12 Franklin's microcomputer resides at York University Computer Museum, York University, Toronto.

Figure 1. Howard Franklin re-assembling his 1974 computer at his home in 2003.

Source: Photograph by Z. Stachniak.

TRACE members learned about microprocessor technology primarily from the technical literature and professional presentations by semiconductor companies. Some early members had an opportunity to learn about the advancements in the semiconductor industry from unique Canadian sources. Before its closure in early 1975, Microsystems International Ltd. (MIL) of Ottawa was one of the largest semiconductor companies manufacturing a range of semiconductor products including microprocessors. MIL's marketing program included technical presentations delivered

at corporations and universities. Walter Banks, an early TRACE member and a University of Waterloo employee, attended one such presentation at his university leaving it with promotional literature on MIL's semiconductor devices and the MOD-8 microcomputer (see figure 2). The MOD-8 was introduced by MIL in 1974. This computer, as well as its more able refinement—the MOD-80—were popular microcomputer 'starters' for hobbyists across North America. In fact another early TRACE member and a CDC employee Billy Pettit had an opportunity to experiment with a MOD-8 at work.

> We bought one [MOD-8] at CDC to look into using it to automate a remote terminal. But it didn't have the firepower we needed [...]. The MOD 8 sat around in the lab for years. I used to play with it after hours.[13]

The construction of the MIL MOD-8 and MOD-80 computers would become one of the main hardware objectives of TRACE in its first year of operation.

Some CDC engineers had learned about microprocessors and their potential for implementing central processing units of small and inexpensive computers from another unique Canadian source. Since the beginning of 1972, a Toronto-based company Micro Computer Machines (MCM) was developing its portable personal MCM/70 microcomputer. A prototype of the MCM/70 that employed the Intel 8008 microprocessor was demonstrated in public for the first time during the Fifth International APL Conference that took place in Toronto in May 1973.[14] The presentation attracted the attention of several CDC employees who participated in the event. In fact, later that year some of those employees joined MCM to work on the development of the MCM/70 and other products.[15] The MCM/70 computer was probably discussed informally at CDC especially because it operated under the APL programming language which was also an important software project at CDC. TRACE invited MCM to present its APL computers soon after the club's formation.

A Canadian Computer Club

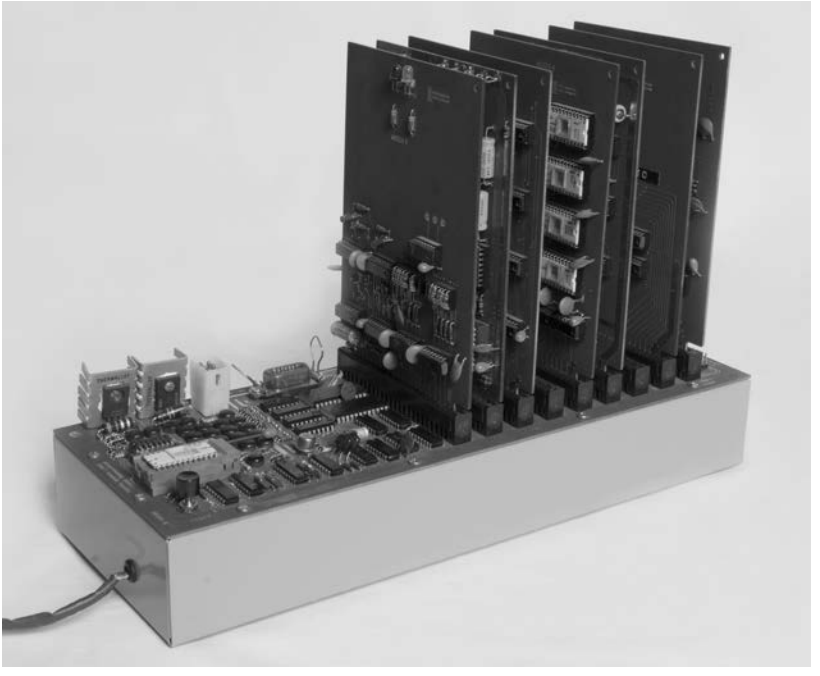
"The microcomputer hobby is alive and well in Canada, if the turnout at our March meeting is an indication," wrote Gifford Toole in the club's newsletter following the club's second meeting in 1976. Twenty eight people showed up for that meeting and took part in a tour of CDC's

13. Bill Pettit, private communication, January 2007.
14. Zbigniew Stachniak, "The Making of the MCM/70 Microcomputer," *IEEE Annals of the History of Computing* 25, 2 (2003): 62-75; Zbigniew Stachniak, *Inventing the PC: the MCM/70 Story* (Montreal: McGill-Queen's University Press, 2011).
15. Ibid.

manufacturing facilities. In the following months the membership was growing rapidly crossing the one hundred member mark by the end of the year.

TRACE hobbyists regarded their club as part of the global North American microcomputer movement rather than a distinct Canadian organization. Since June 1977, TRACE had been a member of the Midwest Affiliation of Computer Clubs; it exchanged newsletters with several American computer clubs, and its members regularly attended microcomputer events in the United States. However, specific local factors would affect some of TRACE's defining characteristics and in the process distinguished it from other North American computer clubs. One such characteristic was TRACE's focus of its early hardware activities on the Canadian-made MIL MOD-8 and MOD-80 microcomputers.[16] Another distinct feature of the club was on the software side; as no other club in North America, TRACE was following closely the APL programming language developments.

Figure 2. The MIL MOD-8 microcomputer.



Source: Courtesy York University Computer Museum.

16. The development of the MOD-8 and MOD-80 computers is described in Zbigniew Stachniak, "The MIL MF7114 Microprocessor," *IEEE Annals of the History of Computing* 32, 4 (2010): 48-58.

Both the MOD-8 and MOD-80 computers were well documented.[17] Their components were available from various sources including Space Circuits, a company located in Waterloo, Ontario, in close proximity to Toronto. Fully assembled MOD-8s and MOD-80s were also available from Moducomp Inc. of Brockville, On., Great Northern Computers of Ottawa, and MiniMicroMart located in Syracuse, NY. These computers were easy to build, expand, and experiment with. The first presentation of a fully functional MOD-8 to TRACE members took place in April 1976. In the same month, the MOD-8/80 special interest group (or SIG) was formed within TRACE and a group purchase of MOD-80 printed circuit boards was organized. Two months later there were thirteen fully functional MOD-8/80 systems, in comparison with ten Altair 8800s and just one IMSAI 8080 (both very popular early American microcomputers). The proximity to Space Circuits and prior experience with the MOD-8 hardware by some TRACE members played a role and so did MIL's marketing presentations in the early 1970s.

TRACE hobbyists did build the popular Mark-8s, Altair 8800s, and IMSAI 8080s as did their American counterparts. Furthermore, many hobbyists in the United States—including some at HCC—were experimenting with the MOD-8 and MOD-80 computers (In fact, the MIL MF8008 manual describing the Canadian MOD-8 computer was circulating during HCC's first meeting). However, these were the MIL-designed MOD-8 and MOD-80 computers, and not exclusively the American computers that introduced many early members of TRACE to microcomputing.

Regional computing landscapes directly affected the activities of other early Canadian microcomputer clubs as well. The Ottawa Computer Group (OCG) was a hardware-oriented club formed in the late 1976. In the early 1977, Jocelyn and Frank Tait—the co-owners of the Ottawa-based Tarot Electronics—offered a remake of Tarot's MIMIC microcomputer to the club. "We belonged to a hobby group in Ottawa," recollects Jocelyn Tait,

> and some of the members expressed an interest in the new microcomputers, so I worked up a kit and instructions so they could build their own (which is what they liked to do) if they cared to. Eventually we were taking a display case to every meeting and selling parts to them as well as delivering quantities of the kits.[18]

The Taits also helped with the debugging of MIMICs. For those who did not want to solder the MIMIC's components together, the Taits offered fully assembled computers enclosed in a slope-front metal case in

17. *GNC 8: Modular Micro Computer User's Manual* (Great Northern Computers Ltd.: 1975); *The MF8008 Applications Manual, Bulletin 80007* (Microsystems Systems International Ltd.: 1974); *MOD8 Manual and MOD80 Supplement* (Moducomp Inc.: 1975).
18. Jocelyn Tait, private communication, May 2002-March 2004.

blue and black. Over 200 MIMICs were sold to the hobbyists. "The MIMIC users shared their experiences and successes," recollects Tait "and I published hints on construction and debugging [in the club's *OCG Newsletter*]." Tarot Electronics MIMIC was also discussed during TRACE's July 14, 1977, meeting.

Another unique characteristic of TRACE was its involvement with the APL programming language. The language's fundamentals were conceived by a Canadian, Kenneth Iverson, in the early 1960s. APL was implemented at IBM and made available in 1968. By the early 1970s, the language was well-established and its fast growing popularity turned into a world-wide APL software movement. In Canada, the APL phenomenon resulted in several early implementations of APL for mainframe computers (such as York APL, 1969), the first implementation of APL on a microcomputer (the MCM/APL for the MCM/70 computer, 1973) and the early introduction of APL to universities.[19]

Several TRACE members had considerable APL expertise. One of the software projects at CDC's Development Division in Mississauga was the implementation of an APL interpreter for the Star-65 computer. A TRACE member William Kindree was one of the software engineers involved in this project. Other members' enthusiasm for APL stemmed from their professional programming experience with APL. In April 1976, TRACE APL enthusiasts formed the APL special interest group (or APL SIG). The following month, TRACE provided its members with an opportunity to glance at the MCM APL computers during a special MCM's presentation. TRACE APL SIG was looking for ways to use microcomputers to execute APL software from extensive libraries created for mainframe computers. This was a formidable task as APL required large amounts of memory. Toronto's MCM had to devise a sophisticated and expensive memory management system to have its microcomputers operate under APL.[20] It is unknown to what degree the TRACE APL SIG was successful in attaining its objectives.

By contrast, members of the Homebrew Computer Club were almost exclusively interested in the BASIC programming language developed by John Kemeny and Thomas Kurtz at Dartmouth College in the early 1960s. The language was popularized by MITS that equipped its Altair 8800 computers with a dialect of the language implemented by Microsoft's founders Bill Gates and Paul Allen. There were hobbyists outside TRACE interested in implementing at least a subset of APL on a

19. APL was introduced to the Universities of Waterloo and Alberta as well as to Queen's and York Universities in late 1960s.

20. Stachniak, *Inventing the PC: the MCM/70 Story*, 54-62.

microcomputer.[21] However, since APL required much more memory than BASIC and since computer memory was expensive, the cost of a microcomputer running APL—such as the Canadian MCM/70—was prohibitively high for most hobbyist and, realistically, BASIC was the only language that they could afford. Microsoft's BASIC could be executed on a computer with as little as 4Kbytes of memory. The connection between TRACE and the APL community continued into the early 1980s.

Organization of Hackers

TRACE's beginnings were typical of an early North-American computer hobby club. It was formed by hobbyists who wanted to build and operate their own personal computers. There were also those who joined the club and already had a working microcomputer kit or, as in the case of Howard Franklin, a homebrew computer. Microcomputers were what their hobby was all about and it was only natural that building them became the main early focus of TRACE activities. In just six months since the club's inception, TRACE hobbyists built 35 systems, mostly MOD-8s, MOD-80s, and the Altair 8800s. However, some embarked on the design of their own machines. "I'm going to design my own [computer], and build it from scratch—with a little help from my friends," wrote Phil Olynyk in February 1977 issue of *TRACE Newsletter*, "Which I feel is what TRACE is all about."

Soon, their hardware was operational and LED lights on the front panels of their computers were illuminating patterns corresponding to bytes of data and addresses stored in the computer's memory. The club had to evolve, but to find a formula defining the club's purpose and reflecting the expectations of its diverse membership was proving difficult. The majority of TRACE members did not see microcomputers only as world's greatest toys and the design of rudimentary hardware and software was never satisfactory to them. They wanted to explore the potential of microcomputers more fully. Indeed, the 1976 survey on topics of interest to the club's members revealed that the majority of TRACE hobbyists favored subjects such as computer graphics and advanced hardware and software. The subjects that scored the lowest on the survey were "getting a system together" and "what I do with my computer" (similar results were reported after the 1979 survey).

21. In September 1976, *Byte* magazine published an announcement of the formation of Microprocessor APL Enthusiasts club in Chicago, dedicated to APL; a month later the same magazine published Mark Arnold's article "What Is APL" aimed at demystifying the language for the hobby microcomputing community. Even Microsoft was developing its own APL language and interpreter since 1976. In the end, the Microsoft APL-80 was never released.

Among the top forms of club's activities, formal presentations and flea markets were the favorites, closely followed by manufacturers' talks which were frequent in the first years of the club's existence.[22] In spite of clear preferences articulated in the surveys, it was not evident how to turn them into the club's stated role as an organization. A discussion on the role and purpose of TRACE was initiated in October 1976, and soon thereafter a decision was made by the club's executive "to solidify TRACE as an organization and [...] as a communications medium for the benefit of computer hobbyists in this [Toronto] area."[23] Consequently, in November 1977 a constitution draft was presented to the club's members for discussion and approved in the following June. "The general purpose of TRACE shall be to promote and encourage community interest in hobby computing."[24] The term 'hobby computing' was not specified in the constitution but it was understood, informally, as a non-commercial activity concerned with building hardware, writing software, experimentation with, and sharing information about microcomputers. To many, however, TRACE was an organization for computer hacking—a type of activity that required working hard on laborious hardware or software projects. "I think [the term] 'hobbyist' connotes someone who's just passing time doing 'the thing' without a real goal and without intense motivation," comments Hew Fulko, TRACE's last president, "whereas a hacker is out there to improve either something or themselves—the 'works hard' part [of the definition of a hacker]." According to Fulko, TRACE members "were hackers in the proper definition of the term [...]. We were hackers [...] we built the future of personal computing. We were doing things that (relatively) few other people in the world were doing. Five thousand people world-wide [...] maybe ten thousand people world-wide."[25] Fulko's depiction of TRACE as an organization of hackers echoes Bob Kamins' views as expressed in his June 1982 "Real Hackers Don't Use IC's" editorial for the *TRACE Newsletter*: "If there is one thing distinguishing TRACE from many other computer clubs, it is the disproportionately large number of hackers among the members. Hackers will continue to make contributions [...] to the art of computing."[26]

Fulko's and Kamins' depiction of TRACE as an organization of hackers mentions neither hacker ethic nor the need for socio-political reforms that prominently feature in Steven Levy's analysis of the early computer

22. TRACE's program coordinators arranged presentations by companies such as Digital Equipment Corp., MCM, Volker-Craig, Intel, Mostek, Motorola, National Semiconductor, and IBM.
23. Gifford Toole, "Tracing," *TRACE Newsletter* 11 (1977): 2.
24. [s.a.], *TRACE Newsletter* 21 (1977): 4-5.
25. Hew Fulko, private communication, August 2007.
26. Bob Kamins, "Real Hackers don't use IC's," *TRACE Newsletter* 58 (1982): 1-2.

hacking activities given in his book *Hackers: Heroes of the Computer Revolution.* There is compelling evidence of continuous hacking activities at TRACE to support Fulko's and Kamins' point of view. Fulko himself 'hacked' a high-resolution graphics display with an embedded control co-processor. Using his system he was able to display high-resolution images produced, for instance, by the Tiros-N weather satellite (one of such images was reproduced on the cover of the August 1982 *TRACE Newsletter*). However, Fulko did not commercialize his display. On the other hand, Kamins did convert his hardware hacking experience into business when he started his HAL Computer firm in Toronto to manufacture IBM PC and XT compatible computers. And so did Joe Sutherland, whose company—J.L.S.—manufactured IBM PC, XT, and AT compatible computers, and another TRACE hacker Walter Banks who co-founded an electronics company Byte Craft in Waterloo in 1976. Howard Franklin's experimentations with microcomputer hardware culminated in 1977 with his design of a microcomputer-based voting system for the Borough of North York. The system consisted of individual voting stations and peripherals (such as clerk console, a printer, and display boards) connected to a control console. All operations of the voting system were under the control of a SOL PC microcomputer manufactured by Processor Technology. Franklin's system remained in use for several years.

Possibly the most successful among early TRACE hackers were Jim Butterfield and Peter Jennings. Between 1976 and 1977, Butterfield devoted his time to making the MOS Technology KIM-1 microcomputer more accessible to hobbyists. The result of his work was a popular book *The First Book of KIM* published in 1977 (fig. 3).[27] Later, Butterfield became a legendary promoter of Commodore products and prolific writer on the subject of microcomputing. His enthusiasm for the KIM-1 brought him and Peter Jennings together. In 1976 Jennings wrote Microchess—a chess playing program for the KIM-1 (fig. 4). The computer game became one of the most successful entertainment programs written for early home computers and launched Jennings' successful entrepreneurial career. In their article "The Quest to Build a Thinking Machine: A History of Computer Chess" Dag Spicer and Kirsten Tashev mention that "Microchess sold several million copies and demonstrated that there was an audience for early computer games [for microcomputers]. Interestingly, some of the early profits from Microchess were used by the Personal Software company (which had purchased Microchess from Jennings), to help finance the marketing of one of the first spreadsheet programs,

27. Jim Butterfield, Stan Ockers and Eric Rehnke, eds., *The First Book of KIM* (Argonne: ORB, 1977).

VisiCalc."[28] VisCalc, arguably the first "killer application" and one of the best selling software products in the early personal computer industry, was published in 1979. It was initially offered for the Apple II computer exclusively helping the young Apple Computer Inc., rooted in another hobby computer club, HCC, to establish itself as an early industry leader.

However, the image of TRACE as an organization of hackers was not universally shared by former club's members. In Jennings' opinion, "Judging by the number of [microcomputer] owners who got no further than making patterns on the LEDs, if they had a higher purpose, it was beyond their capability to realize it."[29] Jennings agrees that there were those at TRACE with considerable hacking drive and those who, like him, wanted to turn their passion for microcomputing into an entrepreneurial venture. But he also notes that there were those who never considered their hobby a business opportunity. "I don't think most of the others were thinking about products at all. Most of them [TRACE members] were consumers, not creators."

Fulko, Kamins, and Jennings paint a complex picture of TRACE that reflects their expectations of what the club could have accomplished. They recall hackers and consumers of microprocessor products. They mention those who, like Jim Butterfield, were very curious about the new microcomputer technologies and applications. They finally talk about future entrepreneurs, like Jennings himself or Jocelyn and Frank Tait, who were not hobbyists at all but microcomputer enthusiasts attending clubs' meetings to mix and network with people sharing similar interests.

Interfacing with Community

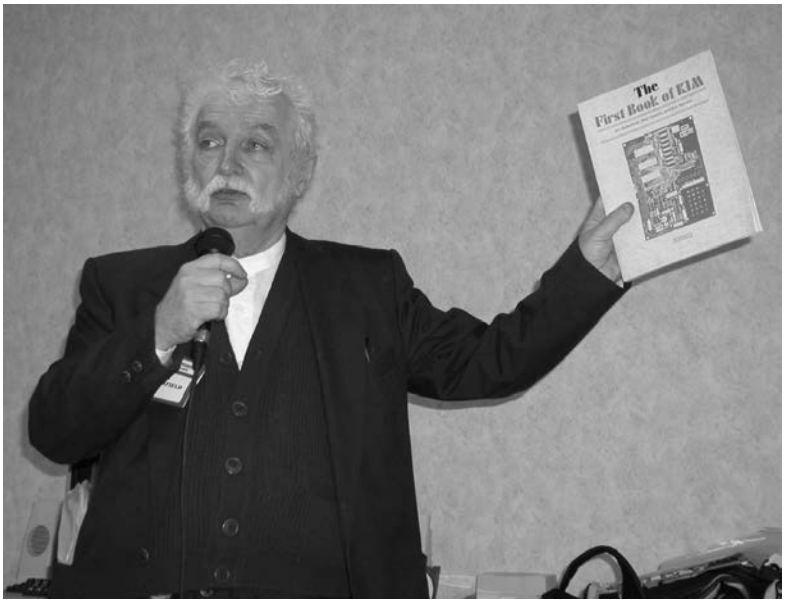
In the 1970s, computer hobbyists considered their movement as the main channel by which the society would gain knowledge about computing and, eventually, accept microcomputers as useful personal tools. Until the arrival of the first wave of commercial home and personal computers from large manufacturers such as Commodore, Atari, and Tandy in 1977 and 1978, that was indeed the case: hobby computing's versatile infrastructure that included clubs and groups, microcomputer events and programs, dedicated microcomputer magazines and stores, offered comprehensive information about microcomputing to the general public.[30]

28. Dag Spicer and Kirsten Tashev, "The Quest to Build a Thinking Machine: A History of Computer Chess," *Core* 5, 1 (2006): 3-12 (magazine of the Computer History Museum, available online at http://www.computerhistory.org/core/backissues/pdf/core_5_1.pdf, accessed on September 30, 2011).

29. Peter Jennings, private communication, December 2008.

30. See, for instance, Fresiberger and Swaine, *Fire in the Valley*, and Steve Dietlea, ed., *Digital Deli* (New York: Workman Publishing, 1984).

Figure 3. Jim Butterfield shows his The First Book of Kim *during his 2005 lecture at York University.*



Source: Photograph by Z. Stachniak.

Figure 4. Peter Jennings demonstrates his Microchess program during the 5th Vintage Computer Festival, Mountain View, California, 2003.

Source: Photograph by Z. Stachniak.

Judging by the high attendance numbers recorded during the Canadian Computer Show and Conference in the second half of the 1970s,[31] Canadians were ready to take a closer look at microcomputers as soon as those were brought out of the clubs and basements into the open. TRACE participation in the Canadian Computer Show and Conference events as well as organization of microcomputer exhibits and shows provide examples of information transfer from Canadian computer clubs to the general public that was occurring in the late 1970s and early 1980s.

The first public event organized by TRACE was not, in fact, the club's initiative at all. It was Toronto's Ontario Science Center (OSC) proposal to mount a microcomputer exhibit during the International Federation for Information Processing (IFIP) meeting hosted by OSC on August 8-12, 1977. For TRACE, the OSC's invitation was a unique opportunity to showcase microcomputing in front of a large audience of computer professionals and general public visiting OSC. It was also an opportunity to test the organization's readiness and maturity to organize outreach programs. Both Butterfield and Jennings offered to help.

The OSC microcomputer exhibit opened on August 1 and presented a range of systems and their applications (from computer games to microcomputer-controlled model railroad controller). Unfortunately, the very successful microcomputer exhibit mounted by TRACE was not matched by equally stimulating lectures on microcomputing during the IFIP's sessions. TRACE OSC exhibit was followed by another presentation during the 1977 Canadian Computer Show and Conference that took place in Mississauga, Ontario, in early November. The organizers offered exhibit booths to several Canadian computer clubs including TRACE, the Kitchener-Waterloo Microcomputer Club, and the Ottawa Computer Group. Under *The First Canadian Personal Computing Showplace* banner, the clubs as well as local suppliers of microcomputer products showcased the age of microcomputer by exhibiting hobby, personal, and business computers. The exhibitors demonstrated to an estimated thirteen thousand visitors a variety of microcomputers from those built by the hobbyists to those offered by small and well-established companies such as Technical Design Labs (Xitan computers), Vector Graphics (Vector 1), Commodore (PET 2001 and KIM-1 computers), Heath Data Systems (H8 and H11 computers), and Tandy (TRS-80 model 1 home computer).

The success of the 1977 microcomputer exhibit at the OSC, allowed TRACE to exhibit there again in the following two years. Reporting on

31. Canadian Computer Show and Conference was a prime Canadian computer event organized annually by the Canadian Information Processing Society since 1969. The attendance at the 1977 Canadian Computer Show and Conference was estimated at 13,000. Gifford Toole, "Tracing," *TRACE Newsletter* 21 (1977): 1. According to Business.ca, 26 November 1999, there were 12,400 visitors during the 9th edition of the event in 1978.

the overnight preparations for the 1978 exhibit, Ross Cooling wrote in *TRACE Newsletter* about the public's high anticipation of the event: "You could tell the public knew what was happening—we had hard time holding them back that night."[32] The 1978 Canadian Computer Show did not have a personal computer track, as in the previous year, but an exhibit booth was reserved for TRACE and the club could, once again, promote microcomputers to over 12,000 visitors.

The biggest event put together by TRACE was the Computerfest that took place at Toronto's Harbourfront on July 8-10, 1983. The Computerfest was an annual event sponsored by Midwest Affiliation of Computer Clubs (MACC) to promote microcomputers and their use in society. In 1982, TRACE formed the Computerfest committee (chaired by Greg Louis) and competed successfully against other MACC clubs for the privilege of hosting Computerfest'83 on behalf of MACC. TRACE Computerfest'83 took place under the slogan "computers are fun!" It aimed at attracting both the hobbyists as well as the general public (fig. 5). The registration fees were set low to encourage high participation. The three-day event was well attended and its program included microcomputer seminars, workshops for children, films, demonstrations, and exhibits on a wide variety of software- and hardware-related topics prepared by computer clubs as well as vendors of computer equipment. A flea-market and public domain software swaps completed the program.

Figure 5. Lining up for tickets at Computerfest'83.

Source: Photographer unknown. Courtesy York University Computer Museum.

32. Ross Cooling, "Tracing," *TRACE Newsletter* 29 (1978): 1.

TRACE Computerfest was a successful event due, in large part, to an army of volunteers who helped with the preparations and running of the festival. But the event also demonstrated that by the early 1980s, the effective promotion and delivery of large scale computer literacy programs by computer hobby organizations such as TRACE required expertise and resources that the clubs did not and would not have. The opening of the Harbourfront Computer Center just two months later (and in approximately the same location as Computerfest'83) was clear evidence that many aspects of microcomputing were now out of the hobbyists' hands. The Center was opened on September 19, 1983, at Queen's Quay Terminal as "A place where you, your grandmother, your three-year-old child or your brother can come and learn on and learn about computers."[33] It was co-founded by the federal and Ontario governments, had 30 full time positions, and supported its programs with 60 computers. It was well-positioned to deliver high-quality computer literacy programs.

By contrast, TRACE was never an organization of educators and the club was never focused on external, 'after-club' activities aimed at sharing the enthusiasm of its members for microcomputing with the rest of society. Although the promotion and encouragement of community interests in hobby computing was explicitly stated as an objective in the club's constitution, it was only sporadically discussed on the pages of *TRACE Newsletter*. In October 1982, Kamins had to remind the readers that

> One of the reasons for our existence as a club is to help educate those less fortunate than ourselves, who have not yet had any personal contact with computers [...]. As experienced computerists, it is our responsibility to promote any action that will help to bring people closer to the blissful state of computer literacy [...]. We should endorse any program that will assist in attaining this goal.[34]

In the end, TRACE did contribute its fair share to the process of the social acceptance of personal computing. It had also found its voice to represent the hobby movement in Ontario and speak on its behalf. The much improved newsletter published by the club between 1982 and 1984 provided comprehensive information on computer stores, shows, meetings, and other events. While there had never been a significant discussion on the pages of *TRACE Newsletter* about the role of computer clubs in society, the newsletter offered its pages to promote activities of other computer clubs in the region.[35]

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33. "Announcing the Harbourfront Computer Center," *TRACE Newsletter* 65 (1983): 15.
34. Bob Kamins, "From the Editor," *TRACE Newsletter* 61 (1982): 5.
35. Only in November 1982, the following clubs advertised their meetings in *TRACE Newsletter*: Apple-Can, TMUG, TPUG, Toronto Osborne Users Group, Sorcerer Users' Group (Toronto), Toronto Wizardry Interest Group, FIG-FORTH Chapter, THUG, Forth Interest Group, Osborne Users' Group, IBM PC Users' Group of Toronto, and the Toronto Ohio Scientific Idea Exchange.

Wheels are Turning Too Fast and in Too Many Directions

Since the introduction of the first microprocessors into the market in the early 1970s, the commercial segment of microcomputing, as represented by companies such as General Automation, Intel, MCM, and the French Réalisations et Études Électroniques, had been developing independently of the hobbyists' movement.[36] However, until the arrival of the home microcomputer in the late 1970s, it was the hobbyists, and not the commercial microcomputer or consumer electronics industries, who almost exclusively disseminated the microcomputer knowledge in society. By the end of the 1970s, this situation had begun to change rapidly due, in large part, to the introduction of a new consumer electronics gadget—the home computer. By the early 1980s, the consumer electronics market was full of inexpensive computers for home and schools manufactured by companies such as Apple Computer, Atari, Commodore, Texas Instruments, and Tandy. Home computers were being sold fully assembled and supported with ever growing libraries of software and manufacturer's warranties. They were readily available from large department stores or, as in the case of Tandy, from dedicated retail centers. For the first time in the computer industry's history, some manufacturers sold over a million computers in a single year.[37] With these new offerings came dedicated commercial magazines and other publications. In parallel to home computing, the desktop computer market had started to attract considerable attention since the introduction of the IBM *Personal Computer* in August 1981. Soon afterwards the first user groups focused on a specific company or even on a microcomputer model started to form.[38]

All these developments had a profound effect on general-purpose computer clubs such as TRACE and HCC. Already by the end of the 1970s, the clubs were facing one of the biggest challenges in their short existence. They were becoming increasingly diverse. By mid 1978 the vast number of microcomputers owned by TRACE members were mostly software and hardware incompatible. A hardware survey conducted by TRACE in October 1982 showed that 11% of all computers owned by the club members were manufactured by Apple Computer, another 11% by Digital Research, 7% by Heath, Commodore, and Ithaca Audio each, and the rest were homebrew ones built around a large variety of microprocessors. In addition to the hardware incompatibility issues, many members of

36. See Stachniak, "Microcomputers," in *Wiley Encyclopedia* and Stachniak, "The Making of the MCM/70 Microcomputer."
37. In 1983, Commodore sold over one million of its VIC-20 home computers. This figure is quoted, for instance, in Leslie Wood's "History of Commodore," in *The Best of the Torped Plus More for the Commodore 64 and VIC-20*, ed. Bruce Beach (Toronto: Torped, 1984): 4-7.
38. Josh Martin, "Computer User Groups," in *Digital Deli*, 72-73.

computer clubs across North America were beginning to turn away from building their own hardware from individual components and focusing instead on fully-assembled home computers. This hardware and software diversification as well as the growing gap between the objectives and expectations of individual members was making it difficult to simultaneously satisfy the needs of most of the members of a general purpose computer club. "How can the club help us all enjoy our hobby more?" asked Bill Dunkan in his article "This is our club and our hobby" published in the December 1978 issue of *TRACE Newsletter.* The article was intended to initiate a discussion on the role of a general purpose computer club in the computer hobby movement.

But to reprogram TRACE's activities so as to capture the attention of most of its membership was not an easy task. The club has been brought about by electronics hobbyists whose main objective had been the construction of a hobby microcomputer for the purpose of self-education and experimentation. TRACE had been formed not because its early members had no access to high-performance computers but because they had been searching for ways to express their hobby interests and because it had been easier to fulfill their hobby interests in an organized form such as a club. However, in the new home and desktop computer reality of the early 1980s, those aspirations were no longer valid as many members were turning away from the homebrew hardware in favor of assembled computers bought in computer stores. While in the mid 1970s, a computer hobbyist could construct his or her own computer from the ground up by using state-of-the-art components, just five years later this task could only be performed by the most knowledgeable hackers. In the March 1980 issue of *TRACE Newsletter*, Paul Cooling wrote: "The introduction of sixteen bit microprocessors this past year such as the Intel 8086 and the Zilog Z8000, and the Motorola 68000 this year, are making it difficult for the home hobbyist to build a simple system." Buying a fully-assembled and tested computer in a store was simply the only option for many hobbyists to operate state-of-the-art hardware. "Today a person can go into a Computer Store and purchase a computer [...] with all the software he or she would ever want to use, excluding games," continued Cooling in Summer 1981 editorial for *TRACE Newsletter*. That's why "The need of a computer club to help people get their systems going is almost noexistent [sic]."

Another challenge to social relevance of the early general-purpose computer clubs was the rapidly developing commercial home and desktop computer markets. Computer clubs of a new type—dedicated to

specific manufacturers—were mushrooming all over the North America.[39] These new clubs were eroding membership from older general-purpose clubs at an alarming rate. For TRACE, this diminishing membership, in addition to other factors, almost resulted in its closure in early 1982.[40] When only a few members showed up for the January meeting and none of them was willing to assume responsibilities for the club's operations, a motion was put forward to discontinue TRACE as a formal organization. At the same time, the Toronto PET Users Group formed in 1978 and dedicated to Commodore microcomputer products was about 15,000 member strong and was the largest Commodore-oriented user group in the world. Fortunately for TRACE, the motion to discontinue its activities was defeated. A new and energetic executive took over and, in a short period, the club staged a spectacular comeback.

To stop the membership erosion, TRACE, like other general-purpose clubs, was in need of knowledgeable volunteers who would reorganize the club and keep their members active and informed. "Volunteers are the life blood of an organization like TRACE. If you don't work, TRACE won't work," wrote Kamins in the February 1982 issue of *TRACE Newsletter*, in his rather desperate attempt to enlarge TRACE's volunteer base. His plea seemed to work. The attendance at the meetings picked up again through 1982 (reaching the old levels of over 100 paid members) and the elections were held bringing a new and dedicated executive in which Fulko was the president and Kamins the *TRACE Newsletter*'s editor. The renewed TRACE offered high-profile presentations to its members[41] and improved the quality of the club's newsletter which, for a brief period, was commercially sold in Toronto. New clubs and computer stores found *TRACE Newsletter* a convenient place to advertise their services.

By 1985, TRACE found itself in the middle of a rich and diverse microcomputing environment. It was evident that the activity that had been powering TRACE for almost a decade—microcomputer hacking—was at its end. The development costs of state-of-the-art hardware and software products became prohibitively high for a hacker. The success of the IBM

39. A partial list of such clubs formed in Canada between 1975 and 1985 can be found in Stachniak and Campbell, *Computing in Canada*, 63.

40. In the early 1980s, several early members of TRACE were dedicating less time to their club due to their extensive professional commitments. In his book *Hackers*, Steven Levy makes a similar observation regarding HCC on page 276. "Homebrew still drew hundreds to its meetings… [but] It no longer was essential to go to meetings. Many people involved in companies like Apple, Processor Tech, and Cromemco were too busy. And the companies themselves provided the communities around which to share information."

41. In 1982, TRACE meetings featured, among other presentations, talks on LOGO programming language, on the development of SPAR Aerospace Shuttle Craft Manipulator Arm, and on Canada's Telidon videotex system.

personal computer in the marketplace, followed by its informal acceptance as the industry standard for a business desktop computer, shifted the attention of many hackers to the IBM microcomputer hardware and software products and to new business opportunities created by the IBM PC clone vast market. Furthermore, many computer literacy programs and large-scale computer events such as exhibits, shows, festivals and conferences, were being organized across Canada by educational institutions, dedicated organizations and companies with a substantial financial backing and expert knowledge. For all these reasons, in the mid 1980s, people just stopped coming to the TRACE meetings, to the meetings of the Homebrew Computer Club, and to the Ottawa Computer Group.

Conclusions

The microcomputer hobby movement in Canada began soon after the first computer clubs and groups had been formed in the United States. It constituted a part of the larger North American movement, going through similar phases of the microcomputing's development while retaining its separate regional character.

In their *Fire in The Valley: The Making of the Personal Computer*, Paul Freiberger and Michael Swaine placed TRACE among the early clubs that fueled the rapidly spreading 'wildfire' of hobby computer movement. They stressed the role of *TRACE Newsletter*. In this paper we show that TRACE history also reflects the main developmental phases of the movement that lead from early hardware design activities almost exclusively confined to computer clubs, to social acceptance of the personal computer as exemplified by the rapid growth of home and personal computer industries since the late 1970s.

By the mid 1980s, TRACE and several other early general-purpose North American clubs wound down their operations but not before sowing the seeds of enthusiasm for personal computers into society at large and bequeathing their legacy to the new generation of microcomputer users. The decade-long microcomputer hobby movement left a rich landscape of organized computer activities: computer groups and clubs, shows and stores, computer publications and bulletin board systems (BBSs).[42] In the 1980s, the new generation of computer enthusiasts stepped forward to drive microcomputing. These young computer enthusiasts began forming vibrant computer gaming, music, and multimedia subcultures frequently supporting the computational needs of their

42. See, for instance, Fresiberger and Swaine, *Fire in the Valley*; Stan Veit, "Computer Magazine Madness," in *Digital Deli*, 66-69; Stan Veit, *Stan Veit's History of the Personal Computer* (Asheville: WorldComm, 1993).

communities. In 1982, the Ottawa-based NABU Manufacturing Corporation recruited a number of Ottawa area high-school students who worked as student instructors at a computer camp organized by the Ottawa Board of Education. Since 1981, NABU Manufacturing had been developing its NABU Network concept—home personal microcomputers linked to cable television networks supplying a constant stream of application programs and services. NABU was aiming at family oriented network and those young computer enthusiasts running the 1982 Ottawa Board of Education computer camp understood the audience targeted by NABU well.[43] Hired on a part-time basis to work in NABU's Games Department under supervision of senior programmers, they were soon expressing their vision of family-oriented digital entertainment by creating their own content.[44]

Similar transformations of the computer hobbyist culture, from the computer hacker club-based movement of the 1970s to new forms of digital interaction and expression that emerged in the 1980s, were taking place in several other regions of the world. Our full understanding of these changes, still woefully inadequate in the current state of research on the history of microcomputing, is much needed to uncover all the pivotal factors that contributed to the rise of personal computing in the last century.

43. According to Leo Binkowski, one of the high school students hired by NABU, "Chris Wallace [NABU recruiter and, later, director of Games Department] thought it would be a good idea to hire high school students because he figured that we were the audience. In hindsight, he was right." Leo Binkowski, private communication, September-November 2009.
44. Some of these games were available outside of the NABU Network. In 1983, NABU released Mania, a game written by a young programmer George Gallagher. The game was popularized by ASCII Corporation that released it as *Heli Tank* for its popular MSX game console (under the license from NABU).