Roberto Dillon

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A Commodore 64 Retrospective

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To all my school friends with whom I shared the early passion for 8-bit computers, in particular:
Alberto Baratta, Francesco Gambaro, Andrea Lombardo, Matteo Lunardi, Silvio Morando, Mario Oneto, Marco Sardi and in memoriam of Lorenzo Borghetto (1973–2002)

Foreword

How Commodore Opened the Floodgates to Home Computing

Today, as most of us use smartphones and other devices that are genius-levels smarter than the first home computers, we tend to forget where home computing got started.

In this excellent, well-researched and entertainingly written book, Roberto Dillon tells the story of how the Commodore 64 (and its predecessor, the Commodore VIC-20) jump-started the home computer revolution. You will learn how home computing got its start, and gain new perspectives on the home computer revolution that opened the floodgates to the remarkable computing technologies and apps we are benefiting from today.

Roberto's experience receiving his first home computer—a Commodore 64—at the age of 10 is a story that was repeated all over the world in the 1980s. Tens of millions of people, mostly in the U.S. and Europe, were introduced to home computing by Commodore, thanks to company founder Jack Tramiel and a brilliant team of innovative engineers and marketers who unleashed the home computer revolution. I was privileged to play a role in the design and launch of those first home computers and I have to say that I am impressed by the scope and insights presented in this terrific book by Professor Dillon.

Roberto describes how the Commodore 64 jump-started the home computer revolution. From the unique and inventive architecture of the computer itself, to creative marketing (using William Shatner as Commodore's spokesman), to the thousands of applications developed by an enthusiastic user community, Roberto gives Commodore its rightful place in the history of home computing. He draws a direct line from the C64 to many of the technologies and apps we take for granted today, from video games and telecomputing to early applications that spawned the Internet.

He also gives much-deserved credit to the engineers and marketers who developed this remarkable pioneering computer, and to Jack Tramiel, the visionary who wanted to design computers "for the masses, not the classes."

I was fortunate to play a role in the development of the Commodore VIC-20 and Commodore 64, and I can attest to the electric, innovative environment that existed in the company. We were conscious that what we were doing could change the world. Today, I still receive emails from people around the world expressing their gratitude and describing how their first Commodore computer transformed their lives.

In the early 1980s, everyone was asking, "Where's the home computer revolution? When does it start?" Businesses used minicomputers and mainframes. Most schools could not afford computers for their students. Then Commodore computers came along with sleek, Porsche-inspired designs, affordable prices, and the power needed to drive practical applications like wordprocessing and spreadsheets, that we all take for granted now.

When we were developing the first home computers, there were no cellphones or wireless networks because the wireless infrastructure did not exist. Commodore's plug-in modem, which I co-designed, and the Commodore Information Network which I established on CompuServe, were among the first telecomputing networks, an early precursor to Internet communities.

Making home computers affordable was a huge achievement. Suddenly, for a few hundred dollars, anyone could use powerful apps that were previously available on minicomputers and mainframes only. Hobbyists could write their own software programs. Commodore computers quickly found their way into classrooms—even kindergartens—where the first generation of students were introduced to computing.

These achievements occurred more than 30 years ago but they are not forgotten. As Roberto observes, Commodore today is not an artefact, but a living, dynamic technological heirloom that has found a home among retrocomputing enthusiasts and collectors of computer memorabilia. The Commodore 64 is on display in many museums around the world while dozens of retrocomputing clubs keep alive the "Commodore spirit" by restoring and maintaining original computers, celebrating the achievements by the talented and dedicated people who launched the home computer revolution.

It is extremely gratifying to see that the Commodore spirit is alive and well, and new "Commodorians" are continuing the tradition of innovation that we began, so many years ago.

Michael Tomczyk
Home Computer Pioneer
Innovator in Residence, Villanova University

Acknowledgments

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Last, but clearly not least, special thanks also to all the C64 hobbysts, programmers and hackers around the world who managed to keep our shared passion alive for all these years, with a special mention to the Lemon64 community for the inspiring and insightful discussions on its forum!

Contents

1 Computers for the Masses, not the Classes 1

2 The Commodore 64 and Its Architecture 9
2.1 The VIC-II 13
2.2 The SID 14

3 Ready 17

4 Games, Games and More Games! 27
4.1 Action Adventures 28
4.2 Adventures 33
4.3 Arcade Conversions 39
4.4 Driving Games 43
4.5 Edutainment 46
4.6 Movie Tie-ins 49
4.7 Platformers 54
4.8 Puzzles 58
4.9 Role Playing Games 63
4.10 Shoot ‘em Ups 68
4.11 Sports 73
4.12 Strategy 77
4.13 Virtual Life 80
4.14 3D: Vectors and Polygons 82

5 Rise of the Game Engines 87
5.1 The Quill—Adventure Writer (Gilsoft 1983) 88
5.2 The Graphic Adventure Creator (Incentive Software 1986) 88
5.3 Adventure Construction Set (Electronic Arts 1984) 90
5.4 Garry Kitchen’s Game Maker (Activision 1985) 92
5.5 The Shoot ‘em Up Construction Kit (Sensible Software 1987) 94
5.6 A SEUCK Primer 95

6 Windows and Icons 105

7 BBS: The Internet Can Wait 109

8 Verba Volant, Scripta Manent 113

9 Today and Tomorrow 121

Appendix A: Collecting for the Commodore 64 129

Appendix B: Online Resources 143

Appendix C: VIC-II Registers 145

Appendix D: SID Registers 147

Bibliography 151

Index 153

About the Author

Roberto Dillon originally from Genoa, Italy, but currently based in Singapore, Dr. Roberto Dillon is active both as a developer and as a professor of game design.

As an academic and educator, Roberto was the Game Design Department Chair at DigiPen Institute of Technology Singapore, with several of his students gaining top honors at the Independent Game Festival (IGF) both in San Francisco and Shanghai, and is now an Associate Professor lecturing Game Design in James Cook University, where he is also the Curator of the 'JCU Museum of Video and Computer Games', the first museum completely dedicated to the preservation of video games in South-East Asia. As a developer, on the other hand, his games have been showcased at events like Sense of Wonder Night in Tokyo, FILE Games in Rio de Janeiro and at the Indie Prize Showcase Asia, besides reaching top positions on Apple's AppStore across several countries.

Roberto is a regular speaker at game related conferences worldwide and wrote different books for AKPeters and CRC Press: 'On the Way to Fun', where he introduced the 6–11 Framework, a game design methodology now referenced in several university curricula as well as used by game designers in small and big studios alike, 'The Golden Age of Videogames', a history of the gaming industry from its origins till the PlayStation launch and 'HTML5 Game Development from the Ground Up with Construct 2' to introduce aspiring developers to the world of game making.

"Ready: A Commodore 64 Retrospective", published by Springer, is his latest work on the history of home computing and its impact on modern society.

Introduction

It was a rainy day in late November 1981 when I, a young eight-year-old boy, followed my parents who were invited for dinner by one of my dad's colleagues and mentors, Prof. Augusto Gamba (1923–1996), for an evening that, unknowing to all of us, was going to set the future direction of my life.

Professor Gamba, a distinguished theoretical physicist author not only of influential scientific works but also of brilliant educational books, had just got a new computer from the US, a TI-99/4A, and was willing to show us this little new technological marvel. Needless to say, I have no memory at all of what was on the dining table that evening: all my attention, in fact, was quickly grabbed by the home computer and the programs Prof. Gamba showed us. On the way back home I was holding tight in my tiny hands a roll of paper with abstract geometrical patterns printed on the TI's plotter: I remember staring at them in wonder for a long time and I couldn't really sleep well that night. I was too excited: in those drawings, in those sounds and images coming from the computer monitor, I actually saw my own future and knew that computers were going to play a fundamental role in my life.

As you can imagine, it did not take long before I started bugging my dad to bring a computer home. Finally, for my tenth birthday in 1983, we went to a nearby electronics shop and got back home with a computer that had just been released in Italy: the Commodore 64. This was the beginning of my lifelong learning journey with technology and programming: I started learning BASIC to develop my own games, first with the help of my dad and then on my own. These were simple arcade style games or text adventures with rudimentary graphics that only my closest friends ever played or pretended to care about. Nonetheless, the die was cast and the rest, so to say, is history.

Those pioneering years were a truly magical and revolutionary time. I have no doubt that the "Computer Revolution" that happened across the decade spanning the late 1970s till the late 1980s, with computers getting into the homes of millions worldwide, will be regarded in the history of mankind with the same importance, if not even more, as the Industrial Revolution of the nineteenth century. It was something that changed the world and I consider myself very lucky for having lived at such a time.

Among all the different home computers, the Commodore 64 holds a special place in the hearts of many, being the best selling model of all time. This book aims at discussing both its origins and the characteristics that made it so special and successful. Most importantly, it aims at discussing and analysing the different ways it affected the rise and popularity of home computers, together with the related game industry. In fact, not only innovative, genre defining games were born or became popular on this platform but also user friendly development tools, like the first generation of what was going to be later called "game engines", were made widely available to the general public. These programs allowed a generation of passionate kids to easily experiment with their ideas, learning the ropes of game design and possibly seek fame and fortune, paving the way for modern "indie" (independent) game developers and corresponding gaming culture.

Nonetheless, focusing exclusively on games would be reductive as the C64 influence on modern technology runs much deeper: affordable GUI-based Operating Systems and new modems, bringing many people online for the first time, were also fundamental to the growth and acceptance of computers as must-have home appliances. These are discussed here as well to better appreciate the overall impact Commodore in general and the C64 in particular had.

Overall, whether you are a C64 original user like myself or a much younger enthusiast who wants to learn about the origins of our modern computer-driven society, I am confident you will find something interesting and new here. Either way, if reading this book will bring back good old memories or spawn the curiosity for digging deeper into the subject, my mission would be accomplished and the long hours passed in writing this book would have been worth every minute.

Singapore, August 2014 Roberto Dillon

Chapter 1
Computers for the Masses, not the Classes

Abstract This chapter discusses the origins of Commodore under the helm of Jack Tramiel and the events that followed MOS acquisition, from the release of the PET to the idea of providing "computers for the masses, not the classes" which led to the VIC-20 and, ultimately, the C64.

Keywords JackTramiel · Commodore · MOS · 6502 · KIM-1 · PET · VIC-20

A lot has been written about Jack Tramiel (1928–2012) and, undoubtedly, much more is yet to be written about a self made business man with an iron fist who managed to build an empire and ignite a technological revolution out of nothing.

Born in Lodz, Poland, as Idek Tramielski (or Jacek Trzmiel, according to different sources) he emigrated to the USA after surviving the horrors of Nazi's concentration camps in Auschwitz during World War II. In 1952, after learning how to repair office equipment while serving in the US Army, he started out his own small typewriter repair shop in the Bronx, New York, while also working as a taxi driver. Then, in 1954 he founded the "Commodore Portable Typewriter Company" and moved to Toronto, Canada, to assemble and sell typewriters imported from Eastern Europe, something that wasn't legally possible in the US during those cold-war years. The company was then renamed to "Commodore Business Machines" (CBM) when formally incorporated in 1955.

However, in 1966 the pressure from cheaply imported Japanese typewriters, together with a financial scandal, almost put CBM out of business and only the intervention of a Canadian investor named Irving Gould (1919–2004) managed to keep the company afloat. Gould bought 17 % of the shares, becoming Commodore's Chairman. Under his influence the company shifted focus from typewriters to calculators, moving back to the USA in 1968 with a new headquarter in California.

Unfortunately, savage competition and price wars led once again by Japanese calculator manufacturers as well as Texas Instruments, brought Commodore on its knees in the mid 70s.

It was at this critical time, in 1976, that Jack made one of the most significant business decisions of the century, asking Gould to finance the acquisition of MOS

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Technology with a $3 million investment that enabled Commodore to implement its own "vertical integration" strategy, i.e. build as many components as possible for its own products in-house, without relying on external vendors.

At the time, MOS was a relatively small semiconductor and chip manufacturer that, thanks to the genius of Chuck Peddle (1937) and a team (1937) and a team of extremely bright engineers who had previously worked together on the first 6800 Motorola CPU, had just released a new microprocessor: the 6502. The new CPU was designed to be as flexible as possible to suit applications for a multitude of devices and home appliances and was revolutionary in many respects, including its price: at a time when Motorola and Intel were selling their 6800 and 8080 CPUs respectively for a few hundred dollars apiece, the 6502 was available for $25 only! This astonishing feat was made possible also thanks to a unique manufacturing process in place at MOS that allowed for producing chips with a much higher success rate: in those pioneering days, in fact, up to 70 % of manufactured chips at Motorola and Intel were defective and had to be thrown away, rising the final costs for the good ones left.

Anyway, to capture people's attention and show the 6502 wasn't a toy, like some people suspected at first due to its ridiculously low price, Peddle and his team also went on to design a dedicated computer based on it, the KIM-1 (short for "Keyboard Input Monitor", see Fig. 1.1).

Although the KIM-1 was a very simple computer with only a 1 KB RAM, it managed to offer very handy features like saving programs to a tape device. This, together with an extensive documentation, made it relatively user friendly (for the time) and made the computer a perfect tinkering machine for the new, burgeoning group of computer hobbyists and hackers, enabling them to experiment freely and learn how to use the new tool.

MOS started selling the KIM-1 towards the end of 1975 and, despite its essential simplicity, it deserves a very important place in history since it was the world's first single board microcomputer: like later home computers, all main components were mounted on a single motherboard. This was something quite revolutionary at the time if we consider that all other contemporary microcomputers, like the Altair 8800 (Fig. 1.2), were designed instead as a set of interconnected boards, each hosting components dedicated to specific tasks, like memory, CPU, I/O interfaces etc.

Commodore and MOS were a perfect match and, under the influence of Peddle, Jack soon agreed Jack soon agreed to start diversifying Commodore's portfolio, progressively reducing its involvement in calculators and moving into fully fledged computers instead.

The first fruit of this new focus was the PET (Fig. 1.3), short for "Personal Electronic Transactor", just a made-up name to justify the cute acronym. The PET was the first all-in-one personal computer integrating keyboard, monitor and cassette recorder for storing and loading programs.

The PET was first publicly presented in January 1977 at the Winter Consumer Electronics Show (CES) and later at the West Coast Computer Faire, where also Steve Jobs and Steve Wozniak were presenting their seminal Apple II, running a

Fig. 1.1 Tens of thousands of KIM-1s were sold to budding engineers from its debut in late 1975 till 1980. Here one of the first ads published in computer magazines in 1976

MITS

BUILDING YOUR OWN COMPUTER WON'T BE A PIECE OF CAKE.

(But, we'll make it a rewarding experience.)

Chances are you won't be able to assemble the *Altair 8800 Computer* in an hour or two. But, that's only because the *Altair* is a real, full-blown computer. It's not a demonstration kit.

The *Altair Computer* is fast, powerful, and flexible. Its basic instruction cycle time is 2 microseconds. It can directly address 256 input and 256 output devices **and** up to 65,000 words of memory.

Thanks to buss orientation and wide selection of interface cards the *Altair 8800* requires almost no design changes to connect with most external devices. Up to 15 additional cards can be added inside the main case.

The *Altair Computer* kit is about as difficult to assemble as a desktop calculator. If you can handle a soldering iron and follow simple instructions, you can build a computer.

You see, at *MITS*, we want your experience with our kits to be rewarding. That's why we take such pains to write an accurate, straight-forward assembly manual. One that you follow step-by-step. (We leave nothing to the imagination.)

Some electronic kit companies are experts at cutting the corners. They promise you the sky and deliver a box full of surplus parts and a few pages of faded instructions run off on their copying machine.

We're experts at **not** cutting the corners. Our *Altair Computer* has been designed for both the hobby and the industrial market. It has to be constructed of the finest, quality parts. And it is.

That's why we give you double-sided boards, gold-plated connectors, a 10 Amp power supply (enough to power 15 additional cards), toggle switches and an all aluminum case complete with sub-panel and detachable dress panel.

That's why we give you three manuals (Assembly, Operator's and Trouble-shooting) in a hard-cover, 3 ring binder plus an Assembly Hints manual.

Buy our computer and we'll automatically make you a member of the *Altair User's Group*. You'll have access to a whole range of custom software designed exclusively for the *Altair 8800*.

We're quite serious about making computer power available to you at a price you can afford.

BASIC ALTAIR AND OPTIONS

The basic *Altair 8800 Computer* includes the CPU, front panel control board, front panel lights and switches, power supply and expander board (with room for 3 extra cards) all enclosed in a handsome, aluminum case.

Options now available include 4K dynamic memory cards, 1K static memory cards, parallel I/O cards, three serial I/O cards (TTL, RS232, and TTY), octal to binary computer terminal, 32 character alpha-numeric display terminal, ASCII keyboard, audio tape interface, floppy disc system, and expander cards.

PRICES: Altair Computer Kit with complete assembly instructions **$439.00**
Assembled Altair Computer **$621.00**
1,000 word static memory cards **$176.00** kit
& **$209.00** assembled.
4,000 word dynamic memory card **$264.00** kit
& **$338.00** assembled.

NOTE: Altair Computers come with complete documentation and operating instructions. Altair customers receive software and general computer information through free membership to the Altair User's Club. Software now available includes a resident assembler, system monitor, text editor, and Basic compiler.
Prices and specifications subject to change without notice. Warranty: 90 days on parts for kits and 90 days on parts and labor for assembled units.

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Circle 16 on reader service card

MAY 1975

25

Fig. 1.2 A 1975 ad for the Altair 8800. The Altair was the first personal microcomputer but it was designed following a much different approach than the KIM-1 and later machines. Note how the ad acknowledges the challenges of assembling the kit but emphasizes how rewarding the experience would be

Fig. 1.3 The PET 2001: the first all-in-one personal computer. This figure is licensed under CC and copyright is owned by Tomislav Medak and Bill Bertram

MOS 6502 CPU as well.[1] Roughly at the same time, Tandy RadioShack went on introducing the TRS-80, completing a trio completing a trio that the computer magazine Byte nicknamed as the "1977 Trinity" and starting the personal/home computer era in grand style.[2]

As we can see, times were mature for personal and home computers to come and competition romped up quickly. The sudden interest and growing numbers of players in the personal computing space surely alarmed Jack Tramiel who, due to his previous negative experiences with typewriters and calculators, knew that, soon or later, someone would have come to conquer the market by bringing prices down.

This time, though, things were going to be different thanks to the MOS acquisition. Now Commodore had an advantage and Jack would have not allowed anyone, not even the Japanese, to undercut his newly found business niche.

Jack's next move became evident in an historical meeting hold near London in April 1980 where all top Commodore managers were gathered together to discuss upcoming strategies and new products. Over there Jack announced his intention to develop a new color computer to be sold at an extremely low price, less than $300, to finally start selling the computing revolution "to the masses, not the classes". Such a low price point, especially for a color computer, was completely unheard of but the initial shock and scepticism that such a plan raised around the table was quickly dismissed by Jack shouting "Gentlemen, the Japanese are coming, so we will become the Japanese!"[3]

This statement was actually a perfect synthesis of Jack's extremely aggressive approach to business. Especially after the previous defeats in the 60s and 70s, Jack

[1] The Apple I, also built around a 6502, was released as a single motherboard in mid 1976, for $666.66.

[2] The PET launch price was $795 while the Apple II was sold for $1,298 (computer only) and the TRS-80 retailed for $600 (including a monitor).

[3] Michael Tomczyk: "Home Computer Wars", Compute! Books, 1984.

Fig. 1.4 The VIC-20, first released as the VIC-1001 in Japan in late 1980 and then worldwide in 1981 with a price tag of $299.95. Byte magazine reviewed it in May 1981 with high praise: "even with some of its limitations […] it makes an impressive showing against more expensive microcomputers like the Apple II, the Radio the Radio Shack TRS-80 and the Atari 800". This figure is licensed under CC and is credited as follows: Cbmeeks/processed by Pixel8—Original uploader was Cbmeeks at en.wikipedia

had no fear of potentially cannibalizing existing Commodore products and always pushed the company to compete with itself to ultimately improve its offerings: if they didn't do so, external competitors, whether Americans, Europeans or Japanese, would easily step in with far worse consequences for the company in the long run.

The low cost color computer idea took shape in just a matter of months in the form of the VIC-20 (Fig. 1.4), developed and marketed under the direct supervision of a newly hired manager named Michael Tomczyk.

To market the new product, Michael decided to present it as the "Friendly Computer". While trying to "humanize" computers wasn't a completely novel approach (Atari was proposing their line of computers as the "Computers for People" and the TRS-80 manual was trying hard to make users comfortable by avoiding overly technical concepts and jargon while stressing ease of use instead), it was the very first time the whole marketing campaign of a newly launched computer was entirely based around the concept of "friendliness".

To attract a new crowd of users and show how "friendly" the computer actually was, the marketing also emphasized the gaming qualities of the VIC-20, putting it in direct competition with home gaming consoles like the Atari VCS and Mattel Intellivision. Indeed, games were a very important component of the VIC and were developed not only by the group directly managed by Michael but also by a very young team of developers from a start-up named HAL Laboratory[4] in Japan. It was there, in fact, that the computer was first launched in October 1980 to test the market while, hopefully, also impress and scare off Japanese tech companies by showing that an inexpensive and good computer had already been done. The new home computer market, at least in the West, was going to be in Commodore's steady hands.

[4] HAL Laboratory was also going to develop several of the early C64 games like Jupiter Lander, Avenger and Le Mans. Later it went on to become a major console developer closely tied to Nintendo and responsible for great games like Kirby and many others. Their first VIC games were unofficial ports of famous arcade games like Space Invaders and Rally-X and showed the possibilities of the VIC-20 while also bringing in some legal trouble for Commodore.

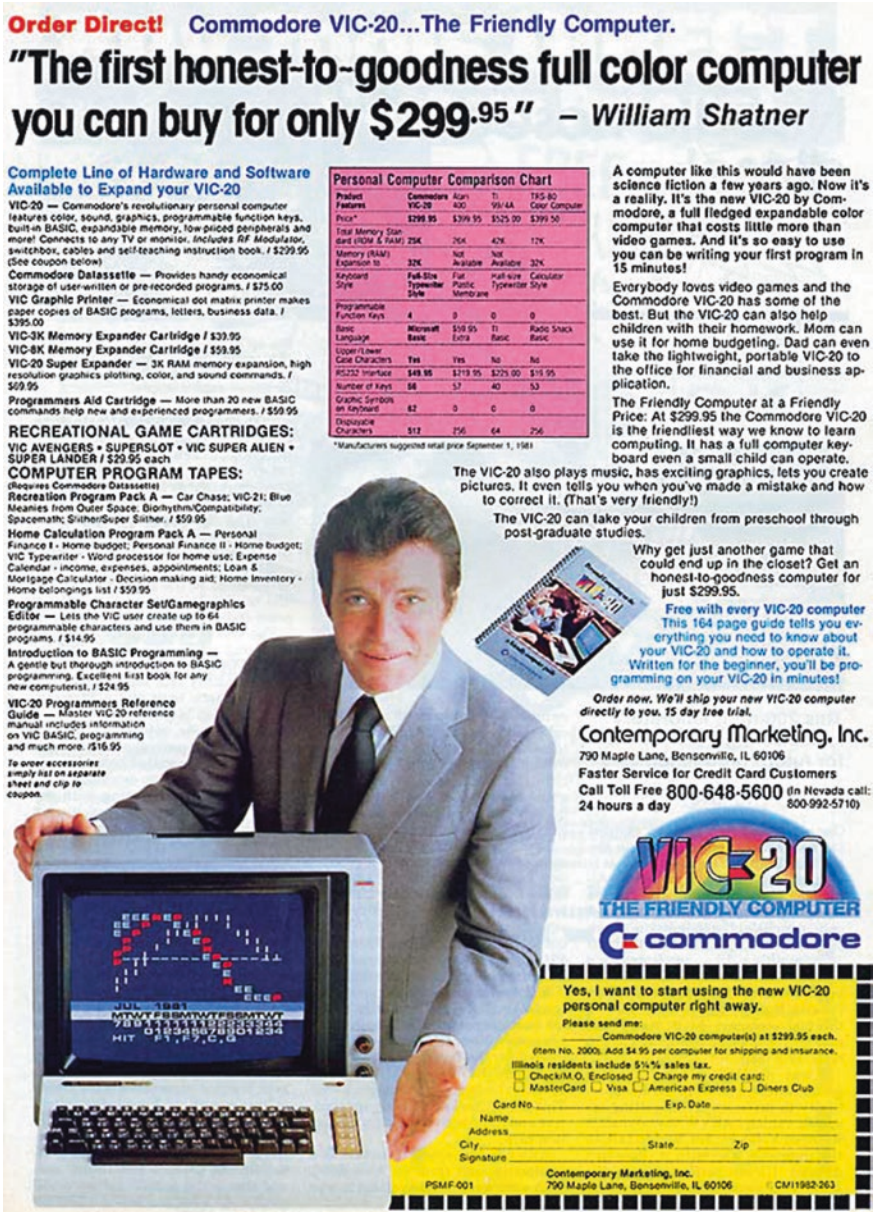

Fig. 1.5 One of the original VIC-20 ads featuring actor William Shatner

The friendly and game focused marketing plan was then pushed forward masterfully by signing actor William Shatner, Captain Kirk of Star Trek fame, for a series of commercials, both printed (Fig. 1.5) and aired on TV.

Fig. 1.6 Jack Tramiel (*left*) and Michael Tomczyk celebrating the one millionth VIC-20 sold. The VIC-20 achieved that goal by the end of 1982: 800,000 units were sold in that year alone, a really impressive number if we think that the Apple II, released in 1977 released in 1977, had sold 700,000 units overall by then while sales for the newly launched IBM PC, between August and December 1981, were just around 13,000 units (photo by kind permission of Mr. Michael Tomczyk)

By selling via general retailers like Kmart and not by relying exclusively on specialized computer stores, the VIC-20 had no problems in reaching a new audience and was a resounding success: it was the first computer ever to sell one million units (Fig. 1.6) and, once discontinued in January 1985, sales were in excess of two and half millions.

Anyway, despite such an achievement, Commodore was not going to rest on its laurels and, true to Jack's golden rule of keep competing with yourself before others do, something even more impressive was already looming on the horizon: the Commodore 64.