

## The wizardry of Woz

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**Steve Wozniak tells us why he left Apple Computer, the company he founded, in his new book, *iWoz*.**

AFTER the US festivals and graduating from Berkeley \* I went back to Apple as an engineer. I didn't want to be an executive. I wanted just to design circuits and apply clever ideas.

But it was weird because I was in the media mainstream and had so much other stuff to do.

I was called by the press and computer groups, and I was working on philanthropic projects like the San Jose Ballet and The Tech, a San Jose computer museum.

I could come up with an architecture idea - such as speeding up the processor five times - but other engineers designed the chips.

I felt it wasn't critical for me to be there, even though I loved Apple.

I was working in the Apple II division after the Apple III project was closed, so the engineers from that department just gravitated around me.

It was fun.

And there were cool people with cool projects starting in my building. On the next floor down from me they were finishing up the Apple IIc. This was as small as today's laptops except it plugged it into a wall. I thought it was a beautiful computer, my favourite one to this day.

One of the engineers was Joe Ennis, the kind of guy I love who's so enthusiastic and passionate about the products he's working on and where they can go and what he could do with them. He had great ideas about extending the Apple II into areas far beyond anything even the Macintosh people talked about.

He thought you could have an Apple II programmed to be a complete telephone switchboard. Today, switchboards are cards you plug into a computer. He imagined storing voices digitally and you could route them to other channels.

I HAD this nice home up in the Santa Cruz Mountains with high-end audio and video equipment. By that time TV sets and VCRs had remote controls. I had laser discs, so I had a remote control for that too. I had an expensive hi-fi system from Bang & Olufsen with a remote. That was rare.

I got a satellite TV through a friend, Chuck Colby, who was building custom dishes for people. But man, there it was. Another remote control.

So I would turn on the TV with one remote and maybe I'd turn on the hi-fi with another, and then I would press buttons for the satellite channel and I turned on my VCR to pass a signal through it.

I am sitting in bed operating all of this equipment with different remotes. It was crazy. I wanted one

remote with one button programmed for all my devices.

A single button to sequentially emit many infra-red codes corresponding to buttons on other remotes. That meant that the buttons on my control were like macros; exactly like a program.

I realised that soon people would need more remote controls and it would become a problem, like it was for me.

I talked to a few people about this idea and I got excited because I realised how easy it was to build. A little microprocessor looks at the codes coming in, stores the data, and outputs the same codes when you press the buttons.

And I thought, I'm the one to do it. And I really did become the first person in the world to do what is now known as a universal remote control.

I built a programming language into the remote, a beautiful language I was proud of.

I was still at Apple when I got this idea. And I started telling people like Joe Ennis about it. I pitched real heavily to Joe the whole idea of "Let's leave Apple and start this company".

I never felt like I was turning my back on my own company.

Apple was a large company, and it wasn't and still isn't the love in my life. The love in my life is starting small companies with small groups of friends. Bringing new ideas out and trying to build them.

I was heading up a new Apple II that was supposed to be better than anything, called the Apple II X. But shortly after we started, upper Apple management canned it.

That was probably a decent decision. They were used to products that sold 20,000 a month, and a high-end product like the Apple II X, because it would be so expensive, probably wouldn't sell more than 2000 a month.

The Apple II GS, with 24-bit colour and real sound (not just chirps), was born out of the Apple II X. You could do interesting things like games and software for kids who needed that level of production to be engaged.

I was so happy to see that we got a project that all of a sudden brought the Apple II into where it really needed to be. But there were morale problems in my group as a result of the people in the Apple II group feeling undervalued compared with the Macintosh group, which was in development.

And I was ready for something new.

I decided to start a company to build the remote control. Joe and my assistant, Laura Roebuck, she'd just had a baby and wanted to work part-time, both wanted to do it.

I called my boss' boss, Wayne Rosing, in the Apple II division, to tell him I was leaving. I didn't call Steve (Jobs) or (Apple co-founder) Mike Markkula or anyone on the board. I had a job in engineering and I felt like I just had to tell someone I reported to so they would know.

I sat them down and sketched out my idea. It would not compete with Apple.

I left within about a week (the letter of release wished me well) but I stayed on the payroll as an Apple employee. I am to this day. I just have the lowest salary a full-time employee can have. I still represent Apple at computer clubs this way.

Steve probably heard I was leaving the day a piece came out in The Wall Street Journal. But the piece got it all wrong.

The reporter called me the day I was leaving and said: "I understand you're starting a new company?" I told him yeah, and he asked me what it was all about. And I told him.

He asked me: "Are there any things that you aren't happy about at Apple?" And I told him the truth. I told him yes, and then I stood up for the people I was working with who were offended by the lack of respect they received.

At the time, the people in the Apple II group were treated as very unimportant by the rest of the company. This despite the fact that the Apple II was by far the largest-selling product in our company and would be for years. It had only just recently been overtaken as No. 1 in the world by the IBM PC, which had connections in the business world that we didn't have.

If you worked in the Apple II division, you couldn't get the money or parts you needed in the same way you could if you worked in the new Macintosh division. That wasn't fair.

Also, there were limitations on the Apple II in terms of taking advantage of new advances in technology.

So I made some comments like this, and then the reporter asked: "So that's the reason you're leaving?"

And I said: "Oh no, that's not the reason. I'm leaving because I want to do this remote control."

But The Wall Street Journal printed the article suggesting I was mad at Apple and that was the reason I was leaving. It was very wrong because I went out of my way to tell the reporter not to get it confused. Maybe it was more interesting to shape the story the way they did.

I have to think it was an accident, but it's been picked up by every book and every bit of history.

Everyone in the world ended up thinking I left because I was mad at Apple.

The only reason I left my day-job at Apple is that I was enthusiastic about the idea of doing this new neat project that had never been done before.

If I hadn't had the remote control idea, I would have stayed, but this was such a cool idea. And we got moving pretty quickly.

OUR first thoughts were where to locate. I lived on Summit Road in the Santa Cruz mountains. Up there at the summit were two restaurants, the Summit Inn and the Cloud 9. I knew that the Cloud 9 was closing so I suggested it as a site. We settled on CL 9 as the name of the new company.

Maybe two weeks after that, we got an office in this older part of Los Gatos, the town where I lived.

It felt just like the early Apple days, so exciting.

We were building something no one else had thought of yet. Today it's more obvious but not back then.

The first thing we did was meet with companies that sold components we would need: infra-red sensors and transmitters and microprocessors. We looked over the data sheets. We got together an idea but it wasn't a design you could breadboard. This was exactly what I did with the Apple II.

A problem we had to tackle was how do you receive infra-red signals in the remote? We didn't have that much expertise. We hired a consulting firm to help us read an infra-red signal.

They designed an intricate circuit with a lot of parts.

I said: "If you're close and it's powerful, then why can't you just detect it with a lot simpler circuitry?" Just go straight to a photo transistor, which senses light instead of electronic signals.

And they came up with a very good circuit that worked reliably. You could play your remote control into our little receiver device and it would capture the signal. It determined how many microseconds the infra-red signal was on and off. Then it traced the signal and made a time recording.

The time came for us to come up with a plastics design. We went to design companies to see if they would show us some samples.

One of those companies was Frog Design, which had done the Macintosh, and they said: "Sure, we do third-party development for people other than Apple."

They said they'd design for anyone. We told them what we wanted, and they did it up in a few models.

Steve Jobs was over at Frog and saw a CL 9 prototype. From what I heard, he threw it against a wall and put it in a box and said, "Send it to him." As if Apple owned it. The Frog guy told me that Steve told him they couldn't do any work for us because Apple "owned" Frog. Not true, and everyone knew it.

But Frog told us they felt uncomfortable doing it without Apple's permission.

I thought, good, fine. We'll go somewhere else.

I ended up choosing two processors for the device - the first remote control with a dual processor.

One microprocessor for small tasks like reading the keyboard and keeping time, and another to do the heavy-duty work. The larger processor was an updated version of the old MOS 6502 used on the Apple I. The other was a smaller, cheaper (50 cents each), 4-bit processor.

Man, was it hard to control.

Nothing was built into the hardware, and when you don't have the resources, you take advantage of what's inside the chip.

The program kept the time, monitored the keyboard, ran the LCD, and gave power to some of the circuit. And it communicated with the bigger, 8-bit microprocessor.

And the LCD connected to the same 4-bit microprocessor chip that was reading the keyboard.

The real guts of our product - memorising all these infra-red codes and repeating them when you

pressed buttons - was done by the second, more powerful microprocessor.

We designed our board so you could connect an Apple IIc to it and type data on the screen, although the remote control was the computer, like a cousin to the Apple II.

The Apple's mini-assembler and other tools were useful in developing the remote control.

Just after we hired the firm Selectron to make the device, I got a call one day from a venture capitalist in England who I had sold some Apple stock to before the company went public.

His venture capital company made a tonne of money on the London market as a result.

I told him all about this new company, and he said: "Can I visit you?"

I described what we were doing and he immediately said he wanted to invest. I told him I wasn't taking any money, but he begged.

When people beg to be a part of something, I give in.

Then I had another big investment from the big Silicon Valley venture firm New Enterprise Associates, which did 3Com, Adaptec, and Silicon Graphics. This guy from England had brought his friends in. So we had 2 or 3 million dollars.

I asked an old friend from Commodore, Sam Bernstein, to be president.

We kept CL 9 in business for about three years.

But I had two small children so it was hard making sure I had enough time to devote to them.

And my relationship with my wife, Candi, was getting rocky. We fought about how to raise the children, and we were talking separation.

So I went to Hawaii and I set up my little Apple IIc so I could start typing the new (8-bit remote control) program in.

I thought solitude would help me finish the project.

But I didn't do a single thing that week. I sat there looking out my window and watching whales every day.

I stayed for four weeks and did not write a single bit of code.

I just enjoyed being there.

I thought there are a lot of engineers in the world and I've got kids. So we hired another programmer to do that job. I wanted more time with my children.

THE PRODUCTS people credit with bringing Apple back to life - the iPods and the iMacs - were being designed by Jonathan Ives back when Apple was in trouble. But the way Steve Jobs presented those new products was amazing.

So when the iPod came out, I was excited. It was expensive but that was the way to do it. Steve is

great at choosing the right technologies, the new ones that will succeed.

And the iPod had iTunes, software that treated your computer as the centre of things where all the music is stored. The iPod is a satellite. And that was perfect. And it makes so much sense that Apple was the one to come up with it. Apple's history is making both the hardware and the software with the result that the two work better together.

I'm proud because Apple turned around in line with our early values about design - so excellent that people would drool over the idea of having that product. Those values were about an emotional feeling - a feeling of fun. Like the way we decided to have colour on the Apple II.

I'm so proud that Apple is back doing important things.

If you're as lucky as I've been, then you'll get to live in a time when you're young just as a revolution is about to take off.

I was there to see and build the first personal computers.

*I, Woz* by Steve Wozniak.

ISBN 9780755314072

RRP \$35. Available now

## **Setting the record straight**

Woz says he wrote the book to correct popular "mythconceptions".

### **Myth**

He's a college dropout.

### **Fact**

He dropped out of Berkeley in 1975 but returned and gained a degree in computer science and electrical engineering in 1986.

### **Myth**

He was thrown out of Colorado University.

### **Fact**

He decided not to go back after he was put on probation for computer abuse.

### **Myth**

Steve Jobs and he were high-school classmates.

### **Fact**

They were several years apart - Wozniak was in university when he met Jobs.

### **Myth**

Jobs and he together engineered the early Apples.

### **Fact**

Wozniak worked on those alone (although Jobs procured parts and marketed the machines).

### **Myth**

Wozniak left Apple, disgruntled.

### **Fact**

He has always been an employee, even when he left (with goodwill, he says) Apple to start his company, CL 9, Inc. He continues to act as an ambassador for Apple.

## **The Wheels of Zeus**

Woz credits to his inventive genius the Apple I and Apple II, the arcade game Breakout (created in four days) and the universal remote control. He is a well-known philanthropist, having "adopted" a California school district, working in the ballet and advising The Tech museum in San Jose.

## **NEXT LESSONS**

My advice has to do with what you do when you find yourself sitting there with ideas in your head and a desire to build them. But you're young. You have no money. Those ideas are what drive you, they're all you think about. But there's a big difference between just thinking about inventing something and doing it. So how do you do it? How do you actually set about changing the world?

- Believe in yourself. Don't waver.
- A revolutionary new product won't be understandable to most people. Don't let these people bring you down. They only know what they're exposed to. It's a type of prejudice against the spirit of invention. Trust your intuition, that way lies happiness.
- See things in "grey scale".
- Don't follow the crowd. Do a factual study. Don't waste time supporting a bad idea. Keep your ego out of the equation.
- Work alone.
- Don't work in a corporate environment where products are designed by committee.

-- STEVE WOZNIAK

More on Woz, Apple and computing's history

## **DVDs**

*Pirates of Silicon Valley* (1999)

*Hackers: Wizards of the Electronic Age* (1986)

*Triumph of the Nerds* (1996) by Robert X Cringely, PBS ([www.pbs.org/nerds/](http://www.pbs.org/nerds/))

Nerds 2.0.1 A Brief History of the Internet by Robert X Cringely, PBS (<http://tinyurl.com/f55x6>)

## BOOKS

iCon Steve Jobs: The Greatest Second Act in the History of Business (2005) by Jeffrey S. Young, ISBN 0471720836 (<http://tinyurl.com/bzyqw>)

*Revolution in the Valley* with foreword by Steve Wozniak (2004) by Andy Hertzfeld, ISBN 0596007191

*Apple Confidential 2.0: The Definitive History of the World's Most Colorful Company* (2004) by Owen W Linzmayer, ISBN 1593270100

*Hackers: Heroes of the Computer Revolution* (2001) by Steven Levy ISBN 0141000511

*Digital Retro: The Evolution and Design of the Personal Computer* (2004) by Gordon Laing, ISBN 078214330X

## WEB

<http://woz.org>

\* *Wozniak received a BS in computer science from UC Berkeley in 1986 (he left in 1975) under the name "Rocky Raccoon Clark". In the two years between crashing his light aircraft in 1981 and returning to Apple, he re-entered the university's undergraduate program, married Candi Clark (his second), and sponsored two loss-making music festivals.*

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