

# When We Invented the Personal Computer . . .

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*"When we invented the personal computer, we created a new kind of bicycle . . . a new man-machine partnership . . . a new generation of entrepreneurs."*

Based on an interview leading to three full-page ads in many news papers and magazines. These ads were of great general interest, and apply in many ways to other brands of personal computers than Apple. See note at the end of the article for some additional suppliers of personal computers.

## Outline

1. What is a personal computer?
2. What is the difference between a personal computer and other computers?
3. How does the personal computer increase productivity on an individual level?
4. What are those 150,000 people doing with the Apples they have bought?
5. What are people going to use Apples for, ten years from now?
6. How is Apple Computer Inc. carrying on a Silicon Valley tradition?
7. Has Apple's entrepreneurial spirit permeated other aspects of the personal computer industry?
8. How is Apple going to maintain its leadership in the industry?

### 1. What is a personal computer?

Let me answer with the analogy of the bicycle and the condor. A few years ago I read a study... I believe it was in Scientific American... about the efficiency of locomotion for various species on the earth, including man. The study determined which species was the most efficient, in terms of getting from point A to point B with the least amount of energy exerted. The condor won. Man made a rather unimpressive showing about 1/3 of the way down the list.

But someone there had the insight to test man riding a bicycle. Man was twice as efficient as the condor! This illustrated man's ability as a tool maker. When man created the bicycle, he created a tool that amplified an inherent ability. That's why I like to compare the personal computer to the bicycle. The Apple personal computer is a 21st century bicycle if you will, because it's a tool that can amplify a certain part of our inherent intelligence. There's a special relationship that develops between one person and one computer that ultimately improves productivity on a personal level.

Today most people aren't even aware that the personal computer exists. The challenge of our

industry is not only to help people learn about the personal computer, but to make the personal computer so easy to use that, by the end of this decade, it will be as common in our society as the bicycle.

That's one of the reasons I wanted to do this interview. I wanted to explain what a personal computer is, how it can help all of us make better decisions and how it will eventually impact all phases of society... from training dolphins to glaucoma research to growing a more nutritious crop of soybeans.

### 2. What is the difference between a personal computer and other computers?

The key difference is that one-on-one relationship between man and machine I was talking about, because the emphasis is on a personal interaction.

The whole concept is this: for the same capital equipment cost as a passenger train, you can now buy 1,000 Volkswagens. Think of the large computers (the mainframes and the minis) as the passenger train and the Apple personal computer as the Volkswagen. The Volkswagen isn't as fast or as comfortable as the passenger train. But the VW owners can go where they want, when they want and with whom they want. The VW owners have personal control of the machine.

In the 60s and early 70s, it wasn't economically feasible to have the interaction of one person with one computer. Computers were very costly and complicated; 50 people had to share one computer. Back then, you could have the passenger train but not the Volkswagen. But with the advent of microelectronics technology, parts got smaller and denser. Machines got faster. Power requirements went down. Finally, electronic intelligence was affordable. We finally had the chance to invent the personal computer, to invent the "intelligent bicycle."

Basically, Steve Wozniak and I invented the Apple because we wanted a personal computer. Not only couldn't we afford the computers that were on the market, those computers were impractical for us to use. We needed a Volkswagen.

People like us were the initial market for the personal computer. After we launched the Apple in 1976, all our friends wanted one. By the time

Apple II was on the market in mid-1977, the demand for the personal computer had already begun to skyrocket.

Today, we've sold over 150,000 Apple personal computer systems. That's because Apple recognized this passenger train/Volkswagen relationship about 2 or 3 years before anyone else. When we designed Apple II, we wanted to offer the benefit of a \$15,000 computer or a \$100,000 timesharing system with a computer that costs as little as \$1,500. Obviously, one of the differences between a personal computer and other computers is price. Another difference is size.

I'd like to use another analogy here: the big motor and the fractional-horsepower motor. When the first motor was invented in the late 1800's, it was only possible to build a large and expensive motor, just like it was with the early computers. Those motors were used to power entire shops, with pulleys and belts running throughout the shops to drive the individual machines scattered within. Only with the advent of the fractional horsepower motor could horsepower be brought directly to where it was needed.

With the portable Apple, you could say we invented the first fractional-horsepower computer. The Apple is small enough to go where you need it. You can get the information you need on your desk, in your office, in the lab, the school or the home. In other words, Apple broke down the huge monolithic computer into small, easy to use parts. We made the computer friendly. So, like the fractional horsepower motor distributed horsepower to where it was needed, the personal computer can distribute intelligence to where it's needed. Ultimately, it will be this distribution of intelligence that will change the way we all make our decisions.

### 3. How does the personal computer increase productivity on an individual level?

Personal computers will increase productivity because personal computers are tools, not toys. For example, in the last 15 years, there have been only four tools that actually have increased the efficiency of the office worker: the IBM Selectric typewriter, the calculator, the Xerox machine, and the newer advanced phone systems. Maybe that portable cassette player you're using could be number five. Like all those inventions, the personal computer offers its power to the individual.

In the 80's the personal computer will do as much for the individual as the big computers did for the corporation in the 60's and 70's. Today, Apple's putting the power of computing into the hands of people who might never have had the chance to use it before.

We at Apple call our personal computer a third wave tool. Toffler, in his latest book, writes that the first wave was the invention of agriculture...made possible by the tools of agriculture. The second wave embraced the tools of the industrial revolution. The personal computer is a third wave tool to help every individual deal with the complexities of modern society.

You know, about 10 million bicycles will be sold in America this year alone. When we start thinking of a personal computer as a bicycle, a Volkswagen or a fractional horsepower motor, we start to realize what kind of effect 10 million of these typewriter-size machines is going to have in our own lifetime.

Apple has sold over 150,000 personal computers. What are people doing with them?

### 4. What are those 150,000 people doing with the Apples they have bought?

Let's talk about two general points before we get into specific applications. First, a personal computer is more than just a small "big" computer. Let me explain that by going back to the analogy of the large horsepower motor and the fractional horsepower motor.

You see, the Fractional horsepower motor was one of the breakthroughs of the industrial revolution. It was more than just a small "big" motor because it gave the people freedom to apply affordable horsepower directly where it was needed. The fractional horsepower motor created uses for horsepower that were never possible or imagined with the large horsepower motor, and made portable tools a reality. It's been less than 100 years since its invention, and the enormity of its impact surrounds us. The average American household contains no less than 50 fractional horsepower motors.

The personal computer is more than just a small "big" computer for the same kind of reasons. It brings intelligence directly to where it's needed: at the personal level. It lets you use that intelligence in creative ways you never imagined. And it's a portable, easy-to-use tool that everyone can afford.

But the most important thing, Apple isn't just a window into intelligence like the big computers or the timesharing networks of the 60's and 70's. The Apple is a realization of a man-machine partnership that lets an individual interact one-on-one with a computer. 100% of the Apple's computing power is available at your fingertips. Apple's computing power is totally dedicated to doing what you want. You can customize the Apple to work for you in ways a big computer never could.

The second point is that, unlike the camera or the stereo which are dedicated to just one function, the Apple is truly a general purpose tool. One minute the Apple can help educate elementary school students on math drills - the next minute, that same Apple does financial modeling - the next minute, it encourages artistic creativity via color graphics.

We originally underestimated the enormous creativity people would use in applying our general purpose tool. Apples are now being used for literally tens of thousands of applications that we never imagined. This general purpose, flexible nature is the reason that the personal computer will be a long-lasting tool with an ever-expanding number of applications.

"You still haven't answered the question, Steve. What are those 150,000 people doing with their Apples?"

Okay, now I'll give you a few specifics. There was a sewing machine repairman in England who almost went out of business because he didn't know how many different parts he had in his inventory. He'd buy more stock than he needed, and run out of parts he thought he already had in stock. That repairman couldn't afford a \$15,000 computer to help him manage his business, but the \$2500 Apple system he could afford literally saved him. The Apple system supplies him with vital information in a form he could easily understand. He finally had a chance to see how his business really worked, so he could recognize the inventory problem - what it was doing to his business - and how to solve it.

Another example: A financial analyst and consultant considers his Apple II as his business partner. He uses his Apple for everything from statistical analyses and company modeling to creating charts and graphs for his newsletter. His Apple allows him to test assumptions and ask "what if?" questions. So his Apple is the tool that gives him the opportunity to dissect a problem before committing to firm, final decisions. But the partnership with his Apple doesn't end at the office. He takes his Apple home on weekends and when he's through with his financial analyses, his kids use it.

More examples? Loyola University's emergency medical center uses Apples to process ambulance reports in one-tenth the time it usually takes. In Florida, one company actually puts Apples in the back of a van and drives around from supermarket to supermarket every day. At each supermarket they enter the prices of certain grocery and produce items into the Apples. This information is then correlated and made available to consumers, so that they can plan the most nutritious meals at lowest possible price. The bottom line is, that company is providing consumers with a service that never could have been possible before the advent of a portable, powerful Apple personal computer.

But a really good example of how Apple not only eliminates drudgery but frees people to concentrate on creative solutions is how we use Apples at Apple. Everyone uses Apples here. We don't even buy typewriters for our secretaries anymore - they use Apple systems.

We freed our secretaries to do more sophisticated tasks by improving their productivity. They're learning skills like departmental budgeting, sales analyses and forecasting - and those skills let them make the jump into other parts of our organization. Some of our secretaries are just as computer fluent as the people we hire right out of business school. So, not only do our secretaries have the freedom to do more rewarding, enriching tasks - they have the chance to get involved in solving important problems that can ultimately affect the success of Apple as a company. And that means I have more time to creatively explore and implement business strategies. All of us at Apple are experiencing the satisfaction of this man-machine partnership that frees people to do what they do best: think conceptually.

b. What are people going to use Apples for, ten years from now?

The Apple isn't some futuristic dream. It's a creative tool people are relying on right now. The personal computer is changing lives today.

A personal computer isn't only a tool for people in business. There's a whole generation of kids growing up learning how to use the personal computer as a problem-solving tool - 97% of the students in Minnesota have the opportunity to solve problems with an Apple. But Apples aren't just being used to teach computer science courses. Students from Alaska to Mexico learn physics, mathematics, spelling and a slew of other subjects on their Apples. And kids who have problems learning how to read and write are actually overcoming their disabilities with the personal computer Apple's colorful graphics that make it fun to learn; so problems these kids have are being dealt with successfully in a very innovative way.

As all these students who are now using Apples grow older, they'll integrate the personal computer into their life as a friendly tool, just like their bicycle. And those kids are the ones who will create the applications we at Apple haven't even dreamt of.

By the end of the decade, the personal computer won't be a mystery to anybody. Society will realize that the opportunity for a man-machine partnership is well within everyone's reach. Let's put it all in perspective for you: five years ago, the personal computer didn't even exist. Yet, as of this interview, personal computing has statistically reached one in every 100 American households - and there are 72 million households in America! By the end of the 80's, that figure will be one in ten.

The vast penetration of the personal computer into our society not only is inevitable, it's real. I feel privileged to be a part of it all, and to see the results in my lifetime.

#### 6. How is Apple Computer, Inc. carrying on a Silicon Valley tradition?

Silicon Valley is the finest example of the American entrepreneurial, risk-taking culture. You won't find this kind of culture anywhere else in the world. Hewlett-Packard started here. Intel invented the microprocessor just eight miles from where we're sitting now. The heart of the semiconductor industry is here. Woz (Steve Wozniak) and I grew up in this Valley. Bill Hewlett and Dave Packard literally were our heroes when we were growing up, so it just follows that Apple would carry on the tradition.

Like a lot of entrepreneurs, Woz and I didn't consciously set out to start a company. We tried very hard to convince two other established computer companies to fund us while we developed the personal computer. We spent a lot of time got nowhere. Ultimately, we had no choice but to do it ourselves.

Today, that entrepreneurial spirit still exists throughout the company. That's one of the reasons Apple's been able to attract and retain some



of the finest technological talent in the world. Our people want to work in an entrepreneurial environment - and they also want to help create a product that will affect the lives of millions of people.

**7. Has Apple's entrepreneurial spirit permeated other aspects of the personal computer industry?**

Definitely. Right now, there are over 170 small-to-medium-size entrepreneurial companies supplying software packages and hardware peripherals designed specifically to work with Apple systems.

An Apple is a general purpose tool. It's the software packages and hardware peripherals, offered by Apple and these other companies that help the user tailor the Apple to his or her specific needs. It's the combination of Apple, software and peripherals that gives someone a personal computer solution. The more solutions available, the more Apples we sell. Here's an example.

Say an engineer who works full time at a large corporation buys an Apple. That person decides that, in their spare time, they can create a useful piece of software that other Apple owners might want to buy. Hypothetically, that engineer can manufacture the program for \$10, the retailer would buy it for \$25 and in turn sell it to the customer for \$50.

If just 10% of Apple's installed base (over 150,000 owners) buy this program in the first year, that engineer would sell 15,000 copies. That's a \$15 profit per copy, and that's a \$225,000 total profit in just 12 months! And the only necessary capital equipment to make this possible was one Apple system that cost less than \$5,000!

This phenomenon couldn't happen if the Apple didn't exist. In the past, it was possible for an entrepreneur working on a large computer or time-shared system to write a piece of software. But there were three major roadblocks. There was a very small installed base to sell the program to, so the entrepreneur had to sell the program for maybe \$1,000 or more per copy to show any profit. There was no distribution channel through which to sell this program, so they would have to hire salesmen which, of course, they couldn't afford. Finally, they might not have been able to write the program at all because you can't take a time-shared system home to create a program in your spare time.

That's why this phenomenon couldn't happen if the Apple didn't exist. Our installed base is large, the entrepreneur's capital equipment cost is small, and there's an existing chain of software distribution through the retail dealers.

Apple pioneered the retail distribution of personal computers. To do this, we helped create a network of over 2,000 dealers worldwide. These dealers own their own business. They are the entrepreneurs who distribute the products of an entrepreneurial industry.

ship in the industry?

Our industry is still in its infancy. It's continually evolving. Rather than just a series of events happening in the industry - new products, new companies coming and going - there's an underlying process going on here, a process to which Apple is committed: the integration of computers into our society on a personal level. We think that process is going to take 10 to 15 years. Let me give you two examples of processes like the ones I'm talking about, which we've all witnessed in our lifetime.

When was the last time you saw a mimeograph machine or used a piece of carbon paper? You don't use either today because of the invention of the Xerox machine - a tool that has radically altered the way we all work. Yet the first Xerox machine was introduced only 20 years ago, in 1960.

Second example: HP introduced the first hand-held scientific calculator, the HP-35, in the early 70s. In less than 10 years, the world's largest manufacturer of slide rules stopped making slide rules altogether. We believe the integration of personal computers into society will have an even greater effect than the calculator or the Xerox machine.

We also believe Apple's continuing success and leadership position will result from innovation, not duplication. Innovation in products and marketing as well as in distribution.

For example, we've learned that one of the factors in the growth of our marketplace is that it takes about 20 hours to get truly fluent with your Apple. We'd like to reduce that to under an hour. The way this will be accomplished is to spend a larger portion of the computer's computational power on what we call the "user interface." The user interface is the way the computer and user interact with each other. Future Apple systems will spend more of the computer's intelligence to translate or adapt information in a way people are already familiar with, instead of forcing people to adapt to the computer. Let me illustrate this:

Look at any desk in your office. You'll see stacks of paper, the telephone, a calculator and a typewriter. The people sitting at these desks must intuitively understand concurrency - several things occurring simultaneously. They understand priority - stacks of paper on a desk, with the one on top being most important. And they understand interruption - the phone rings, a memo gets put on top of a stack, etc.

But if you went up to any one of them and asked if he or she could define concurrency, priority and interruption - you would probably get a blank stare. Yet people intuitively understand things that they're not cognizant of; we all know more than we know we know.

Today, to use a personal computer, you must deal with these already-familiar concepts in a new way. Tomorrow, the computer will adapt itself to the way you're used to dealing with concurrency, priority and interruption - not vice versa.

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phrases all mean the same thing, we can adopt a symbol standing for that thing, that idea.

# 10. Programming a Computer for Understanding Language and Engaging in Discussion

We are now ready to re-examine two of the questions we asked earlier:

1. How shall we program a computer to recognize ideas and discuss and argue with them?
2. What shall we do with the cement-words so that a computer can operate with them?

We shall try to answer these questions, in part if not completely:

First, the programmer specifies a particular context, such as Acoustics, or Zoology.

Second, the programmer tells the computer idea-labels for the ideas referred to by the brick-words or their synonyms. The idea-labels may be adopted standard terms or they may be symbols.

Third, the programmer gives to the computer idea-labels for the frameworks of cement-words which express or assert relations. Here are some examples of frameworks of cement-words:

1. All -- are....
2. The purpose of these questions from the point of view of...was to have information available as to how....
3. With respect to...the situation is similar: very little...is -- from...
4. It is reasonable to assert that in... there was virtually no...of -- by --

It will be a long task to translate the hundreds of cement-words in their usual combinations into exact ideas, and assign to them idea-labels, so that the computer can "understand" each kind of sentence given to it. But it is a finite task. Once done, in fact, the solution will apply to all kinds of discussion and argument in all kinds of contexts, because the cement-words are inevitably used in every context.

Finally, the programmer assigns to the computer purposes in discussion. In the case of an argument, the computer should be able to test it for its agreement with certain rules:

1. The argument should be free of internal contradictions.
2. The argument should be logically complete, without gaps.
3. Any conflicts with given statements should be printed out.
4. All special terms should be defined using only terms earlier defined.
5. The argument should be free of contradictions of established scientific principles.

In the case of an explanation, the computer should be able to turn a poor explanation into a good one:

1. An appropriate amount of description and illustration is given for each new term or proposition.
2. The explanation should proceed from the more simple to the more complex.

In the case of a conversation, still other rules could be given to the computer similar to those used by a person who wishes to be interesting and entertaining yet not talk about subjects that his hearers have no knowledge of.

Are these future developments too extraordinary to be believed? No; on the contrary there are great needs in present-day society for just this kind of ability in computers. As soon as this ability is programmed in computers, you and I and everybody else will be able to have such wishes fulfilled as these:

- I wish someone could read this for me, and tell me what is in it.
- I think I am opposed to this proposal but I wish I knew what it's really about.
- That argument sounds convincing--I wish I knew if I could believe it.

Different people can go through logical arguments and reach the same conclusions, and the way in which different people understand language is programmed into them by their education and experiences. Therefore, computers also can do this sort of thing, and can discuss logically and entertainingly and usefully.

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But this leads to an interesting paradox: to make a computer easier to use requires a more sophisticated computer. And the more sophisticated the personal computer, the more expensive the personal computer. As this trend manifests itself - and it will - you should expect prices of useful personal computers not to decline over the next few years while we develop and perfect this new technology.

It's always been Apple's objective to build the least-expensive, useful personal computer - not necessarily the cheapest. We build tools, not toys. Ultimately, you will get more Apple power for the same dollar.

But that's just part of the Apple strategy for maintaining our leadership position in the 80s. Obviously, I've only been talking to you conceptually about what's going on at Apple. Ultimately, the Apple must adapt totally to the way people work. The Apple has to change, not the Apple owner. And that's exactly what Apple is planning through the next decade.

Editorial Note: Among other suppliers of personal computers are:

Tandy Radio Shack  
California Computer Systems  
Digital Microsystems  
Texas Instruments  
Commodore, etc.

More than 100 computer dealers offer personal computers and service that keeps them working.

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anism that is fair to customers and all competitors. In 1980 the FCC proposed an interim access charge plan and initiated a joint board of federal and state regulators to study this problem.