The story behind Kaypro – San Diego's early PCs

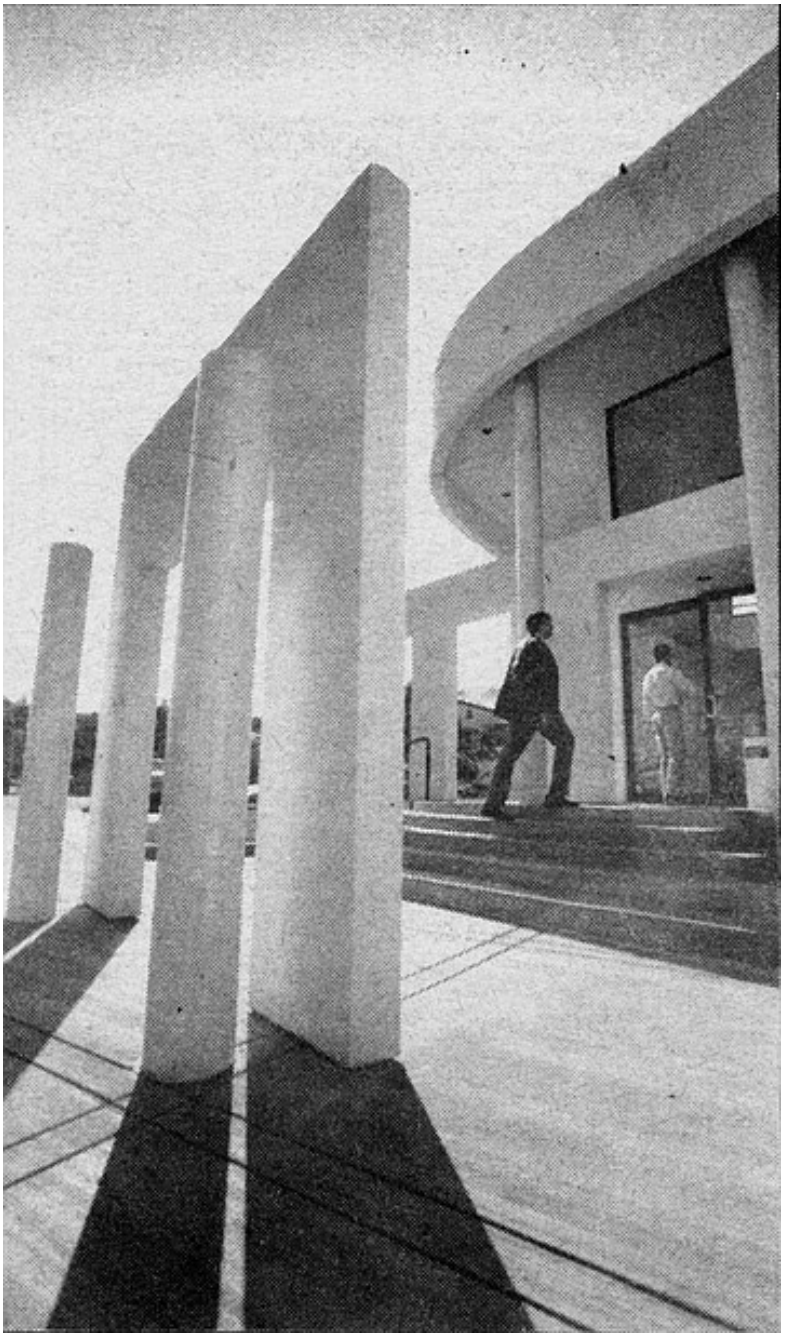
Andy Kay's permissive management

Jeannette DeWyze Jan. 19, 1984

Andy Kay reasoned that a complete microcomputer could be designed to fit into one compact

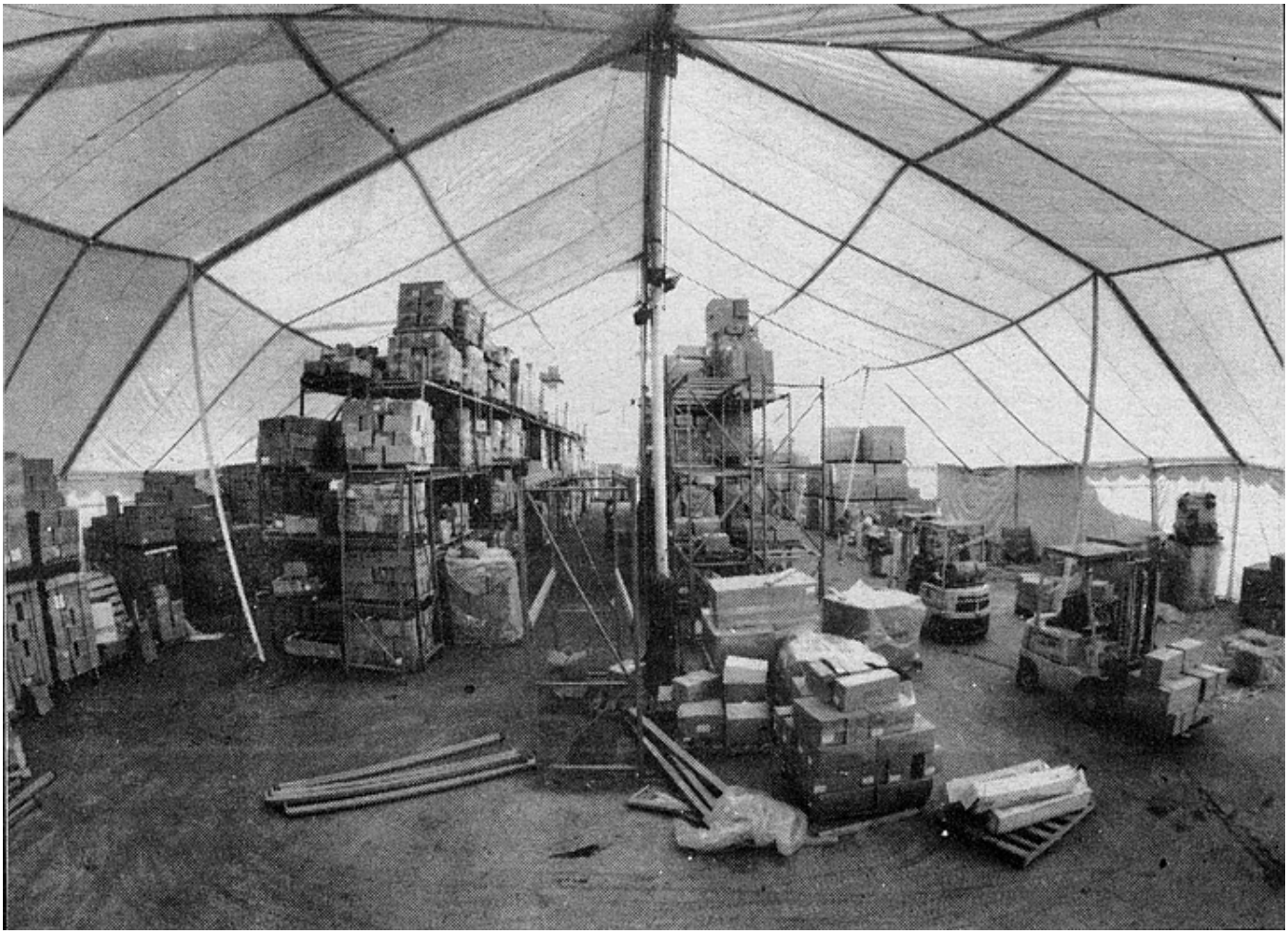
box the size of a portable sewing machine.

Andy Kay is a man who has a second chance at greatness. Up in Solana Beach he is building little “personal computers’’ called Kaypros, which today rank among the most popular microcomputers in the country and which already have earned Kay millions. But instantaneous profits are almost commonplace in the computer industry; the real challenge that confronts Kay — and the opportunity he has now — is to take his computermaking company (the only such firm in San Diego County) and to build it into a truly great business success, an enterprise worthy of being mentioned in the same breath with IBM, a household word. Once before, twenty-five years ago, big success came within his grasp and ... he blew it. It won’t happen again, he vows.



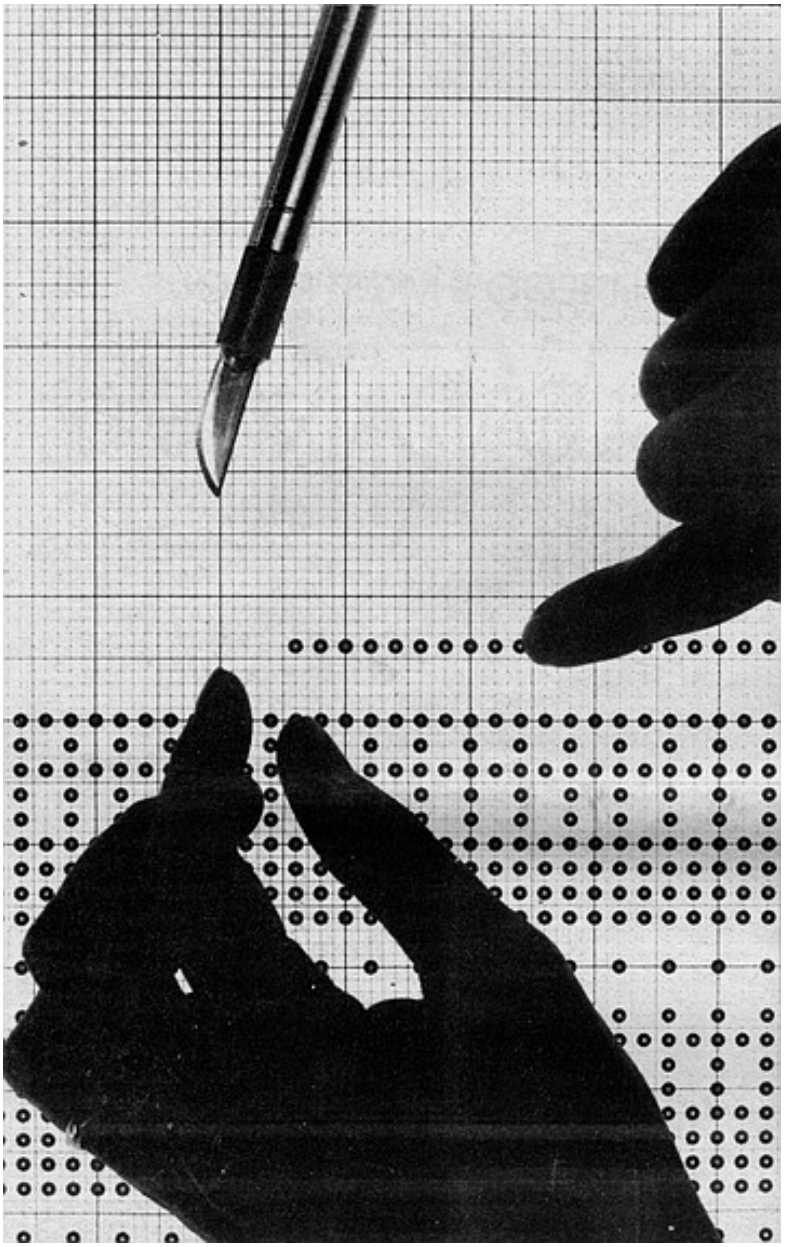
Kaypro offices in Solana Beach

Kay is such an amiable man, a man so favored by fortune that it's tempting to accept his hopeful scenario on faith. At sixty-five, he wears his age as if the years were somehow discounted, as if they had cost him less. A little over five foot seven, he weighs exactly the same today (131 pounds) that he did in 1936 when he left his home in New Jersey to attend the Massachusetts Institute of Technology. He's a man who smiles with his whole face: mouth wide, eyebrows lifted into inverted Vs, cheeks deeply furrowed with laugh lines.



The tent and a fleet of sixty storage trailers hold completed computers and the electronic components from which they are built.

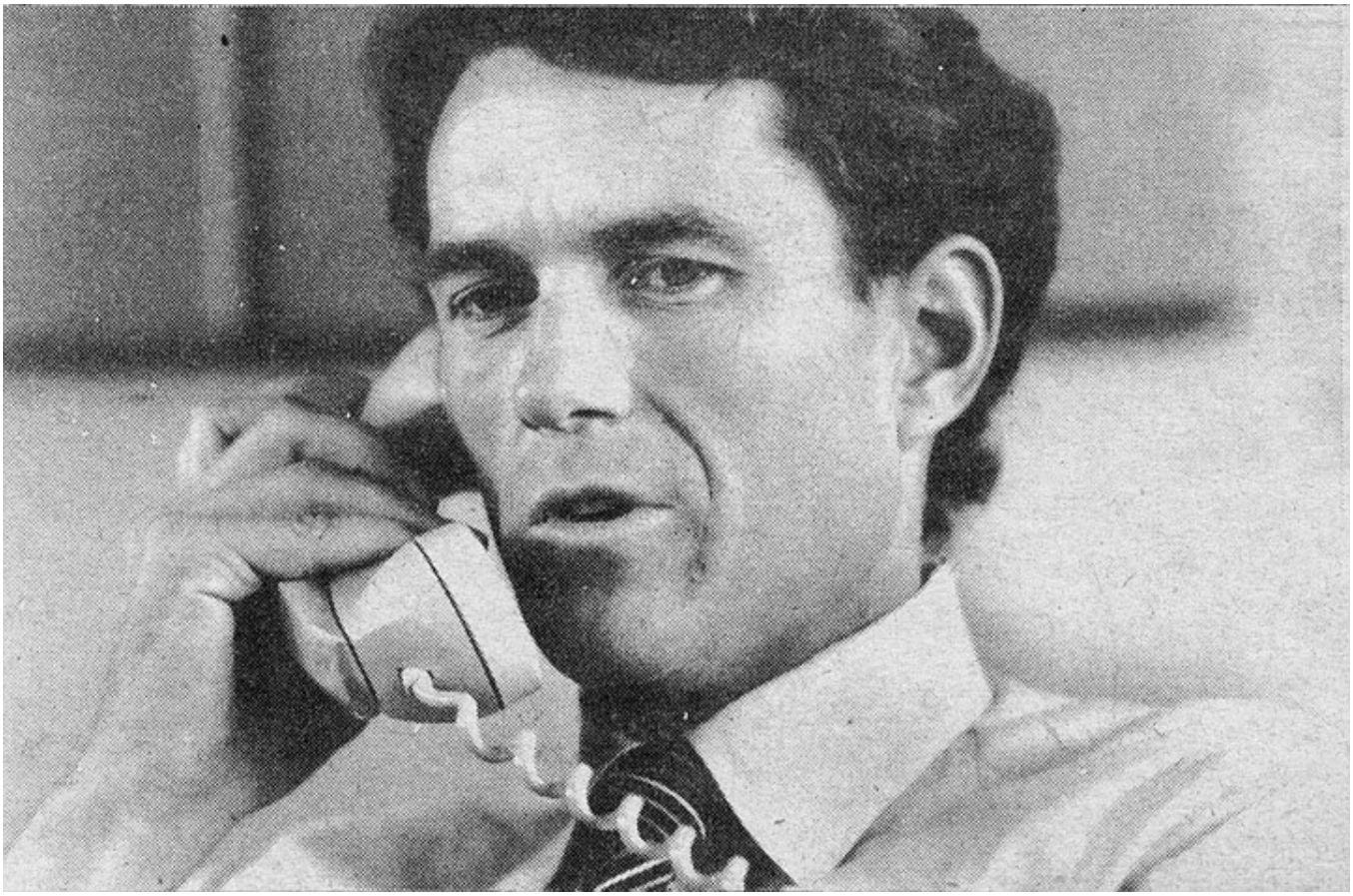
He's also a man who places great value on a good vocabulary, and who has worked hard to enlarge his own if he now knows all the multisyllabic words, he doesn't use them gratuitously. On the contrary, there's still a bluntness, a touch of pugnacity to his speech which somehow hints at the fact that his parents were immigrants who came to America from the Carpathian Mountains in Eastern Europe, and then labored as textile workers, and lived in the poorest section of Clifton, New Jersey. Kay doesn't assume any intellectual airs, yet he is "deeply interested in ideas,'' asserts Dick Farson, founder of the Western Behavioral Sciences Institute, a La Jolla think tank. "He's an intellectual in that sense.''



Printed-circuit board design. Kaypro workers solder the chessboard-size printed circuit boards and attach the various chips and other components to the boards.

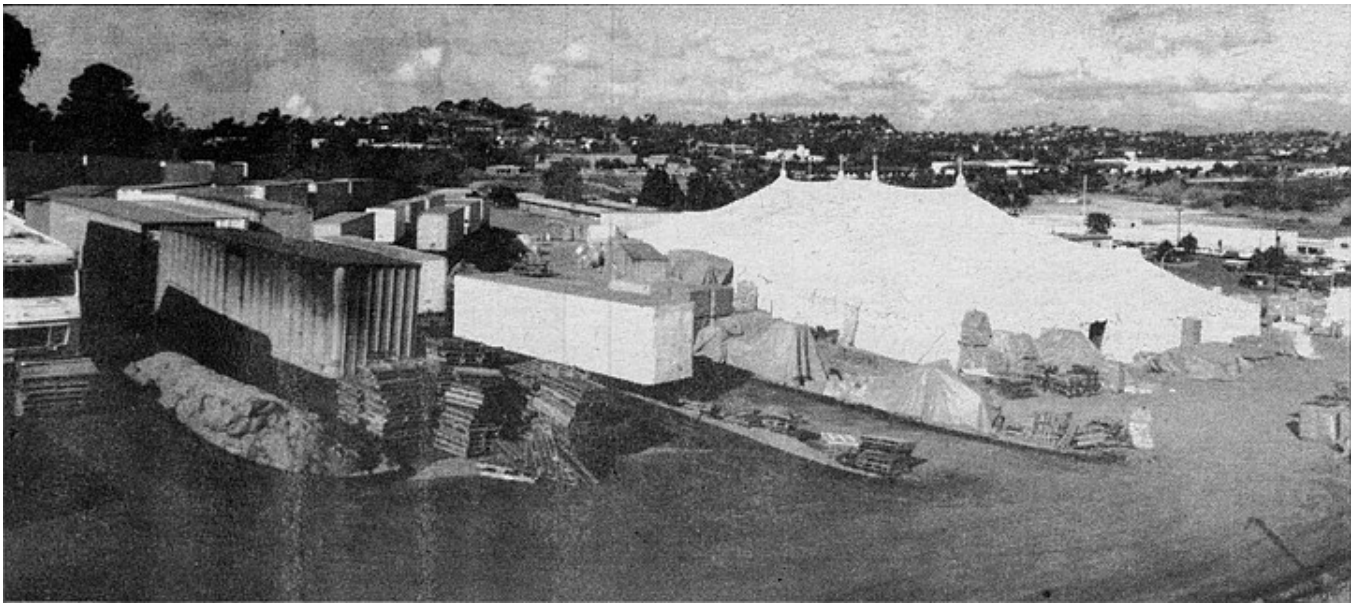
Farson got to know Kay about 1957, back in the days when Kay first seemed on the brink of major business success. At the age of thirty-three, after working as an engineer for several other firms, Kay had started his own business in Del Mar, naming it Non-Linear Systems. (A “non-linear system,’’ in engineering parlance, is one in which elements interact in ways which are complex and difficult to predict.) Almost immediately, he invented a much better electrical voltmeter than the world had seen before. Whereas existing voltmeters registered electrical voltage by

having a needle swing across a numbered scale that was difficult to read precisely, Kay built a tool which simply displayed the voltage as a number that could be read at a glance. It represented one of the first uses of digital technology, and Kay became known as the "father of the digital revolution.''



Instead of the company bringing in professional managers, most of the direction of it has fallen to David Kay.

The achievement also brought his company swift growth. Within five years Kay was employing 150 people and annually selling more than five million dollars from a line of almost forty different electronic measuring instruments. Today he boasts that Hewlett-Packard, the electrical industry giant, tried three times to enter the digital voltmeter business before it actually succeeded. Farson says, "His [Kay's] product was so good that it just dominated the market. And I think that success led him to feel he could do a lot of things."



The 40,000-square-foot storage facility which the Kays are planning to build on the site won't be completed until April.

Early on, it had become clear that Andy Kay was interested in more than simply watching his profit margin. At his location in the San Dieguito River Valley, site of an old World War II blimp station, Kay soon was tinkering with improvements to his employees' working environment. He built long, narrow building additions, some situated east-and-west, other north-and-south, in an experiment to see which took best advantage of the ventilating sea breezes. He hired a string of illustrious management consultants — Farson and many others — to counsel him on how further to hone his managerial expertise. Kay devoured all their theories and pondered them and gradually he began contemplating a really radical experiment. One day in May of 1960, he assembled hjs staff on the lawn and sprung this on them: Non-Linear Systems, pioneer in the digital world, would now lead the way to a brave new world of enlightened capitalism . . Gone would be all time clocks! Banished were all salesmen's expense accounts! Down would come the old-style assembly line! In their place "participative management" would have a chance to flower.

Workers commonly rotate from one job to another until each person could construct the whole board himself.

More specifically, as part of the experiment, Kay gave his sales people blanket expense allowances along with encouragement to pocket whatever they could save. He reorganized his team of executives according to function, doling out such responsibilities as “innovation” and “public responsibility.” The most dramatic changes, however, took place in the production department, where Kay put all the workers on salary, paying them sixty cents an hour more than the prevailing wage, and throwing out all penalties for illness and lateness. In place of the discarded assembly line, he created sixteen autonomous “production teams” consisting of six or seven members each, with each team free to work any way the members chose; some teams might function like miniature assembly lines, for example, while others might allow each team member to build the entire instrument.

Everyone — the public, the press, the business community — yearns for such experiments to succeed, Dick Farson comments today. Given that, when Non-Linear Systems weathered an initial three months of disrupted production and began to boast of higher productivity under the new structure, it's not surprising that Andy Kay soon enjoyed gratifying attention. By 1963 Vance Packard told America about the Del Mar firm in a *Reader's Digest* article entitled, "A Chance for Everyone to Grow." Calling Non- Linear Systems' experiment "revolutionary," Packard gushed that Kay had thrown out "a host of assumptions which businessmen had been making for fifty years about the nature of man as an employee ' ' — and as a result had seen sales double, labor costs drop in half, turnover shrink to a quarter of the national average, and customer complaints drop by ninety percent.

Two years later, however, *Business Week* sounded a few disquieting notes. By then, Kay's small, experimental "engineering teams" had reverted back to the more traditional pool of engineers and a centralized drafting department, and in the sales department, expense accounts had been reinstituted. Also, the company's executives had reclaimed their more traditional titles after ' 'even a heavy dose of sensitivity training" had failed to dispel their unease with the vaguer job definitions. But the *Business Week* article still touted the greater flexibility, higher productivity, and better quality work produced by the unorthodox manufacturing teams. Ripples from Non-Linear System's experiment spread into academe: MIT management professor Douglas McGregor praised the company in *The Professional Manager*, and psychologist Abraham Maslow, who spent four months observing Non-Linear Systems and researching business administration, kept a journal about his findings which later developed into a book called *Eupsychian Management*.

And yet by the end of the Sixties, the articles stopped appearing. An observant reporter who had remained on the scene through the end of the decade might have noted ominous warnings of trouble. Kay himself tells

how one day a professor from the UCLA school of business administration came down to visit Non-Linear Systems, and while he and Kay were alone in one of the special rooms designated for the sensitivity groups, Kay happened to ask him, "Bob, have any other companies of roughly the same size done things to the degree that I have?"

The professor said yes, two others that he knew of.

"And what happened to them?" Kay probed.

"They're not doing it anymore."

"Why?"

Another long silence, and then, "Don't rightly know."

"Well, I found out," Kay says today. "It was very expensive for me to find out. Extremely expensive. To give you an example of how expensive it was, I believe I could have gotten eight million dollars for the company in 1961 or 1962 from ITT. They were coming around and wanted to buy the place. I turned it down." By 1970 Kay was offered half a million dollars for the company. ''Now, this is the reverse of growth. I was going downhill."

What had happened? Toward the end of the 1960s, Kay had seen his sales begin to sag; he says Maslow had warned him that the permissive management worked best in a fast-growth situation, and that it "would not work particularly well in a desperate situation where people were beatin ' each other on the head for the last morsel of food that was around." Far more important, however, Kay indicates, is that he had stopped paying attention to why the sales were sagging, to what trends were occurring in his industry, to long-range planning. "I was spending practically all my time thinking about management and experimenting with different things, and really feeling that that was managing the company. It wasn't. It was only *talking* about managing the company. The whole thing was an

experiment; a laboratory. . . . Now if the business had been a consulting firm that did this sort of thing for other companies, showing 'em how to do it, terrific. But if it was going to put out digital voltmeters or computers or shoes or whatever, we would have done better to get on with the business."

All during the time Kay was distracted with the noble experiments, his business had depended heavily on the aerospace industry. All the missiles that America sent into space during the Sixties contained thousands upon thousands of electrical circuits, all of which needed to be tested with voltmeters. Then the aerospace industry suddenly collapsed in 1970, and Kay simply wasn't prepared for the crash; he hadn't come up with new products for the changing market. Ultimately, he watched his business shrink to $1.6 million a year, down from a high of more than six million dollars.

As a result, throughout the Seventies he learned such gritty business lessons as how to operate with a minimal crew. He fired his financial controller and instead kept personal tabs on the company's books. He leased out most of the office space in the quarters he had built in 1968 when he had moved the company to a site off Stevens Avenue in Solana Beach. He changed his line of products to include small, inexpensive digital voltmeters which could be used by repairmen and electronics hobbyists, as well as oscilloscopes and other sundry instruments. And all the time,"I was looking constantly for a product that would be wanted by lots of people." He was prepared to wait fifty years to find it.

Kay says he had thought about the computer business way back in the late Sixties and early Seventies when so- called minicomputers were beginning to become very popular. But although minicomputers were a smaller, cheaper generation of machine than the room-size calculating monsters of the early Sixties, they still cost between $15,000 and $50,000 apiece. To develop and market one would have required a great deal of

both technological expertise and money, at a time when Kay was showing losses of up to a half million dollars a year. Besides, Kay adds, the main customers for minicomputers were scientists and engineers working for large public and private organizations — ''people spending other people's money" to buy the machines.

Those years of selling digital voltmeters to industries and to the military had acquainted Kay all too well with this type of customer — people not overly concerned with getting the best deal on their purchases, or worse, swayed by sales touches such as free cases of Scotch. Kay still gripes about being told that one of his problems was an unwillingness to take people out to lunch. "Lunch is only the beginning. It's lunches, dinners, spend time with 'em. Why should I waste *my life* talking to the likes of that kind of character?" Instead of lunches, Kay sees himself as always having offered high quality at a low cost, so it always rankled to hear of some government contractor buying a competitor's higher- priced product based solely on the old saw that "you get what you pay for."

By the Seventies, Kay desired to produce something he could sell to small business people, folks who could appreciate Kay's competitive advantage: offering good value for the money. He tinkered with building a vocabulary-building teaching machine, but never successfully marketed it. In the meantime, another development took place in the computer industry: the invention of the "microprocessor chip," a tiny wafer of silicon that could be inexpensively mass produced and that could perform all the same logic functions previously done only by a large printed circuit board. Soon a parade of small companies was using microprocessors to build desk-size "microcomputers" which could do as much as thp larger models had — at a price low enough to be bought by individuals. By 1979 Kay's son-in-law, North County architect Michael Batter, had bought one of them — an Apple II — to use in his business, and Kay's thoughts again swung back to the computer business.

Kay says he spent about a year wondering if the fledgling microcomputer market had grown big enough to warrant his attempting to develop a product, and by early 1981 all his doubts had vanished. A clear mental picture of the type of product he wanted to develop also had formed in Kay's mind by then. He had seen how his son-in- law liked to use his Apple both at home and at his office, even though the Apple was a cumbersome assembly of three separate pieces of equipment (a keyboard, a monitor, and a disk drive) connected by wires, all of which had to be unplugged whenever the system was moved. It was clunky. But a complete microcomputer *could* be designed to fit into one compact box the size of a portable sewing machine, Kay reasoned. In the spring of 1981, he committed Non-Linear Systems to doing this, borrowing against his personal real estate holdings to finance the development. He calculated that sales of such a product (primarily to engineers, he assumed) would add at least five million dollars a year to the company's profits, "and hopefully, ten."

The task of designing such a computer never shaped up as a particularly difficult one, Kay says. "Some of our digital voltmeters were much more complicated and much tougher to develop," he says. The portable micro-computer design was "essentially cookbook,'' says Kay's thirty-eight-year-old son David, who's now in charge of sales and marketing for the business. David explains, "Anybody can buy the [microprocessor] chip. Then it's a matter of taking that chip, makin' a PC [printed circuit] board that works . . . putting it in a box . . . then getting that product out the door just like you would with any other product. Thee was never any question of whether we would be able to do it." David says probably the toughest part of the job was buying all the components cheaply, but the Kay's familiarity with the electronics industry gave them an advantage in that. As in the past, Non-Linear Systems' strategy was to offer its product for a startlingly low price, figuring to make money on volume. "We knew we had to sell 12,000 units a year in order to break even," David says.

Very soon they were bolstered in their hope of selling that much when Adam Osborne, the glib Bay Area publisher-turned-computer-maker, in July of 1981 intfoduced a portable unit remarkably close to what Andy Kay's firm was working on. Yet rather than disturbing the Kays, all the Osbornegenerated ballyhoo only made them more optimistic about the number of their own portables they would be able to sell. They planned to match the Osborne's price of $1795, plus the Kays thought their machine would have several obvious advantages, and when David finally took a prototype up to a San Francisco computer fair held in March of 1982, their hunches were confirmed. "We kind of felt like we were at a jewelry auction and we had bars of gold, except our gold was selling at half of what everybody else was. charging, so people were coming up and saying, 'Yeah, I'll take some!' "

Like Osborne, the Kays gave buyers not just the portable computer but also a whole bundle of expensive programs with which to make the computer do things (like typing and financial planning)— all for the $1795 price. But the Kays' product, first called a "Kaycomp" and later changed to "Kaypro" because of a conflict with another company's product, also claimed two dramatic advantages over the Osborne. First, the Kaypro had a much bigger display screen, a nine- inch-diagonal that could show eighty characters on each line. Osborne's tiny monitor, by comparison, was less than four inches wide and could show only fifty-two typewritten characters, less than the width of a normal letter — a constraint which made typing very cumbersome. Another major advantage of the Kaypro w as its use of discs that could store twice as many words as those accepted by the competing portable.

A lack of all the clamorous attention which the strutting Osborne had drummed up for his product seemed to make little difference when the first Kaypros were shipped from the Solana Beach facility in June of 1982. "From the very beginning the business threw off cash," Andy Kay asserts. "Do you know what that means? I didn't have to go out and get additional

money while the company grew to fifteen times its size in one year ... We were growing fifty percent a. month for seven

1 expected because the sales expenses were lower. . . . We couldn't hire people fast enough in the sales department to spend the money in a proportion to the rate at which the units were being produced and shipped." Dumbfounded, Kay revised his estimate of how many machines the company would sell in the 1982-83 fiscal year. Instead of ten million dollars' worth, as he had originally dreamed about, or forty million, as he had started predicting after the San Francisco computer fair, Kay began telling reporters that he thought the firm might well hit the $100 million mark. *Forbes*, *Popular Science*, *Business Week* and other national news media once again turned their attention to Solana Beach, and despite a crash in the market for high- technology stocks, Kaypro still raised $40 million when it floated its first stock issue last August.

Today anyone who didn't already know about Kaypro's wildly dramatic growth probably could guess it from a visit to the company's Solana Beach plant. There it's almost difficult to discern the original manufacturing campus Kay designed back in 1967. When he bought twenty-one acres a few blocks west of Interstate 5, Kay had liked the way the land sloped upward to the west and the way the ocean breeze spilled over the rise. He wanted to retain the long narrow building design he had come up with in Del Mar and he also disliked the idea of leveling the land with a bulldozer. His solution was to create in the hillside four parallel terraces, each containing a building sixteen feet wide by 550 feet long, so "you could stand in the outside hallway in front of one building and look right over the other (buildings] into the valley beyond." It was the ultimate human-centered factory, where each worker toiled in a room open on two sides to the sun and fresh air.

Today the long narrow structures are still there, though Kay has sold all but eleven acres of the land. But competing for the attention of anyone

who turns off Stevens Avenue and drives the short block up to the plant is a giant white circus tent erected on the hill at the end of the street. The tent and a fleet of sixty storage trailers hold millions of dollars worth of both completed computers and the electronic components from which they are built; of course all this equipment should be in a warehouse, but the 40,000- square-foot facility which the Kays are planning to build on the site won't be completed until April.

Also obscuring Kay's spare but functional building tiers is a brand-new reception area designed by his daughter Janice and her husband (who run the Batter-Kay architectural firm). It's the perfect facade for a nouveau-riche, high-tech whiz-corp like Kaypro today (the company name was changed from Non-Linear Systems last June). Snowy white, the fagade is all ninety-degree angles and nonfunctional columns and freestanding wall extensions which make it look a little like a child's cardboard cutout.

Even inside the heart of the complex it's hard to see the buildings themselves, obscured as they are by mountains of boxed computers and cardboard cartons of components and carts containing tray upon tray of glittering metal components, blocking the cement walkways between the buildings, piled up on the grass, everywhere. Between them run rivulets of Kaypro employees, who seem for the most part young, animated, casually dressed. There's no dress code here, Kay is proud to say, nor are there many written policies of any kind, even though the work force has grown in the last year and a half from about eighty to close to 600 employees. None of those people punches a time clock, and when one of the members of Kaypro's small "production teams" wants to take a break, he or she need not wait for some sanctioning whistle. A favorite gathering spot is the company-subsidized salad and juice bar, a reflection of Kay's crusading belief in the link between good health and nutrition.

In so many ways — in the absence of any traditional assembly line, in the concern for a team-spirited work force — the scene reminds one of Kay's

experiments of the Sixties. And for good reason: Kay says no matter what the excesses of those experiments might have cost him in the past, he's never for a moment rejected the basic lessons, i.e., that people work best in a decentralized, humane environment. In fact, he credits that management philosophy with enabling his company to handle all the growth "without destroying quality, and without creating tension." Kaypro makes for a much more impressive example of that philosophy than Non-Linear Systems ever did, Kay believes. He says even when the acclaim for what he was doing was thickest back in the Sixties, the ultimate question he always faced was how much money he was making. "And the answer was 'Not that much,' " he admits. "But now we can say, 'We're makin' a lot.' "(Recently released figures show that for the first three months of its current fiscal year Kaypro's sales totaled $29.2 million, with net earnings of $2.8 million.)

He takes great pleasure in recounting how his son David recently gave a tour of the premises to a fellow who'd seen a dozen computer factories, and when they returned to David's office the man asked, "Well, where's your production facility?" He'd just *seen* it, and yet it was as if he had automatically disbelieved his eyes.

One can hardly fault the poor fellow. Kaypro currently has six teams building computers, with each one occupying a separate sixteen-byforty-foot section of the second-tier building, and it does seem surprising that 8000 to 10,000 computers a month, the current production rate, could flow from such small, cozy spaces. Twelve to fourteen people make up each team, and they seem to work with alacrity, each member handling a bafflingly complex series of tasks. It takes a while to perceive the order in their movements, but gradually a pattern emerges. Over on the workbench next to one bank of windows, two young men hustle to fasten pre-assembled plastic keyboards into the panels that will house them. Across the room, another four men start with the empty shells that will house the main body of the computers; into these they plug in wires,

circuit boards, switches, and the dozens of other parts necessary to construct the functional machine. Each time this group completes a set of the computers, they hoist them onto yet another workbench, where a middle-aged woman plugs each machine into a power source, inserts a test program, and checks to see if each computer is functioning properly. When she ascertains this, she carries the computers to an adjoining "burn-in" room for a twenty-four- hour testing sequence. At the same time, computers that have just successfully completed their burn-in move to the workbench attended to by another two men who will complete the case assembly, touch up paint, attach the proper stickers, and finally bag and box them.

Although the teams thus reflect some level of specialization, Kaypro boasts that on different days, those same workers might very well be handling different jobs. "Everyone in the room knows how to build the computer from scratch," David Kay explains. The same basic arrangement also prevails in the separate areas where Kaypro workers solder the chessboard-size printed circuit boards and attach the various chips and other components to the boards; workers commonly rotate from one job to another until each person could construct the whole board himself. "Where we need you, that's where you get to go,'' declares Pam Silva, the sixteen-year veteran in charge of all Kaypro's production areas. Silva says virtually none of the members of her ethnically mixed crew had any electronics experience before coming to Kaypro, a lack of knowledge which she prefers because then the workers don't have to unlearn less flexible ways of doing things. At the same time, David Kay says he doesn't think Kaypro spends much more money on employee training than do more traditional manufacturers. "Just by being in a room and seeing the thing come out the door, finished, has got to rub off on you. If it's a mile down the road, you don't even know what it is that you 're making! You 're just putting this part in this box." David sees the primary strength of the team approach as being its "agility." He asserts, "Whatever long-term efficiency you might gain by having a long assembly line with everyone

doing one little thing, you lose in changing the line and making a change in all the support people."

Andy Kay claims he's even had some independent confirmation that his manufacturing methods are objectively superior to at least one competitor. It came from a former Apple Computer employee who was able to tell him how much that company spends building computers in a fancy modern assembly line in Texas; Kay was gratified to hear that Kaypro's costs for building its computers in the small groups were forty percent of Apple's costs, "and we make a more complex unit."

But here's the skeptical response to Kaypro's methods: "When you look at these things, it turns out that what was a bold and noble experiment is mainly good for making Rolls Royces and Saabs," says Peter McWilliams, a computer writer whose weekly columns are syndicated in more than seventy newspapers nationwide. "The hard fact is that the modern assembly line is still the best way for making most things." McWilliams adds that if Kaypro were "turning out machines that had a higher reliability factor than anyone else in the country," the company's methods would be more impressive, but in fact a series of reliability problems has bedeviled Kaypro in recent months. "I don't know how many Kaypros I've heard of being broken after a very short time," McWilliams says.

That's not the only tough assessment coming from a man who not long ago was one of Kaypro's loudest fans. "I probably have done more than any other journalist to put them on the map,' ' McWilliams says. "I was the first to review them, and lots of dealers have told me they've bought Kaypros because of me." In fact, McWilliams says he still thinks Kaypro's machines are "fine," but at the same time he thinks the firm is in desperate need of professional management — 'executives who have been trained to run a large corporation. McWilliams says he told that to the Kay family four or five months ago. But instead of the company bringing in professional managers, most of the direction of it has fallen to David Kay, who ran a tiny

windmill-building company before coming to work for his family's business in 1980. Now McWilliams maintains that "everything is going through David Kay — everything. And when that happens, people bum out and then they start making bad decisions." Moreover, once a bad decision is set in motion in the small-computer industry, it can be fearfully hard to stop, McWilliams says.

This is an industry in which millions can be made in a hurry, but they also can be lost just as dramatically. One of the most recent and sobering examples was the bankruptcy of the Osborne Computer Corporation last September. It seemed as though one moment Adam Osborne and his employees were preening before the *Sixty Minutes* cameras, boasting of their newfound wealth, and almost the next moment those same employees were lined up at the unemployment counter. Not far from the Bay Area site of Osborne's shattered glory, Apple Computer, for several years the industry leader, is now widely perceived to be faltering, with flattening sales and a persistent inability to develop any new products that sell well. One industry analyst estimates that there are about 200 manufacturers of personal computers, of which about fifty got started just last year.

Given those circumstances, McWilliams says he hasn't yet seen Kaypro make any fatal decisions. But McWilliams points to disturbing portents. One is the trouble which the company has had with the Kaypro 10, a more expensive computer that can store up to 3000 pages of text, compared to the 200 pages that can be held in the memory of the first Kaypro model. Last October David Kay blamed production problems with the Kaypro 10 for the fact that the company only logged $75 million worth of sales in 1982-83, rather than the $ 100 million which had been predicted.

Since then Kaypro has found new suppliers for the parts that were causing breakdowns and also has instituted more stringent testing. But McWilliams says there's still the issue of "IBM-compatibility." This is the

phrase which, within the last year or so, was probably uttered more often than any other by America's computer salesmen. It's an imprecise term. In the purest sense, an IBM-compatible microcomputer is one which functions *exactly* like the IBM Personal Computer (known as the IBM PC). In its loosest sense, the phrase means the ability of a non-IBM microcomputer to use the same programs that run on the IBM PC (although the keyboards might function differently and other modifications might be required). The issue of IBM compatibility has become increasingly urgent as the IBM PC, introduced in November of 1981, has acquired the biggest share of the personal-computer market. The thinking is that henceforth all hot new com- puterprograms will be written to work on the IBM PC — and thus even if you prefer to spend $1795 for a Kaypro instead of $3800 or so for the IBM machine, you still will want your Kaypro to run those hot programs. Thus it must be "IBM-compatible." However, although Kaypro announced in October that it had come up with an attachment to achieve such compatibility, McWilliams says the attachment only partially succeeds at that; while users of the modified Kaypro can run some programs written for IBM machines, they still can't use any programs that feature computer graphics, for example, a significant drawback.

But more than anything, McWilliams seems disturbed by Kaypro's attitude, an attitude the computer critic believes was exemplified at the gigantic computer dealers' convention held in Las Vegas the week after Thanksgiving. McWilliams says the talk of the show was the full-page "message to everyone who still wants to be in the computer business three years from now," which David Kay ran in the exposition newspaper. "It was a very preachy, didactic sermon [about what personal-computer buyers want] from someone who's been making computers for a year and a half to everyone else in the computer industry," McWilliams says. "It was just an embarrassment. . . . The mantle of arrogance that Osborne once wore seems to have settled on them."

Is it arrogance, dangerously blinding arrogance, that the Kays are manifesting? An alternative explanation is that the Kays have seen their company break many rules which so-called experts have declared to be inviolable, and the experience has filled them with a well- justified confidence in their own judgment. Andy Kay still sounds upset by the reaction from investment bankers across the country to whom he and David talked this summer in preparation for the public stock offering. He says when the bankers saw that he spent only $250,000 to $300,000 on the engineering for the first Kaypro they wrinkled their noses and thought *there had to he something wrong with Kaypro's computers*. "It [the development money] was one-tenth of what other people were spending, and Wall Street declared that it was simply impossible, that there had to be something funny." Kay laughs sourly and recalls the one financier who asked him if he wasn't aware that he needed to be spending twenty percent of his budget on advertising and ten percent on research and development. "I said, 'Yeah, I used to know that but I don't know it anymore!"

It's a pattern. When Kay was asked how many square feet of manufacturing space he has, and how much he gets out of that space, he replied that on three shifts he can get 25,000 computers a month, worth about $30 to $35 million a month. "That's a third of a billion a year from 35,000 square feet, plus some warehouse space. They thought I was mad!" In contrast, Kay says one of his competitors, a firm called Compaq, which currently is doing about the same amount of business as Kaypro, has 200,000 square feet for manufacturing and has plans for expansion.

Or when Kay turns the tables and asks visitors who know something about accounting how many people they think he should have in Kaypro's bookkeeping department, he says he usually hears estimates of thirty to sixty. He has fourteen. A lesson from the lean years, he says. "I learned not to overstaff. I don't have very many [white-collar workers] around and the work's gotta get done, so they do it. Fall to it with a will! If you have fifteen

people to do five people's work, what happens? All fifteen look busy, don't they? They divide the work up some way." Still the visitors express amazement over how Kay can keep control over all the financial activity. ''I say, what do you mean by control? When I tell 'em, 'Well, I watch the business,' that's not good enough. They think it's gotta happen automatically without me. I say, 'Why without me? I'm here. Gettin' paid.'"

So the Kays are used to dumbfounding the experts, and today one of the expert opinions they scoff at most vehemently is the Legend of the Coming Small-Computer Shake-out. According to it, so many small-computer makers have now sprung up that disaster is imminent. The market can't support that number, so most will have to disappear. (Of the 200 or so in business now, maybe thirty will survive, the *Wall Street Journal* recently quoted one analyst as predicting.) Since IBM is probably the only company that *everyone* agrees will survive whatever happens, all such shake-out talk tends to help IBM, which infuriates the Kay family. David says, ''What's unfortunate is that the people in the media [by airing the shake-out speculation] have been inadvertently helping a multinational corporation dominate more and more of the world with its high- priced technology."

Instead both he and his father reject the inevitability of any ''shake-out" that would force most computer makers out of business. The Kays do think it likely that a handful of manufacturers will wind up producing the bulk of small computers, but the rest of the manufacturers probably will survive and even prosper by finding and catering to tiny, specialized applications for their machines. If this prediction about the future of the industry is correct, then Kaypro looks likely to continue making computers for a long time to come; the only question is whether the firm will be one of the giants or one of many minor competitors. And it's difficult enough to determine Kaypro's status in that regard right now, let alone in the future. One of the top industry analysts, Texas-based Future Computing, for example, says Kaypro now has about two percent of the personal-

computer market — respectable but certainly small compared to IBM's twenty-six percent or Apple's twenty-one percent. However, a different analyst, Infocorp of Cupertino, disputes the Future Computing figure and says Kaypro has six percent of the market and is definitely among the industry's top ten.

In any case, Andy Kay sniffs that he ''doesn't see the relevance" of talking about the possible shake-out. ''What's the point of dwelling on that. . . ? Are they *warning* me?" he asks.

People in the small-computer industry have no idea what real competition is, Kay declares. The individuals moaning about a coming competitive squeeze "are MBAs who have never worked in a factory, who don't know any other industry, and who learned what they know about the computer industry from each other! Talk about competition when you're scramblin' hard to sell a lousy four million dollars' worth of instruments, and you're trying very hard to think of a good new product, like one that might sell a million dollars a year. And here, hey, we make one thing that's *much* simpler, and the first year out we collect orders for $75 million? You call that competition?"

It's enough to make a man who has survived real competition, if not arrogant, at least supremely confident, confident enough to answer that five years from now he'd like to see Kaypro selling five billion dollars' worth of products per year. If that's a wildly unrealistic aspiration (equal to almost seventy times as much as Kaypro sold last year), David Kay sounds very serious when he says the company's goal is to record close to a billion dollars in sales by the end of 1985, which not only would require the company to grow almost as much over the next two years as it did in the past two, but would indeed place Kaypro in the ranks of American megabusiness.

Looking at the opportunity before him this time, Andy Kay seems to have given a lot of thought to the question of whether he can now succeed

when he didn't before. He says one factor that has changed in the intervening years concerns his own aptitudes. Years ago Kay discovered the work of Johnson O'Connor, a Harvard-trained engineer who became interested in measuring people's abilities and consequently developed the field of aptitude testing in this country. Back in the 1920s, one of O'Connor's major discoveries was that a startling correlation exists between highly successful people and a rich and extensive vocabulary. That's not to say that vocabulary is the only component of success, Kay explains, but that it is an indispensible component. And yet when Kay had his own aptitude tested back in the Fifties, he found that his general English vocabulary was only so-so, certainly "not what it should have been for me to utilize my abilities."

It took him a long time to get around to correcting that, but Kay says that by the late Sixties he constructed a vocabulary-building machine based on principles developed by O'Connor. Both Kay and his wife then used the machine to enlarge their lexicons and Kay estimates that he learned between 5000 and 7000 new words. (To put that in perspective, he says O'Connor figured there are 30,000 to 35,000 basic nontechnical words in English, of which the average working man might know only 10,000 to 11,000.) Kay says the extra words have helped him significantly. He says it's not necessarily a matter of "knowing long words or difficult and arcane words," but instead, of being comfortable talking to people from factory workers to banking executives. "I can speak to people at the different levels of abstraction that are required," he says. A lack of words no longer limits him.

He says he also lacked another crucial element in the past. He started Non-Linear Systems primarily "to have something to do," not particularly because he wanted to make a lot of money. But Kay was jolted one day back in the Sixties in a sensitivity group when he mentioned his lack of interest in making lots of money, and another member of the group told him he was immature. "That was his response, nothing complimentary,"

Kay says. “But I took it under advisement, and in a sense he was right. If I don’t have the goal of making money in the business, which is a measure of success, what am I about? This time I have the goal.”

He has the goal, he says, because he believes he has the aptitude to run a really huge business, and one thing he learned from Abraham Maslow was that unfulfilled aptitudes are very frustrating. So now he has the vocabulary and the motivation. He’s working to maintain his good health through diet and exercise. And he also has that rich pool of experience. “I find when I make up a spread sheet on the computer with profit-and-loss statements and balance sheets and all that, I memorize the things in nothin ′ flat. It’s like the way musicians memorize notes after playing ′em a few times. And I find very few people can follow me with that — very few, even accountants. They don’t live with it that way. The symbols are not just symbols; they represent a reality I’m familiar with, a physical reality.

“I’ve found, lo and behold, I seem to know quite a bit about running a business — finally. It’s starting to come naturally to me,” he says with pleasure. “I don’t have to think about it.”