The Final Days

Autodesk, Inc. Information Letter # 14

by John Walker

Revision 24 — April 1, 1991

Here on the level sand
Between the sea and land,
What shall I build or write
Against the fall of night?
Tell me what runes to grave
That hold the bursting wave,
Or bastions to design
For longer date than mine.
—A. E. Housman, 1936

Prologue: The Quaint Eighties

I've noticed something odd over the last few months. Whenever I read something written between 1982 and 1988, or reflect upon those years, they seem increasingly distant, foreign, almost *quaint*. Quaint in the sense the Eisenhower years seemed by 1968, or the earnest hopes of the early sixties from the depths of the mid-seventies. Who would have imagined a few years ago that in the first months of 1991 the news would be filled with a war in which an alliance of the Soviet Union, Syria, Britain, France, Egypt, and the United States used high-tech weapons to flatten an Arab country, of the reorganisation of Europe around a united Germany exporting, among other things, rubble from the Berlin Wall and curios of the departing Red Army, and of a collapsing Soviet Union which even Russia *(Russia!)* was considering abandoning, careening into a crisis of unknowable magnitude and consequences, spurring sober observers to fear "a nuclear Beirut."

If the pace of change in the world seems breathtakingly fast and ever-accelerating, developments in our own software industry are even more rapid and revolutionary. Often it seems like the pressing concerns of six or twelve months ago are no more relevant to our current priorities than the Wars of the Spanish Succession or the controversy over N-rays. Compounded exponential growth is thrilling to experience and pays well, but it demands of those who would prosper by it the ability to make ever larger adaptations with less and less time to prepare.

When a company ceases to change at the rate demanded by the industry it exists within, it finds itself rapidly left behind. Before long, its customers discover products of competitors that better meet their needs. As market share slips, sales fall, and earnings decline, the management of the standstill company asks, "What's happening? We're still doing all the things we used to do."

Surely they are, but that's no longer enough. Times have changed but they did not. Increasingly their company and its products seem like relics from the past, almost... quaint.

Introduction

I am writing to you because I am deeply concerned for the future of our company. Autodesk has been successful over the last nine years because it quickly adapted to the changes in the marketplace for its products. I believe we are embarking on another period of rapid evolution in personal computer software, one fully as significant as that ushered in by the IBM PC in 1982. That product defined the personal computer software industry as we know it. The era we're now entering holds unparalleled opportunity for companies with foresight to anticipate the transitions and position themselves to benefit, creativity to build the next generation of products, aggressive management driven to get the job done and bring it to the customers by energetic marketing, and the financial strength to accomplish all these tasks in times of economic uncertainty.

Autodesk possesses all the prerequisites to lead the next generation of the PC industry, yet it seems to have become stuck in the past, mired in bureaucracy, paralysed by unwarranted caution, and to have lost the edge of rapid and responsive product development and aggressive marketing and promotion on which the success of AutoCAD was founded.

Not only has Autodesk failed to bring the new products it needs to the market, it is allowing AutoCAD, our flagship product and the source of essentially all our revenue, to become dangerously antiquated and under-marketed to an extent that is virtually unique for a product generating sales in excess of $200 million a year.

Just as the rapid changes now underway hold great opportunity for those who exploit them, they imperil companies which fail to adapt. Among software industry leaders prior to the IBM PC, only Microsoft remained in the forefront in the 1980s. The software battlefield is littered with the corpses of companies who had a great success with one product and then neglected that product until it was eventually supplanted by a new, more imaginative product. CP/M, VisiCalc, and WordStar in the past... Lotus 1-2-3 today... and tomorrow? I believe that unless Autodesk acts immediately and decisively, effecting a rapid and comprehensive top-to-bottom change in what the company believes possible and how it goes about accomplishing its goals, AutoCAD will suffer this same fate, destroying with it all we have worked for so long and so hard, extinguishing forever the promise and opportunity that Autodesk still holds in its hands.

Background

In the early days of Autodesk, I wrote status reports on the progress of the company for employees and shareholders (who were, at the time, the same people). These papers chronicled the triumphs and disappointments, the crises and their resolutions which are part and parcel of building a company. It's been years since I brought my view of the company to you in this way; since I removed myself from management in 1988 I've been concerned primarily with software development and identifying technical directions in which the company should move, not commenting on where it was going or how effectively it was getting there.

But now I feel compelled to speak out. I believe that our company is entering a time of great peril combined with unparalleled opportunity. Regrettably, I do not believe that Autodesk's management is positioning the company to emerge from this period stronger and better equipped for future growth. Indeed, it is my opinion that their current policies place at risk everything we have achieved since 1982.

First a few words about me and my relationship to the company. As you probably know, I initiated the organisation of Autodesk, was president of the company from its inception through 1986, and chairman until 1988. Since I relinquished the rôle of chairman, I have had no involvement whatsoever in the general management of the

company. On occasion, management has sought my opinion on various matters, in the same manner they consult others with relevant experience and insights, and from time to time I have volunteered my opinion on various issues, both verbally and in writing. My view has always been one of many inputs weighed by management when reaching their decisions. Over the years I have agreed with many of their choices and disagreed with some, but all in all I felt our company was in good hands. In any case, I never doubted our senior management was doing a better job of running the company than *I* ever did when I was involved more directly.

Some people mistakenly believe I still "call the shots" in some covert fashion; that despite my repeated and sincere expressions to the contrary, somehow management either rubber-stamps my decisions or grants me veto power over their judgements. Nothing could be further from the truth; were that the case, I would certainly not be bringing these concerns to you today in this fashion. I have raised these issues that trouble me so deeply with senior management repeatedly and forcefully. My premises and the conclusions I draw from them have not been disputed. In fact, on numerous occasions, I was told action would be forthcoming to implement many of my recommendations. But nothing has happened. Well, something has happened: time has passed. And as the months and years go by, the difficulty of refitting Autodesk for the realities of a new era in the software market increases as its importance grows. Inaction in the face of a changing market and world is the chief cause of my concern for Autodesk's future. I see in it the same somnambulistic plodding to the precipice that preceded the demise of so many former leaders in the software market.

Also, let me state unambiguously that regardless of the sentiments I express herein and the direct manner in which I characteristically state my opinions, I have no desire whatsoever to see Autodesk's management removed from their jobs or to resume any rôle in management myself. What I want is for them to *act:* to act in the same way managements of other companies of similar size in comparable industries facing similar challenges act—to do what is *necessary*, not what they've come to believe is possible; to make the difficult choices they are paid to make and put the company back on the path to further growth and success. The decisions will not be easy, their implementation will not be simple, nor will the process be devoid of pain. But the alternatives are all much worse.

As you may know, for reasons largely unrelated to the matters I discuss herein, I have decided to permanently leave the United States. It was my plan to continue my work in software development at Autodesk's new software development centre in Neuchâtel Switzerland. That is still my intent, unless Autodesk responds to this message by silencing the messenger.

Finally, in this paper I will largely focus on AutoCAD, as opposed to the company's other products. First, the simple reality is that AutoCAD is where all the money comes from, and therefore developments which threaten it threaten the company. Utterly botching AutoShade, Animator, or Xanadu would be tragic, but would not bring the company down. Allowing AutoCAD to lose its leadership would. Second, the problems that I see afflicting AutoCAD are the same problems faced by the other products. For a number of years I believed that Autodesk's lack of success with new products stemmed from a dangerous fixation on AutoCAD; no other product received the attention necessary to make it a success because its near-term contribution to revenue was swamped by that of AutoCAD. Now, however, I believe that AutoCAD has suffered from the very same neglect, both in the product development resources committed to it and especially in marketing and sales aimed at expanding its market. The inaction that led to the lackluster performance of AutoSketch and AutoShade after their introduction is today threatening to destroy AutoCAD. The redirection of the company which must occur to rescue AutoCAD will benefit all our products.

It isn't possible to discuss the state of Autodesk and AutoCAD or to adequately describe the competitive risks I believe threaten our company and its products without speaking frankly of the shortcomings of AutoCAD, contrasting it with the products of other companies, and, in pointing out Autodesk's vulnerabilities, providing a

roadmap a competitor could use to mount an assault against Autodesk. I have thought long and hard about the risks of bringing such information to the attention of a wide audience; surely, given the first- and second-hand distribution of this document, copies will fall into the hands of the press and competitors. Given that the author is a founder of the company, excerpts may be used in the short term to embarrass Autodesk or to promote competitive products. I have concluded, though, that these risks are unavoidable consequences of placing the issues I discuss here on Autodesk's agenda. If Autodesk acts as I believe it must, it will quickly render impotent competition based on its prior weaknesses. If Autodesk doesn't move to remedy these shortcomings, they will soon (if not already) be sufficiently obvious that competitors won't need me to point them out, nor my guidance to draw plans to exploit them.

"The Game Has Changed"

Throughout the proposal, organisation, and early operation of Autodesk, my constant theme, repeated until I'm sure everybody was thoroughly sick of hearing it, was "the game has changed." From the perspective of 1990, the original concept and mode of operation of Autodesk seems hopelessly naïve. It would certainly be so today, were anybody foolish enough to think they could enter what is now a mature industry in so amateurish a way.

But in 1982, I used the phrase "the game has changed" to shock people into realising that even then the stakes were rapidly rising and that to build a successful software company would require funds, commitment, professionalism, and risks far in excess of what previously characterised the personal computer business. Sometimes people forget that personal computers were already six years old when the IBM PC was introduced, and that several companies had grown to $10 million per year or more manufacturing CP/M, Apple II, and other early machines. What had been, in 1977, a game into which anybody with a bright idea and a soldering iron could jump in had, by 1982, become a serious business in which millions were made and lost.

The first PC software fortunes had already been made. CP/M from Digital Research, MicroPro's WordStar, and Visicorp's VisiCalc dominated the software landscape to such an extent that some believed no opportunities remained to found new mass-market software companies.

Yet today, none of those companies commands a substantial position in the market. What happened? The game changed, but they did not. As the game changed, the stakes to stay in it grew enormously and those companies, the former leaders, failed to summon the resources they needed and the courage to deploy them. What one day looked like an utter, unassailable monopoly fully as secure as AutoCAD's grip upon the CAD market evaporated within months at the hands of competitors with products that better served the customers in the new environment. Times have changed; clear the screen; turn the page.

When the IBM PC appeared, the expectations of software customers rose rapidly. Software purchasers would no longer settle for a disc with a handwritten label, a five page manual photocopied from a dot-matrix original, or unreliability of any kind. The standards of quality, professionalism, presentation, and support all rapidly escalated, and those companies who survived were those who realised the bar had been raised and did what was necessary to continue to clear it. Indeed, the great successes of the early IBM PC era: Microsoft, Lotus, and Ashton-Tate, were the very companies that raised expectations through their own products. Since that time, standards have continued to rise and the struggle for supremacy in the mainstream business applications: word processing, spreadsheets, and databases, has largely been contested by increasing product quality, functionality, and customer service.

When major shifts occur in user expectations, dominant hardware and software platforms, and channels of distribution, companies which fail to anticipate these changes and/or react to them once they are underway are

supplanted by competitors with more foresight and willingness to act. The displacement of Digital Research by Microsoft, of VisiCalc by Lotus, and the current eclipse of 1-2-3 at the hands of Microsoft Excel are all examples of this process.

The Game Has Changed Again

It is my belief that AutoCAD as a product, and Autodesk as a company, is poised to lose its market leadership in precisely this manner. Further, I believe this event is overdue and that Autodesk is living on borrowed time provided only by the absence, as yet, of an effective competitive attack aimed at Autodesk's true weaknesses—one coherent with the emerging characteristics of the software market. Today Autodesk is king of the mountain, but it is poised precariously, waiting to be pushed off by any company that seizes the opportunity and acts decisively. One of the largest unappreciated factors in Autodesk's success has been the poor strategy and half-hearted, incompetent execution that characterised most of our competitors in the past. But betting the future of our company on this continuing for another decade is foolish, a needless prescription for disaster.

During the years when AutoCAD pioneered the market for PC CAD, Autodesk constantly innovated in means of distribution, support, training, promotion, applications—every aspect that contributed to the present success of AutoCAD. Today, Autodesk seems frozen in the past, as if the clock stopped sometime in 1987 or 1988. There seems a cargo-cult-like belief that merely going through the motions that worked so well before will guarantee similar success in the future. But we did those things because they were right for the market several years ago, not today. The game is changing again, and Autodesk shows no signs of adapting to the newly emerging era.

Modern Times

What are the characteristics of the software market that is emerging in the 1990s? Sometimes we are so clever in our analysis that we overlook important points simply because they are so obvious. The products that are building new markets today and becoming the new stars of the software firmament are:

- Big,
- Cheap,
- Widely available, and
- Closely integrated with the platform.

Let's look at each of these characteristics in turn.

Big—more software in the box

The most fundamental characteristic of modern software is that it is *extensive*. Just as the first IBM PC applications dwarfed their 64K CP/M predecessors, modern software exploits the resources of machines with megabytes of main memory and hundreds of megabytes of hard disc: turning the potential latent in that hardware into benefits the user can perceive. This is what I call "the quantity of software in the box," and it is the most obvious metric of software value per dollar spent.

Here are some data points to ponder, showing the amount of software delivered with each of the following products:

Product	Size (Mb)	Executable (Mb)
Dbase III (1985)	0.5	0.13
Lattice C 3.0 (1986)	1.4	0.53
Autodesk Animator	1.6	0.48
Windows Excel 3.0	4.6	1.95
Word for Windows	4.7	1.32
High C 1.6	5.0	2.43
Asymetrix Toolbook	6.5	1.18
AutoShade 386 2.0	7.6	3.74
PowerPoint	7.6	1.30
AutoCAD 386 R11+AME	8.8	4.11
Windows 3.0 SDK	8.9	n/a
3D Studio	9.2	1.32
Borland Turbo C++	9.3	4.14
CorelDRAW!	14.2	3.37
Microsoft C 6.0	14.5	5.62

(These figures were obtained from the size of these products as installed on my Compaq 386. Some products, if installed with different options, can vary substantially in size. For example, when PowerPoint is installed on a system with a Hewlett-Packard LaserJet instead of the PostScript printer I use, it includes special downloadable fonts that increase its size to 18 megabytes.)

The actual executable program, what most folks in software development and consider to be "the product," is a fairly small component of the total software delivered to the customer. Most of the size of modern products comes from what Autodesk dismisses as "support files" and devotes relatively little effort to: fonts, sample documents, help files, on-line tutorials, on-line documentation, clip art, menus, macros, templates, and so on.

But as seen by the user, these components are just as much a part of the product as the executable program. First users appreciate items like on-line hypertext help and documentation. Then they expect them, and soon they demand them. This kind of massive support around the core of an application is becoming a prerequisite for software products, especially those in large, maturing markets.

Another aspect in which modern products are "big" is in what are called "production values" in the movie business; the appearance of the product, documentation, and packaging. I remain a firm believer that, all else being equal, the product that delivers the greatest functionality and performance to the customer will win out in the end. But there's no law of engineering that requires a powerful product to look crude or behave in a less than civilised manner, as if products somehow derived virtue from the software equivalent of exposed screw heads, sharp corners, and chalky grey paint. Simply compare the appearance of AutoCAD with Excel or Word for Windows. Which product looks like it costs $4000?

Let us consider an example, quite close to home. Here is a comparison of AutoCAD with CorelDRAW!, a leading 2D drawing and illustration product for Windows.

	AutoCAD	CorelDRAW!
Fonts included	26	150
Clip art	None	6 Mb
Sample drawings	1.6 Mb	1 Mb
Symbol library	143 symbols	3000 symbols
Colour support	256 colours, proprietary	Pantone, RGB, HLS, CMYK
Line types	24 + user-defined	35 + user-defined
Fill patterns	53 vector + user	35 vector + user 49 bitmap + user 42 PostScript + user 8 grey scale linear, radial fountain
Arrow heads	3 + user-defined	87 + user-defined
Transformations	translate, rotate, scale, mirror, extrude	translate, rotate, scale, mirror, extrude, skew, envelope, bilinear, tween
Drawing librarian	None	Included
Formats imported	DXF, IGES	DXF, PCX, TIFF, BMP, AI, EPS, GEM, PIC, HPGL, CGM, PIF, PICT
Formats exported	DXF, IGES, HPGL, EPS	DXF, EPS, WMF, PCX, TIFF, CGM, PIF, GEM, HPGL, AI, PICT, SCODL, VideoShow, WPG, WFN
Scanned image trace	Discontinued	Included
Font import	None	Adobe, Compugraphic, Bitstream, DigiFont, Readable PostScript (PFA), Z-Soft Type Foundry
Font export	None	Adobe, Z-Soft Type Foundry
Printed tutorial	228 page, 7 lessons	100 page, 8 lessons
Video tutorial	None	1 hour, VHS
Technical support	CompuServe	CompuServe, Phone, Fax
User newsletter	No	Yes
List price	$3,995	$595

Now I don't mean to imply by this that there are not many features present in AutoCAD that CorelDRAW! lacks. CorelDRAW! is an illustration tool, not a CAD system. It is totally two-dimensional (other than simulated 3D special effects), lacks dimensioning capabilities, has nothing resembling object snap or other geometry-driven constructions, does not support digitising tablets for precise co-ordinate input, and has no macro language, user defined objects, or other facilities permitting it to serve as the basis of applications.

My point is this: there is nonetheless a large overlap between CAD and illustration. Despite the pretensions of CAD systems to be seen as modeling tools, the end product most CAD systems in the hands of most CAD users is marks on paper. Consequently, a CAD product such as AutoCAD and an illustration product like CorelDRAW! will, of necessity, provide many of the same capabilities. And within that large common area,

among all those features these two products share, CorelDRAW! surpasses AutoCAD in every single one, in some cases overwhelmingly. In appearance and ease of use AutoCAD is totally blown away.

You might be tempted to respond by saying, "Well, nobody in his right mind would buy AutoCAD to do illustration, and AutoCAD's geometric construction, dimensioning, multi-view plotting, and layer control still make it far more productive for CAD, even in 2D." I agree. But you'd be missing the point. Just because a product provides a larger set of more complicated features is no excuse for botching the simpler, basic stuff, for allowing the functions that constitute the meat and potatoes of all drawing to be inferior in scope, shrouded in an opaque, obscure, and antiquated user interface, and incapable of exchanging data with other applications in widely-used, contemporary formats.

I've discussed CorelDRAW! in some detail because, as a drawing tool, many of its features are directly comparable to AutoCAD. I've grown more than a little tired of hearing AutoCAD developers burst out laughing or dismiss as impossible capabilities present in a product that sells for a fraction of AutoCAD's price. That many people aren't aware of such products disturbs me; that some are and don't seem to care I find appalling. CorelDRAW! is not an isolated example; it is typical of the modern generation of applications, especially in the rapidly-expanding Windows sector. These applications, including products such as Microsoft's Excel, Word for Windows, and PowerPoint, embody a breadth in the scope of the software, a depth in the supporting materials supplied with it, and appearance and other fundamental production values that make AutoCAD look, if not amateurish, at least antiquated.

Restricting the comparison among products to executable file size gives lie to a widely-shared misconception about AutoCAD (and oft-cited excuse for its feature shortcomings, slow development cycle, and inflexibility): the claim that it is a "big, complicated program"—one that strains every limit of the personal computer and embodies not only more complexity, but simply more code than other widely-used applications. Perhaps this used to be true, but it isn't any more. As the pace of AutoCAD development has slowed (in my opinion, due to the meager human resources devoted to it), other products have been catching up and, in some cases, surpassing AutoCAD. The executable sizes in the table above include utilities, translators, and in the case of AutoCAD, both AME and AME Lite. Here is a table that compares just the core executables.

Product	**Core Executable (K)**
PowerPoint	859
Word for Windows	894
CorelDRAW!	904
Asymetrix Toolbook	1,176
Windows Excel 3.0	1,254
AutoCAD 386 R11	1,815

While at first glance AutoCAD might appear to have an edge, note that AutoCAD is the only program on the list compiled in 32-bit 386 mode, which is substantially less efficient in code and data space. In addition, the other applications inherit their low-level drawing and user interface management from Windows, whereas AutoCAD includes its own facilities for these functions. In an era when AutoCAD can not only be run on a laptop computer, but *developed* on one, the constraints on its growth appear a matter of priorities rather than technology. The reality is that AutoCAD is, today, a medium-sized application and will, in the future, have to become much larger to keep up.

Cheap

Most current software products sell at price points ranging from one sixth to one eighth the price of AutoCAD. Around Autodesk it's sometimes easy to forget just how high the price of AutoCAD is. Also, there's a tendency to forget that this wasn't always the case. When AutoCAD was introduced, it was priced at $1000, and for much of its history it sold for roughly $2000. This was a premium price, but much closer to the mainstream of contemporary software.

In fact, the combination of AutoCAD's high price and high volume is, to my knowledge, unique in the industry. Software this expensive tends to be semi-custom products or packages that address a small vertical market, not something sold by dealers with an installed base numbering hundreds of thousands.

Any company able to command a premium price should feel gratified; it's the ultimate verdict of the market on the quality and utility of the product in question. However, when the premium approaches an order of magnitude above other products with similar or greater development investment and, at the same time, dealers find it increasingly difficult to sell the product at anything approaching the recommended retail price, it's time to ask the following question.

> "What price point for AutoCAD generates the maximum revenue and profits for Autodesk and its distribution channel?"

I'll skip the refresher course on price elasticity curves from Econ 101. Just recall that beyond a given point raising the price of a product *reduces* revenue by causing volume to decrease. In the longer term, overpricing renders a product vulnerable to lower-priced competition.

In an environment where concerns about grey market distribution, software piracy, health of the dealer channel, faltering sales growth, and worries about margins abound, it would seem wise to revisit the question of AutoCAD's price and ask whether it is consonant with the pricing of software products which will maintain and expand their leadership in the 1990s.

Widely available

Modern products are heavily advertised in a wide variety of media, and are available through a multitude of distribution channels. By contrast, Autodesk is committed to *reducing* the number of outlets where a customer can purchase AutoCAD. Again, one must ask whether this policy, adopted with the goal of protecting the dealer channel which has been responsible for a large part of Autodesk's success in the 1980s, will in the long-term, benefit Autodesk or its dealers.

Our policy, "AutoCAD is sold by authorised dealers" has been in effect for so many years and has been defended with such vehemence that sometimes we forget that we never planned it that way. When we started the company, software distributors and publisher/distributors were seen as the primary channels through which software developers would move their products, with sales occurring either directly by the distributors or through local retail computer stores who bought products at wholesale from them. At the same time, retail chains such as ComputerLand, MicroAge, and later Businessland were negotiating corporate arrangements with software vendors to buy centrally for their stores. Finally, many of the computer companies then jumping in to compete with IBM in the burgeoning PC market, including Texas Instruments, NCR, Victor, Wang, NEC, AT&T, Zenith, and Fujitsu

were building software distribution channels alongside their hardware sales network (recall that this was years before the "clone" market emerged, so special versions of each software product had to be prepared for each of these computers).

As we were gearing up to launch AutoCAD, we were developing contacts in these three primary channels: distributors, retail chains, and computer manufacturers. After we announced the product, only the manufacturers seemed interested. The distributors and chains didn't see enough volume in an odd "vertical market engineering package" to justify carrying it, but many of the manufacturers saw AutoCAD as a product that would showcase the better graphics and greater speed their machines offered compared to the IBM PC.

And then a funny thing happened; the phone started to ring. After the first couple of articles about AutoCAD appeared in the PC press, customers started walking into computer stores and asking for it. The stores called us. We signed them up and called them "Authorised AutoCAD Dealers." As our dealer channel continued to grow, principally through individual dealers taking the initiative to contact us, we continued pursuing the manufacturers with some success and the chains and distributors with next to none.

Finally, a few years later, the chains and distributors started coming to *us*, having discovered that many of their stores had signed up directly with Autodesk as AutoCAD dealers. We looked long and hard at the deals they were proposing and did business with some of them, but essentially what they were looking for was a cut on the AutoCAD volume their customers were already selling. We didn't see much benefit in this either for Autodesk or for the dealers who were already selling our product so, in most cases, we declined such distribution deals. (The whole story of the twists and turns as Autodesk evolved its reseller strategy is far more complicated than I can relate here. I've tried to capture the main flavour of it, and hope those whose favourite milestones I've omitted will understand.)

By 1985, a structure much like the present one was in place, with Authorised Dealers selling most of the product, a Fortune 500 program getting underway, and a thriving grey market in AutoCAD that we were trying to stamp out in every way we could manage. And there it has pretty much stayed until now, with relatively minor adjustments through time.

The association of AutoCAD with dealers wasn't something we planned. It just happened, to the great benefit of both Autodesk and our dealers. In retrospect we can see why. In the early days of AutoCAD, just collecting the pieces of hardware needed to run AutoCAD, getting them all to work together, installing AutoCAD on the system and tweaking it to deliver acceptable performance on machines that ran anywhere from 10 to 50 times slower that the typical AutoCAD platform today took a great deal of knowledge and no small amount of work. The drafting plotters that can be bought by calling a toll-free number today were, in those days, sold as specialty items by Hewlett-Packard offices; retail distribution for such hardware had never been contemplated. So it was also for large digitising tablets, high resolution graphics boards, and large monitors.

In order to assemble a working AutoCAD system from scratch a user would have had to become, in a real sense, a computer expert. Far better, especially for a person seeking only increased productivity in drawing, to pay a dealer to put all the pieces together, shake it down into a working tool, and install it along with training to bring the user up to speed. All these tasks the dealer did for the user constituted the "value added" by the dealer, for which the customer paid when he purchased AutoCAD and the hardware at retail, rather than the dealer price.

To a lesser extent, the same could have been said about all other PC applications at the time. Today it might seem absurd to need professional help getting a word processing system running, but only by people who've forgotten some of the horrors that were sold as printers in the early 1980s, or who think of a hard disc as something you can rely on day in and day out. Those days, computer stores helped ordinary people, unskilled in the strange

ways of computers, put computers to work in their homes, offices, and workshops.

Then, as the years passed, computers improved. Not only did the absolute price of computers fall while their performance grew, they became more reliable and manufacturers learned to tailor them better to the needs of specific target markets. In addition, the IBM PC clone emerged as an industry standard architecture. This eliminated many of the compatibility problems that bedeviled the industry previously, especially in software. Now it really was possible to take a computer out of the box, load up WordStar or Lotus 1-2-3, and get right to work.

Inevitably, it wasn't long before customers began to ask themselves, "If all it takes is opening the box and plugging it in, why am I paying this guy at the computer store a thousand bucks to do it?" And soon the first headlines about computer stores going out of business began to appear in the industry press. The customer shopping for a PC or software could readily compare the prices quoted by the mail-order merchants who advertised in the back of all the computer magazines with the stickers at the computer store and, since the products involved had become commodities with reputations based upon their manufacturer's position in the industry rather than the recommendation of a local dealer, saw no reason to pay the premium demanded by the local dealer.

Over the last few years the local computer store, as envisioned in the early 1980s and common in the middle of the decade, has largely vanished. Computers are still sold locally, but frequently much in the same manner as televisions and other electronic appliances, with less markup for the reseller. With constant competition from nationwide mail-order distributors, there's little room for the local retailer to increase his price. Software distribution has changed as well. If hardware has become a commodity, so even more has software. A dealer can add value by unpacking a computer, installing the operating system, adding memory chips, and so on, but each copy of Excel 3.0 is just like every other. Since they're interchangeable, and software installation these days usually consists of "stick the little square thing in the slot and type **`A:SETUP`**," there isn't any reason to pay a penny more than necessary for the product. Consequently, the prices charged for software by direct marketers, discount retailers such as Egghead, and other volume channels are remarkably similar and represent a small margin compared to that of a dealer selling at retail a few years ago.

Once the value added by a reseller begins to disappear, what does a manufacturer gain by restricting the distribution of his product to those resellers? Clearly, withholding the product from mass distribution protects the resellers and helps to maintain the dominance of the product within that channel. By preserving a local sales and service network, the need for direct customer support is reduced, lowering the manufacturer's overhead. Finally, a dealer network, properly supported and directed, can act as a nationwide sales organisation for the manufacturer—one that doesn't come out of his marketing and sales budget.

These are powerful arguments, and Autodesk's success has demonstrated the importance of local presence through dealers. But, as with every other aspect of our business, we must periodically inquire as to the health of our dealer network, and whether Autodesk and the dealers who sell its products can continue to prosper in the coming years as we have in the past.

Here I find serious causes for concern. Compared to the typical desktop computer, an AutoCAD machine is bigger, more complicated, and harder to install and optimise, and the same can be said for AutoCAD compared to most other software. But, just as the passage of time and the evolution of the industry eliminated the need for special skills to get a simple PC running, today they are doing the same for CAD. One can turn to an advertisement and order, with a single toll-free telephone call, a ready-to-run CAD system composed of nationally marketed and serviced components, a system one can fully expect to work as soon as it is plugged in. What then is the value added by an AutoCAD dealer?

I think the shrinking margin between the price at which Autodesk sells AutoCAD to its dealers and the price dealers are able to obtain for it from customers (the so-called "street price") reflects the perception on the part of AutoCAD buyers that many dealers are doing little more than passing the product through their hands, and thus deserve only a small markup. In such a situation, trying to raise the average retail price by limiting distribution and pursuing "grey marketeers" is like trying to stop the tide with a teaspoon and a sponge; it's setting yourself against the judgement of the market, and it never works, at least not for very long.

A product becomes a commodity when purchasers discover it meets the definition of one: interchangeable, readily available, and sold at approximately the same price by all vendors. Once these conditions are met, there's nothing the manufacturer can do to change the situation. Nothing, that is, that doesn't harm himself. For what possible benefit could there be in making the product harder to obtain, more difficult to put into service, of unpredictable composition, or capriciously priced? Even if a manufacturer succeeded in driving up the retail price by curtailing supply, the effects would, in all likelihood, be short-lived since a sudden, steep rise in the price of a popular product, combined with its disappearance from many channels of distribution would send the clearest possible signal to competitors that here was a market begging for a readily available, more affordable alternative.

It's no secret that many of Autodesk's dealers are encountering difficulties at present, problems that in many cases began well before the current economic downturn. AutoCAD is the last major software product to retain dealer sales as its only channel of distribution. If the problems in the dealer channel are not transient, but instead indicate that dealers can no longer build a profitable business selling AutoCAD, Autodesk could be left in the position of controlling a channel of distribution which was no longer viable. This would leave the field open for other CAD products to establish themselves in the mass market channels where AutoCAD is not for sale.

Closely integrated—the emerging standard platform

Something is happening in our industry, something very important, and we would be wise to recognise its significance and take account of it in our plans. The advent of the IBM PC in 1982 forever changed the nature of the PC software business, even though many software companies didn't realise it at the time. (Autodesk certainly didn't: we spent at least as much effort on CP/M-80 and CP/M-86 machines in the first two years as we did on the IBM). Today, the shape of the industry is again being changed by the emergence of a new standard application platform defined, this time, not by hardware but by software—Microsoft Windows.

Just as there was nothing "new" about the IBM PC in 1982; 8086 and 8088 machines with similar capabilities existed years before, there is nothing at all new about Microsoft Windows except the way the market has embraced it. But that's all that really matters in the long run. Whether you're a Macintosh fanatic, a committed NeXT developer, an OpenLook advocate, or a Silicon Graphics believer doesn't change this fact: more than *eight million* copies of Windows are expected to be sold this year, and that estimate may prove low since rumour has it more than half that number were sold in the first 90 days of 1991.

Whether it's ugly or beautiful, naughty or nice, good or evil, when a product gains that kind of momentum and enlists that many users on its side, software developers had better start paying attention to it. Consider this: foremost among the companies who desperately hoped Windows would never take off was IBM—an outfit known to have some clout in the marketplace and reputed, by those who dislike it, to be able to persuade people to buy almost anything. Yet even in the Fortune 500, the very heart of IBM's market and the segment it influences most strongly, Windows is spreading like wildfire, brushing away OS/2 as if it had never existed.

Unlike the Macintosh, which has suffered from a premium price, single source, and worries about connectivity, Windows allows a DOS user to upgrade for less than $100 and continue to run all his old software. This both

contributes to the rapid adoption of Windows and reinforces users' demand for truly integrated applications; once Windows is on your machine, the distinction between programs that understand the clipboard, system fonts, system printer, and all the other Windows services and those that go *boinggg!!!* and blop out to a dumb old DOS character screen becomes glaringly evident. This makes getting caught out without a Windows version of your program just about the worst possible thing that can happen to a DOS application vendor these days. Just look at the increasingly desperate and strident promotions being unveiled by Lotus to try to maintain sales of 1-2-3 as they feverishly debug their Windows-based reply to Excel.

All of the dynamics that made the Macintosh market so special, that made Macintosh users so unwilling to consider any alternative, are now being ignited by Windows in a market ten times larger. A community of users ten times the size of the Macintosh, Amiga, Sun, and NeXT user base combined is now beginning to discover, albeit in a cruder way, what possessed people to buy those other systems. You don't have to predict the future to see the Windows phenomenon, you need only open your eyes. Consider this: Windows, like the Macintosh, lets you attach a little icon to an application. Users can make their own icons and customise their systems that way. Proud of their artistry, many users upload their spiffiest new icons to CompuServe and other networks so others can share them. The last time I looked there were, sitting on CompuServe, a total of *1.3 megabytes* of Windows icons ready to download. These aren't the applications, just the icons—a total of 1700 of them, including five each for AutoCAD and Generic CADD!

A market ten times the size means ten times the money to be made by application vendors, and if that weren't incentive enough, it's a market that, with each installation, displaces a raw DOS machine. Certainly Windows continues to suffer some technical shortcomings: it only allows 16 bit applications (unless heroic effort is exerted, as in the case of Wolfram Research's *Mathematica*), it is essentially a single-tasking system, and it inherits all the shortcomings of the MS-DOS file system. All of these limitations are, however, scheduled to be remedied over the next two years. Given the importance of Windows to Microsoft's strategy and the resources they commit to such projects, Windows buyers can be reasonably confident the schedule will be met. And even if it isn't, Windows 3.0, as it stands today, is far and away the best environment you can choose without throwing away your DOS hardware, and that's an option most users can't afford, even if they were inclined to.

In addition, there's an effort underway by Microsoft, Compaq, and others to make a machine-independent version of the Windows–OS/2 environment and use it to enter the workstation market. While there's room for many a slip in such glib and grandiose plans, if I were Sun I'd be more than a little worried about the prospect of twenty or thirty companies cranking out RISC machines that ran a user interface already known by twenty or thirty million people, one to which application vendors could port their software to simply by recompiling.

What I'm suggesting is that Windows is a Big Event—the kind of thing that happens every decade or so in our industry that establishes a new baseline from which future evolution builds. Events of this nature reward those who move quickly enough to exploit them and winnow out others whose attention is elsewhere, who underestimate the significance of the change, or cannot react in time. Big Events force those who wish to survive to revisit their strategies and question long-term plans. This process requires flexibility in an organisation which is difficult to maintain after it has grown enormously in size and become set in its ways.

One central and virtually unquestioned tenet of Autodesk's strategy has been "platform independence." That means, with very few and very limited exceptions, we do nothing on any one machine that cannot be done on every machine that runs AutoCAD. This forces us (some would say "gives us a handy excuse to") exclude support for many facilities on machines like the Macintosh which virtually all other applications, even the least expensive, furnish. The facilities provided to the AutoCAD user become, in a large sense, limited to the least common denominator of those provided by all the machines we support and look, consequently, crude next to applications closely tailored to a specific system. When we feel compelled to address a glaring shortcoming,

such as lack of support of system menus and dialogues, we're forced into a much larger project such as Proteus, since our solution must work on every machine and operating system, not just one.

Severely limiting the integration of AutoCAD with various operating environments hasn't hurt us so far, I believe, primarily because the systems that account for the overwhelming percentage of our sales: DOS and 386 DOS, also happen to be the least common denominator in virtually every aspect. Consider all the things we could have done to make AutoCAD faster and easier to use if we hadn't required everything to run in 640K of RAM. Regardless of your opinion of our Macintosh version of AutoCAD, or your view as to how we might have proceeded in that market, the fact is that regardless of whether we succeeded beyond our wildest expectations or failed to sell a single copy of AutoCAD for the Macintosh, our financial results wouldn't have changed much. That doesn't mean we shouldn't have put AutoCAD on the Macintosh, or that we shouldn't continue to strive to better integrate AutoCAD into that environment (I'm the guy who first managed to get AutoCAD running on the Macintosh, you'll recall); all I'm saying is that Apple's market share is simply too small to have much of an effect on our sales (especially when you only count machines capable of running AutoCAD), and rapid expansion of the market generated by AutoCAD is unlikely as long as the Macintosh suffers in price/performance against 386/486 and Sparc machines.

Windows, however, is changing the rules in the very heart of the AutoCAD market. We will, certainly, ship a Windows version of AutoCAD before too many months pass, and we will upgrade that initial product to take advantage of the new versions of Windows now in the pipeline, but I think we have to revisit the level of support we're planning for Windows. Our Windows product will be integrated with Windows roughly to the extent our Macintosh product conforms to the Macintosh environment, which is to say somewhere between "somewhat" and "moderately." Certainly it will be obvious to any user that many rules change when the mouse strays into the AutoCAD window. This situation has almost certainly hurt us in the Macintosh market, but due to the limited size of the market and the fact we didn't have any sales there to begin with, hasn't become a company-wide priority to fix. I believe that a similar failure to comply with ground rules for Windows applications may hurt us severely, and every week that passes without our thinking about how to address this problem adds to the danger.

(I would hope that whatever we do to allow AutoCAD to fit comfortably into Windows will also let us conform as closely on the Macintosh, OpenLook, NeXT, etc. However, if forced to choose between close integration with Windows now and all-platform user interface support in 18 to 24 months, I'd do Windows first and worry about the others afterward.)

The first modern CAD product

I believe that a CAD product with these characteristics: big, cheap, widely available, tightly integrated with its host system, and promoted and marketed in an aggressive manner could, in relatively short order, displace AutoCAD from its current dominance of the CAD market. AutoCAD would not be eliminated, any more than Lotus 1-2-3 has vanished in the face of competition from Excel, but it would be placed in the same difficult position: forced to play catch-up against the more modern product, trying to reverse an erosion of market share against a newer product with momentum on its side.

Autodesk has the capability today, by making a series of decisions at the level of senior management, to bring the first totally modern CAD product to market. Success in this endeavour would protect Autodesk but, most importantly, would position it to resume its growth into new markets and applications: the broadening of the market that accounted for much of our success in the last decade. Failing to take these steps will, in my opinion, leave AutoCAD a sitting duck waiting to be picked off by the first competitor who launches the product that

AutoCAD could have been. How long might Autodesk have before that happens? There's no way to know, but betting the company on it not occurring is hardly a prudent strategy, or indeed any strategy at all. Ponder this: in my opinion, the magnitude of work involved in adding AutoCAD's capabilities to an application such as CorelDRAW! is roughly equal to that of adding CorelDRAW!'s facilities to AutoCAD. Further, remember that a competitor is free to target the lucrative heart of the AutoCAD market, not being saddled with the baggage of compatibility with prior releases, unprofitable hardware platforms and operating systems, niche applications, and characteristics of our distribution channel that constrain Autodesk's freedom of action.

Modern Problems

> Problems are only opportunities in working clothes.
>
> —Henry J. Kaiser

The large scale, value per dollar, wide distribution, and strong marketing of the new generation of software products reflects ongoing changes in the way the software industry goes about its business. As markets have broadened, revenue has grown, and companies have matured from small bands of moonlighting entrepreneurs to members of the Standard&Poor's 500, the scale of the resources they invest both in the development and launch of new products and the ongoing support of already-successful products has grown apace. Notwithstanding the inefficiencies inherent in doing things on a larger scale, the fact remains that a major release of a modern software product simply reflects many more man-hours of labour and dollars of capital investment than products of a few years ago. There is a lot more software in the box, software that meets or exceeds the ever-rising expectations of an increasingly discriminating community of users, because more people worked more hours using better tools to *put it there*, and when that software reaches the market, it is supported by a vigorous, comprehensive, and thoroughly professional promotional campaign, both at the time of introduction and throughout the subsequent product life cycle.

Except at Autodesk, where I believe this process has broken down.

How to lose sales and market share through imagination and hard work

Consider this: open the AutoCAD box, the actual commodity that changes hands when a customer buys our product from our dealer. Take out all the pieces, then go back through the product release notes, the documentation review routing slips, and the like, and make a list of the names of individuals whose work directly appears in that box—the originators of everything that eventually ends up in the hands of the customer. When I do this, I come up with about 15 names. It's no wonder we never seem able to deliver what we would like to on a schedule we can live with.

I do not mean to imply that only 15 people are responsible for AutoCAD, or to disparage in any way the efforts of the much larger number of individuals in quality assurance, development test, product management, marketing communication, or other aspects of product development: these are just as essential as writing software, producing documentation, and assembling the support materials that constitute a product release. *But they don't wind up in the box!* When the customer takes delivery of the product and unpacks the box, he doesn't see any of those other efforts. He *assumes* adequate resources have been expended to insure the product is reliable, not the least since he parted with such a large wad of cash to acquire it. He *relies* upon the integrity of the product's vendor to protect his investment through upward compatibility and cross-platform data interchange. He *expects* the vendor's financial strength, management resources, and commitment to future development will ensure the company can

continue to meet his future needs. But at the moment, once the shrink wrap has been discarded and the floppies copied to the hard disc, all that the user sees, reads, and uses is what was in the box.

Written by about fifteen people.

Is this an appropriate development commitment to a product that is generating on the order of two hundred million dollars per year in sales, a product that commands an overwhelming share of a rapidly growing market?

Modern software has so much in the box because *more people* are working to put it there. Mythical man months and mystical management aphorisms aside, if you stack a development team of 15 people up against a Microsoft-sized project with a hundred or more people directly contributing components that the user will encounter in the product, the tiny team, however bright, however motivated, however hard-working, will always come up short. Especially if the team of 15 people is only allowed to work on the product for a few months per year, conforming to product release schedules proclaimed by accountants (as is the case for Release 12), not by sales, marketing, development, or (perish the thought) the needs of customers.

But doesn't increasing the number of developers, writers, and the like require corresponding increases in the number of supervisors, managers, testers, spec-writers, and everybody else involved with the product? Yes, of course it does. Doesn't that increase costs far beyond even the already large costs of a big development team? Naturally. That is the way the software industry works these days, and it is the investment required of all companies that wish to remain leaders.

But, can Autodesk afford it?

Out of two hundred million dollars a year?

Autodesk has inherited many things from its history, not least of which is the tradition of the "hungry rat," a reputation as a lean, mean competitor that consistently did more with less through imagination and sustained hard work. This mode of operation was essential when there wasn't anything *but* imagination and hard work from which to forge a company. In the absence of market share, distribution channels, reputation, financial capital, or a community of users, you fall back on what remains. This way of doing business took us very far. Indeed, it took us all the way to the last quarter of fiscal 1991 with an unbroken streak of rising sales and earnings. But I fear it can no longer guarantee the future of AutoCAD in an increasingly sophisticated market. I believe it is burning out our best people and ensuring the eventual eclipse of our principal product.

Benign neglect: silence in the marketplace

Not only are development resources committed to AutoCAD inappropriate to its sales, market share, and importance to the company, the visibility of the product in the marketplace, the ultimate result of Autodesk's efforts in marketing and sales, is unseemly for a product of its stature. Autodesk, once renowned for its innovations in marketing and sales, seems to have settled in recent years for a policy of "All the same things, and less." Divide Autodesk's history into two parts at the halfway point: sometime in 1986. How many new initiatives in marketing and sales have been launched in the latter half?

Autodesk's penchant for abandoning products developed at great cost at the very moment of shipment has long been a source of frustration for me. AutoSketch was the first example of this sorry tradition, and even though our neglect of that product later forced us to spend millions of dollars to buy Generic Software to guard the low end of our market, that didn't keep us from launching both *CA Lab* and *Chaos, The Software* with a marketing budget of essentially zero. In fact, it was only after I offered to pay for the advertisements myself that a small

sum was disgorged to advertise *CA Lab* in the issues of *Scientific American* and *Discover* which each devoted a page or more of editorial copy to the product.

The very existence of the Multimedia group is an admission of the neglect for Animator after its hugely successful initial launch. If Autodesk had, in 1983, treated AutoCAD the way it treated Animator and 3D Studio after their introduction, Autodesk would not exist today.

But while any number of reasons can be advanced for neglecting products which some view as distractions from the central business of the company, indulgements of certain influential people, when AutoCAD suffers the very same neglect in the marketplace, the reasons become much more inexplicable and the potential consequences more dire.

But aren't we spending lots of money on marketing? Well, I don't see the budget numbers, but I believe we are—just look at the phone list and make a body count. But the issue isn't how much you *spend*, it's *what comes out;* the equivalent in marketing of measuring development by what goes in the box. This metric reveals the extent to which Autodesk has abandoned AutoCAD, ceding by default the position its preeminence in the market merits to any competitor willing to assail it, leaving the customer perception of the product in the hands of reviewers, analysts, and the authors of books.

Is this an extreme statement? Yes, it is. But I believe it accurately reflects an extremely dangerous situation. I don't understand the logic behind spending $400,000 developing a product like *Chaos*, then allocating essentially zilch for marketing it after all the development cost is sunk. Such a policy makes failure of the product a self-fulfilling prophecy, or at least treats recovering the investment as a crap shoot on users spontaneously stumbling over the product. If you want to save money, *don't develop the product in the first place!* But don't wimp out at the instant the product has a chance to recover its costs and turn a profit.

But I digress. You probably don't care about *Chaos*. Let's look instead at a $20 million investment which has been abandoned in precisely the same way. I am talking about AME—our only entry in the solid modeling market, the very cutting edge of the mechanical engineering sector, which everybody says is the largest component of the CAD industry and the one at which we are most at risk.

Twenty million dollars? Well, add up what we paid to acquire Cadetron in the first place, the money we spent subsequently bringing AutoSolid to market, the costs we incurred closing the office in Atlanta and moving development to Sausalito, the subsequent investment in AME/Eagle leading to its shipment with Release 11, and I suspect you'll come up with a figure about that size.

I can't be totally disinterested in the fate of AME since, by building the initial prototype in July of 1989, I played a rôle in the transformation of AutoSolid from a $5,000 stand-alone product targeted at mechanical designers into a $500 component of AutoCAD addressed to a much broader market. I initiated that project because I thought it was a way to rescue a project I thought was going nowhere by aligning it with the way Autodesk has always done business. Rather than addressing a small market with an expensive product (by the standards of PC software), we could bring solid modeling within the reach of anybody who could afford the price of AutoCAD. My goal at the time was to "Within one year, sell more solid modeling systems that exist on the entire planet today."

Well, it took longer than I expected (everything does), but the Eagle group pulled it off, delivering, the day AutoCAD Release 11 shipped, a solid modeling extension that was far more comprehensive and ambitious than anything I had contemplated as an initial adjunct to AutoCAD.

And then. . . ? Silence.

Where was the large-scale, high-profile, roll-out of what could easily be adjudged the single most significant event in desktop design since 3D? Where were the advertisements and brochures that properly heralded it as a price/performance breakthrough comparable to the introduction of AutoCAD in 1982? Something like:

> "AutoCAD's OK, but what have you done for me lately?"
>
> How about solid modeling for $500?
>
> For years, designers have struggled to build complex models of three dimensional objects. Repeatedly, they have begged for relief from arcane commands, obscure terminology, and facilities that seem designed more to humble the design professional than to help him. "Why can't I have a system that works like the real world, one that lets me bore holes, mill, weld, and assemble pieces from parts with operations I can understand?"
>
> "Because that would take solid modeling!" was the answer. "That's a sophisticated technology, suitable only for high-end mechanical engineers, far too costly for your needs and requiring much more computer than you could ever afford."
>
> Until today. With the shipment of AutoCAD Release 11, Autodesk announces the Advanced Solid Modeling Extension, which delivers true, thoroughly professional solid modeling as an integral component of AutoCAD. And, in keeping with Autodesk's commitment to its customers, it runs on the same affordable machines that run AutoCAD, costs less than $500, and, through open architecture, encourages users to build application systems upon it.
>
> CAD before AutoCAD was an elite club, foreclosed to the vast majority of designers who couldn't afford expensive mainframe computers. Just like solid modeling before today. With AutoCAD Release 11 and ASME, we're putting an end to that, forever. Welcome to the golden age of engineering.

This was how we announced AME in the Release 11 press release of October 18th, 1990.

> AutoCAD Release 11 supports the optional Advanced Modeling Extension (AME) which gives designers and engineers powerful constructive solid geometry capabilities that are completely integrated within AutoCAD. With AME, designers can create complex, three-dimensional models by constructing them from simple 3-D shapes.

If this were any more low key, it would be apologetic.

The following sentence closed the paragraph on AME that appeared on the second page of the *Autodesk Designer*, a flyer mailed to Autodesk dealers, dated October 15th, 1990. AME appeared next to last in the list of Release 11 benefits, right before "Personalisation."

> AME's price, US$495, is unprecedented for solid modeling software, and is sure to introduce the benefits of solid modeling to a wider customer base, especially in the mechanical engineering market.

Well, gosh, I couldn't have put it better myself, but the very tone of this sentence, examined closer in the context of the rest of Autodesk's promotional material, speaks volumes about the assumptions that underlie Autodesk's do-nothing posture toward its products. Indulge me for a moment while I stick this sentence with a pin and pick it apart under the magnifier. "AME's price... is sure to introduce the benefits of solid modeling to a wider customer base...." Precisely how? What is the chain of cause and effect? How does the *price* act to *introduce* the *benefits*. The price, in other words *the mere event of Autodesk's making the product available*, is seen as an actor in the market, empowered somehow to set in motion the events Autodesk wishes to transpire.

This isn't putting the cart before the horse; it's expecting the cart to go with no horse at all. A low marginal price creates the *conditions* under which Autodesk possesses an *opportunity* to transform solid modeling from a highly specialised niche market into another widely-used application like AutoCAD and perhaps, by doing so, to break down the barrier that has kept most designers from truly entering the world of three-dimensional modeling, creating, in time, a market for additional design tools as large or larger than the current AutoCAD drafting market. All the work that went into AME from the inception of The Engineer Works at Cadetron in Atlanta through the breaking of the champagne bottle on the UPS truck the day Release 11 left Sausalito created only the *potential* for success, conditions that were necessary but not sufficient.

For all the wonderful things to happen which so many people worked to bring about, a few more links in the chain of causality need attending to. Users must learn of the existence of the product. Its benefits must be explained to them. They must understand both what it can do and its limitations. And they need the opportunity to evaluate it for themselves.

These are all the things we had to do between 1983 and 1985 to convert the potential of AutoCAD, the computer program, into the success of AutoCAD, the new world standard for CAD. Having achieved success once does not grant us a license to succeed with additional products, whether related to AutoCAD or not, without doing all the same things we did to bring AutoCAD before its potential customers.

Yet today, Autodesk attends fewer trade shows, garners less press, communicates less frequently and in fewer ways with its user community. What other software company comparable to Autodesk has no user newsletter? What other software company refuses to provide technical support to users in need?

There is a dangerous myth that because we have a reseller channel, we needn't do the things other companies must to create demand for our products. What nonsense. Pushing products into a distribution channel is like pushing on a rope. Distribution is an asset only if the product is pulled out the other end; if customers are brought to the reseller seeking the products for sale there. The responsibility for creating that demand rests primarily with the manufacturer; after all, it is he who keeps the majority of the money from the sale. Manufacturers who neglect this simple, eternal truth of retailing may, in the short term, post better profits but before long will suffer, along with their resellers, the symptoms of declining sales, falling earnings, and eroding market share.

How often do you see an advertisement from Autodesk in the publications you read? Compared to 1984 and 1985, how frequently do you see articles in the press about the myriad applications of Autodesk's products? Compare the visibility of AutoCAD, for example, to that of a typical Microsoft product such as Word or Excel. Immediately somebody shouts, "But those are mass-market products, not highly specialised products like AutoCAD. Besides, they're addressing a much more lucrative market." Well, let's see. Microsoft's sales are about five times ours. Of that, about half is application software, so all the Microsoft applications, including Word, Excel, PowerPoint, Project, and Works, add up to about 2.5 times our sales. If you assume Word and Excel account for the lion's share of this revenue, that means the sales of these products are roughly comparable to Autodesk's revenue from sales of AutoCAD. So in fact the larger volume of these products is just about balanced by their lower retail price, yielding the same revenue. Word and Excel ads are everywhere. Where are the AutoCAD ads?

"You can't sell a product like AutoCAD the way you sell a spreadsheet. It's a different market, and it has to be addressed in a different way." This claim might be credible if, years ago, people hadn't insisted you couldn't sell *spreadsheets* the way Microsoft sells spreadsheets. Remember when spreadsheets were vertical market tools for financial analysts in the Fortune 500? It was only after the products were mass marketed, widely available, and affordable that the market for spreadsheets exploded, including today scientists, engineers, high school students, and diet book authors. It was this same kind of expansion of the market for CAD, set into motion by Autodesk's early and highly successful though meagerly-funded communication efforts, that redefined CAD as something

suitable for “anybody who draws.”

“But advertising is expensive! There are more cost effective ways to getting the job done.” Surely. And advertising and other paid promotion should be but components of a balanced program including trade shows, co-promotions, dealer incentives, and all the myriad ways market-savvy companies stimulate demand. If Autodesk were achieving high visibility in these other ways, one might conclude that advertising was unnecessary. But we aren’t. In fact, I believe Autodesk is increasingly slipping from sight, except within the existing community that uses its products. Talking to them is important, but it won’t expand the market; we’re preaching to the choir. To build markets you have to go out, make some mistakes, find what works, then build upon it. And that costs money. Once you realise that the revenue from a major Microsoft application is comparable to the sales of AutoCAD, the invisibility of AutoCAD is even more inexplicable since Microsoft’s margins are the same as Autodesk’s. Microsoft isn’t doing all that aggressive marketing by spending more on a percentage basis. They’re either doing less of the things that don’t get them in front of the customers, or they’re getting more for their money.

Advertising is, of course, the last resort of the communicator. Autodesk was able to promote AutoCAD in the early days with very little direct advertising by gaining editorial coverage in a wide variety of publications. A five or six page story about a user’s success with AutoCAD delivers many times the impact of an advertisement at a fraction of the cost. These days, however, AutoCAD applications have become far more common and more imagination is needed to get the attention of the press. Imagination is something that’s never been in short supply around Autodesk, yet we seem to consistently squander the visibility it gains us through lack of follow-through. One of the reasons I started the cyberspace project was to create a high-profile, exciting technology project to make the company stand out in the industry. Well, at least that part worked! Within a year, Autodesk was mentioned in the technology focus column and later on the front page of the Wall Street Journal, in the New York Times, and in many other extremely hard-to-crack publications in which paid advertising is forbiddingly expensive. And did we effectively communicate to any of these writers, given the entré created by the cyberspace project, the Autodesk story, of how this project indicated our ongoing commitment to lead the three dimensional design market from the cutting edge? Well, no we didn’t. That story, and with it the equivalent of several million dollars of paid publicity simply slipped through our hands. Or consider the month when *Scientific American* ran a screen shot from one of our products on the table of contents page and devoted two pages to one of our new products. Did we use that opportunity, in the same publication where Autodesk ran its first ambitious four-colour advertisement, to showcase the company and its mainstream products? No, we were identified by the columnist as a “California computer games company.” This would never have happened in 1984.

Foregone opportunities don’t show up on the profit and loss statement, at least not right away, nor are they ever itemised and charged back to internal departments. But each one is the equivalent of burning current dollars and bypassing future opportunities.

If AutoCAD’s invisibility is not in keeping with its importance, then the consistent lack of support for new products makes their failure inevitable. We spend large sums developing a product, ship it, ignore it, and it fails. After a while, nobody’s interested in promoting new products because “they all fail.” And eventually, so does the company. Ignore the subtler points of strategy and look only at the numbers. Autodesk is committed to increasing its sales and earnings at a rapid pace for the foreseeable future. The price/earnings premium on our stock reflects an assumption we will succeed in this. Since AutoCAD already commands a large share of the current CAD market, we cannot achieve this growth by taking business away from competitors. Consequently, the growth objectives can be met only by broadening the market for AutoCAD, thereby increasing its sales, or by launching new products which, in time, will contribute revenue and earnings comparable to AutoCAD. But if we don’t promote AutoCAD, how is its market to grow? And if we push each successive new product off the loading dock, keening our ears for the thud that indicates “another Autodesk new product flop,” how are

these products to help us? The absence of effective promotion of either AutoCAD or our new products precludes success through either path.

"Sure, we'd like to do all those things, if only we could afford them, but the money just isn't there in the budget to do the kind of advertising, promotion, and public relations you're suggesting."

Out of two hundred million dollars a year?

The Risks Of Caution

> No lesson seems to be so deeply inculcated by experience of life as that you should never trust experts. If you believe doctors, nothing is wholesome; if you believe theologians, nothing is innocent; if you believe soldiers, nothing is safe.
>
> —Lord Salisbury, 19th century British prime minister

How has Autodesk come to such a sad state? Surely our management is not incompetent, nor bent on the destruction of our company. After all, they are for the most part the same people who led the company through the times of its greatest triumph, when Autodesk built the initial success of AutoCAD into one of the premier entrepreneurial success stories of the 1980s.

No, I think the problem that afflicts Autodesk, its seeming inability to act in any way whatsoever, stems from a failure of confidence, the self-assurance in the face of uncertainty that what we are doing is *right*, which is essential to any entrepreneur. When confidence ebbs, the courage to act dies with it. Successful businesses are rarely if ever built by following an obvious path, and the actions that created great industries often seem clear only in retrospect. The entrepreneur needs the right mix of brash disregard for the general consensus which usually tells him he is a fool or worse, tempered by firm grounding in the realities and potentialities of the arena he is operating in and the dynamics of the marketplace. These allow him to weigh his chances of success against what is at risk in the venture. An entrepreneurial company needs this balance as much as the founder of a start-up, and it must not only seek individuals who embody these properties, it must structure its organisation to achieve the right balance between imagination and caution.

It is an imbalance, or more accurately a disconnection, between these qualities which I believe lies at the heart of Autodesk's problems.

The stainless steel web

When self-confidence fails, caution rules. When timidity and unrestrainted risk-aversion gain the upper hand, the kind of imaginative and bold initiatives that companies must make in order to sustain their rapid growth are forced to run a gauntlet of analysis and criticism that no suggestion, no venture not already proven successful, has a chance of surviving.

This is the source of paralysis, why companies fail to act even when there is, within the company, a broad consensus that problems exist, action is needed, and even agreement on the nature of the changes required. Even then, each specific recommendation finds itself stuck in a stainless steel web; the chances of it surviving all the individual sign-offs needed to be implemented are remote.

Here are some strands of the stainless steel web.

- ❑ "It's too big a project for the next release."
- ❑ "The users aren't ready for it."
- ❑ "There's no way to know how big the market is."
- ❑ "The market today isn't big enough."
- ❑ "The product support burden would be too high."
- ❑ "That would be competing with the developers."
- ❑ "We can't change the ADI spec to accommodate it."
- ❑ "That won't work on the Apollo/VAX/Cuisinart."
- ❑ "It would complicate the documentation."
- ❑ "It would be too difficult to test."
- ❑ "Nobody's asked for it."
- ❑ "The dealers couldn't sell it."
- ❑ "It would increase profits, but reduce margins."
- ❑ "We'd have to change all the drivers."
- ❑ "We don't have any experience in that area."
- ❑ "It would add a disc to the release."
- ❑ "It would confuse Autodesk's image in the Fortune 500."
- ❑ "We'd have to renegotiate our contract with. . . ."
- ❑ "Another company tried it five years ago and failed."
- ❑ "That wouldn't work on pen plotters."
- ❑ "It would divert resources from. . . ."
- ❑ "We should wait for the database redesign/objectification/second coming."
- ❑ "It'll cannibalise sales from. . . ."
- ❑ "None of our competitors does that."
- ❑ "That will always remain a mainframe application."
- ❑ "It could lead to a channel conflict."
- ❑ "It would be too expensive to introduce."
- ❑ "That's platform-specific."
- ❑ "We'd have a hard time explaining it to the analysts."
- ❑ "If you give 'em that, next they'll want. . . ."
- ❑ "How will you do dragging/picking/drooling. . . ?"
- ❑ "There's no synergy with AutoCAD."
- ❑ "We should wait until there's a standard for. . . ."
- ❑ "The dealers will think we're going around them."
- ❑ "If we include it, we can't charge extra for it."

Each and every one of these concerns may be valid, and all of them, to the degree appropriate, should be weighed when considering a new product, changes to an existing product, or revisions in our pricing, discount structure, distribution channels, or marketing strategies. The difference between prudence and circumspection and becoming ensnared in the stainless steel web is the difference between a can-do spirit and a can't-do, passive outlook on the world, between action and reaction.

Paralysis in the face of opportunity sets in when the valid concerns and genuine difficulties posed by any initiative become viewed not as obstacles to be overcome, but insurmountable barriers blocking its implementation. If any proposal is subjected to an initiation ritual in which any black ball causes its rejection, the chances of any redirection in strategy occurring becomes vanishingly small. And as a company expands, diversifies, and operates in a larger and more complicated arena, the check-off boxes that can block action proliferate. As a suggestion is reviewed, its near-term difficulties and immediate risks come to outweigh the benefits which, though potentially

large, are deferred into the future and subject to uncertainty.

In such an environment, an unambiguous statement of direction, strong and effective leadership, and continued follow-through by senior management is essential if the company is to progress. Otherwise, the parochial concerns of individual departments will block any and all changes to the way they've become accustomed to doing their work.

This is the stainless steel web—the timidity trap. It seizes mature companies who can always seem to amass a hundred reasons *not* to do something against one or two reasons in favour, even if the potential benefits include saving the company. It supplants the entrepreneur's approach, "try it and see if it works," with the central planner's: "let's do some market research and develop a matrix for evaluating this proposal." It is the abandonment of judgement in favour of calculation.

You cannot lead an industry by studying the actions of your competitors. To lead, you must understand the mission of your company and take the steps which, in time, will be studied by other, less successful companies seeking to emulate your success.

Challenges and *Challenger*

Recently, I have been approached by more people concerned for the future of Autodesk than at any time I can recall. I remember no prior occasion where there was virtually unanimous belief among the people I count as key contributors throughout the company—in no way limited to the technical staff—that Autodesk is on the wrong course and that the destruction of all that we've worked for is simply a matter of time.

Further, I have never before encountered the resignation, frustration, and despair I see today. Before, when Autodesk seemed about to do something wrong, people would raise their voices in protest and, if necessary, throw their bodies in front of the wheels to save what they believed in. Problems were seen as opportunities, spurring action to fix them. No longer. Many of the people who did so much to make Autodesk what it is today believe now that they are ignored, dismissed out of hand, scorned, or not trusted. And I think they are correct.

To me, this is more frightening than any of the details of shortcomings in our products or missed opportunities to promote them. It indicates a breakdown of the flow of information in the company, from bottom to top and from top to bottom, which can set in motion the events that lead to disaster.

This reminds me of nothing so much as the report on the space shuttle *Challenger* accident of 1986. NASA seemed to have been sleepwalking its way to that tragedy in an environment where engineers in the ranks knew of problems and groused over being ignored when they raised them, where management heard of problems but was never made aware of their significance or the potential consequences of inaction, and where the pressure of a tight schedule and attempts to meet unyielding demands with inadequate resources caused everybody involved to lose their perspective and make judgements they would have immediately realised were flawed, if only there had been enough time to *think* about them.

Little or none of the industry background, the description of problems in the company, the worries about the state of our products, or the recommendations for addressing these matters originated with me. I have departed from my usual policy of attributing everything to its author both because many of the worries and recommendations are widely shared, and because I've decided to take all the heat personally for putting these issues on the agenda. I'm not a stalking horse for anybody, and I don't want anybody to suffer just because I happen to agree with them.

Autodesk is proud of its open door policy, and counts on it to bring the information before senior management that they need to set the course for the company. Such a policy can work only as long as people believe they are listened to, and that decisions are being made on grounds that make sense for the long-term health of the company. Rightly or wrongly, there is a widely-held belief which I'm articulating because I share it, that management isn't hearing or doesn't believe what deeply worries people throughout the company, and isn't communicating to them the reasons for the course it is setting. This is how bad decisions are made.

And that can lead to disaster.

The Nightmare Scenario

It was a chilly, grey, drizzly April morning. Whenever the weather was like that, and it was *usually* like that near Seattle, the ascetic wunderkind of the software industry was filled with nervous energy. "Damn," he said, looking out the window, "what I need is *more money*."

He looked at the most recent ranking of top-ten software companies, noting with satisfaction not only the extent of his lead in the number one slot, but that it was widening, and gazed further down the list seeming, for a moment, almost like a lion scanning a herd of antelope from a distance, weighing vulnerability against size.

"Excel's got them on the run," he muttered, looking at the faltering growth and eroding margins of a former darling of the software industry. "Hrmpfff... databases. Wait'll they see our...." His eyes continued down the page.

"Now that's interesting," he said, turning his mind in a direction he hadn't thought much about before. "Two hundred million plus sales, 24% after tax, 60% market share, no mass distribution, and they don't even have a product on Windows."

By the time he left the office that evening, the outline of the plan was complete. Implementation began within days. Once he'd realised that this not only had the potential to become the next spreadsheet from a revenue standpoint, but could be the keystone of his larger strategy to move the windowing system and portable operating system into the workstation market, and was, in addition, the largest remaining software market his company hadn't plucked from its pioneer, he gave the project the highest priority.

First, he appointed a strong project manager who'd proven himself on another mainstream application. He delegated total authority to this person to get the job done and gave him discretionary authority over a generous budget and the go-ahead to recruit a project team from anywhere in the company. That person chartered an in-depth study of the market, the users, the target company and its products, and the existing distribution channels. Quickly the plans were drawn.

While negotiations were underway to acquire those technological components of the product more expeditiously bought than implemented in-house, a core team of 75 developers was assembled. At the same time, quality assurance, marketing, sales, and other departments began to assemble the cadres they would need as the product came to require their attention. What with the rapid growth of the existing products even during a recession, resources were tight and many of the jobs were filled by new hires. The staffing up worried the financial planners, but when shown a demonstrated market of more than two hundred million dollars a year waiting to be grabbed, they signed off on all the requisitions.

By July, the central graphics engine had been acquired and was being extended from 2D into a 3D user interface. Some of the developers were particularly amused when they adapted several ideas for object pointing and

orientation in 3D from presentations made at a conference by members of a research project at the target company. Down the hall, the surface and solid modeling code that had been acquired was being hammered into shape and prepared for linkage to the user interface.

Once the outline of the product was clear, another 25 people were added to the project. This group was dubbed the "compatibility team," and immediately set to work developing translators to read and write the databases of the target product, those of its principal competitors, plus the government-mandated interchange standard, awful as it was. Most of the other translators were already in-house, components of the spreadsheet, word processor, or presentation graphics products and needed only to be adapted to the engineering product.

When you do things on this scale, it's hard to keep what you're doing under wraps. But that needn't be a disadvantage. A prototype of the product was shown as part of an industry briefing on the company's strategy for the CAD market. The product was rolled out in Detroit, overlooking the heart of the US engineering and manufacturing plant. The analysts anticipated the outlines of the announcement but were stunned by the details.

- Windows-based.
- Includes 2D illustration, 3D wireframe, 3D NURBS surfaces, and CSG.
- Integrated photorealistic rendering.
- Integrated animation.
- DDE hard links to spreadsheet, word processing, and database servers.
- Reads and writes AutoCAD **`DWG`** and **`DXF`** formats.
- Built-in macro recorder and editor.
- On-line manual and tutorial.
- Integrated drawing management system.
- 1.2 gigabytes of clip-art, samples, and symbols on 2 CD-ROMs.
- "Applications Bridge" allows AutoCAD ADS applications to run with minor modifications.
- Retail price $895, AutoCAD users can trade up for $100.
- Available through all software vendors.

Company officials announced plans to introduce finite element analysis, numerical control machine programming, and other engineering modules over the next several years. "The personal computer has brought a new era of productivity to business, and now it's time to do the same for design, engineering, and manufacturing. Next January, we'll deliver a product that everybody can afford and anybody can learn to use; the first CAD product to break down the barriers between the front office, the design studio, and the factory floor by sharing a common user interface, hardware and software environment, and file formats," said the founder, closing the presentation. As he rode down in the elevator he said privately to the project leader, "That should give 'em something to chew on in Sausalito, don't you think?"

Autodesk's stock fell 25% the next day, and although it recovered half the loss over the next several weeks, the attention of management was consumed for much of the next month in talking to analysts, institutional shareholders, dealers, developers, and key corporate clients. In addition, there were depositions to be taken and documents to be produced in conjunction with the two shareholder suits filed days after the announcement. Product development schedules were advanced, low-priority projects were terminated and staff shuffled around. A crash project was set into motion for a promotional campaign built around the "world standard" theme. But somehow it didn't seem to matter any more.

Windows Engineer was featured in a two minute spot in the Superbowl next January, the game where, ironically, San Francisco lost in the last minute. Shipments commenced the following Monday, the same day the six page

insert ran in the Wall Street Journal and the ad campaign broke in the magazines. The database-compatible Macintosh version was introduced the following July.

Within a year, their market share exceeded 50%.

Marginalia

> Prosperity is an instrument to be used, not a deity to be worshiped.
> —Calvin Coolidge

Are we killing our company by making too much money? I believe this is a possibility, and I'd like to explain the situation and present some ways of remedying it. But first, since it involves some fairly arcane financial concepts, some background is required. I covered these matters in more detail in Information Letter 12, written on July 20th, 1985, which appears in *The Autodesk File* starting on page 269. Here I'll give only a brief summary, sufficient for understanding the discussion that follows.

When a company sells something and gets paid for it, that's *Sales*. Out of that, the company has to pay its bills: the cost of raw materials, salaries, rent, commissions to sales agents, interest on debt, and so forth. What's left is *Pre-tax Earnings*, and if it's less than zero the company is losing money. Next in line are the tax collectors, and what doesn't go into their pockets is *After-tax Earnings*, or plain *Earnings*. Dividing Earnings by Sales gives the *Margin*, the percentage of sales that ends up as profit. If the company is a stock corporation, you can divide the total earnings by the number of shares outstanding and get *Earnings Per Share* or *EPS*. When the stock is selling at a given *Price*, dividing the share price by the EPS gives the *Price/Earnings Ratio* or *P/E*.

These numbers indicate the general state of health of companies and industries. Here are some real numbers for real companies.

	Sales	**Earnings**		
Company	($ millions)	($ millions)	**Margin**	**P/E**
Autodesk	237.8	56.7	24%	22
Microsoft	1183.4	279.1	24%	34
Intel	3921.2	650.2	17%	14
Apple Computer	5558.4	474.9	9%	16
Lockheed	9958.0	335.0	3%	8
Motorola	10885.0	499.0	5%	15
Bank of America	11389.0	820.0	7%	9
Proctor&Gamble	24081.0	1602.0	7%	17
AT&T	37285.0	2735.0	7%	13
IBM	69018.0	6020.0	9%	11
Ford Motor	97650.0	860.1	1%	18

Amazing, isn't it, to think that Autodesk and Microsoft make more than *two and half times* the profit per dollar of sales than IBM? Isn't software neat? Looking at the P/E column indicates investors think it's *awfully* neat. So neat they're willing to bid up the price of a share of our stock or Microsoft's to between 22 and 34 *times* the yearly earnings that share represents, while they're only willing to pay between 8 and 18 times the earnings for companies with sales dozens of times larger and histories spanning decades.

The reason software stocks command these high premiums (which translate directly into the price of the stock), is that they've demonstrated they can run large profits while continuing to grow rapidly. This is usually the case for companies in a rapidly-expanding market. Once the market becomes mature, growth slows, market share battles erupt, and margins fall as companies spend more and more winning customers from their competitors.

Investors and analysts have learned to watch a company's margins closely. Changes in margin are often among the earliest signs of changes in the fortunes of a company, for good or for ill. When sales, earnings, and margins are rising all together, it usually means the market for the company's products is growing even faster than the company anticipated; the future seems bright. When margins begin to decline, however, it can indicate the company has let spending outpace sales. When competition begins to affect the company, or even when a company fears future competition, it may spend more on promotion, accelerate product development, and offer incentives to dealers and retail customers—all reflected in falling margins.

But high margins aren't necessarily a good thing, particularly in the long term. One way to post high margins is by neglecting investment in the company's future. Any profitable company can increase its earnings and margin in the short run by curtailing development of new products and improvements to existing products, by slashing marketing and promotional expenses, and by scaling back the infrastructure that supports further growth. Since there's a pipeline anywhere from six months to several years between current spending and visible effects in the market, sales aren't affected right away. So, with sales constant or rising slowly and expenses down, earnings and margin soar and everybody is happy.

For a while, anyway. Eventually momentum runs out and it's obvious the company can't sustain its growth without new products, adequate promotion, and all the other things that constitute investment in the future of the business. It's at that point the company becomes vulnerable to competitors who took a longer view of the market.

One of the most difficult and important decisions the management of a company makes is choosing the level of investment in the future of the business. Spend too little, and you're a hero in the short term but your company doesn't last long. Spend too much, and the company and its stock falls from favour because it can't match the earnings of comparable companies. Unlike many choices in which there is relatively little room for maneuver, the level of reinvestment can vary widely. After all, Autodesk could have spent $40 million more last year and still earned more on every sales dollar than IBM.

When a company is running margins too high to sustain, the situation can be discerned by the following kind of symptoms. Product release dates are stretched out, and each product release contains less substantive content. Marketing and other promotional activities are cut back, abandoning products to sell themselves. Budgets for the development and promotion of new products are slashed, sacrificing future sales and earnings from those products to current earnings.

Sound familiar?

It's how a company dies by making too much money.

Money in the bank

Let's turn now to what happens to the money that remains after all the bills and taxes have been paid. A small amount is paid back to the shareholders as dividends, but the overwhelming percentage goes into the corporate treasury—the bank account—the money bin. When a company runs the kind of margins Autodesk does for all

the years we have, that adds up to a tidy sum: in Autodesk's case more than $140 million. When thinking about the future of the company, what can and can't be done with that cash is vital to understand.

At the simplest level, the money belongs to the company and management can do anything it wishes within the law: give some back to the stockholders as a special dividend (as we did in 1989), buy other companies (as in the Generic Software acquisition), buy real estate or other capital goods for the company (for example, the scheme to build a "campus" among the cows), or just invest the money, collect the income, and add it to earnings. The overwhelming percentage of Autodesk's cash is currently invested in safe, short-term interest bearing securities, which is why I sometimes refer to Autodesk as a "combined high-tech company and money fund."

But here's the essential point. When you spend a dollar, whether to hire a programmer, buy a truck, run an ad, or take over Chrysler, it *it doesn't matter whether it came from the bank account or from current sales*. Many people think that because Autodesk has $140 million squirreled away (not counting the ball of string or the First Dime), we can use that money free of constraints. If I ran the zoo, I'd change the accounting system to cut some slack for companies that put away profits against future needs, then dipped into the cookie jar when an opportunity presented itself or an unanticipated risk emerged. But that isn't how it works. Regardless of how prudent you've been piling up money over the years, the moment you spend any of it in your business, it's just as if you increased your day to day operating budget. That means rising expenses without an increase in sales, and that translates into... falling margins.

About the only thing you can do with the money that *doesn't* cause margins to fall, other than giving it back in dividends, is investing it in other companies. When you make an investment, that's carried on the books as capital. As long as you don't have to write the investment off, it doesn't affect your operating results. (Outright purchases of companies or large percentage investments force you to merge or *consolidate* their earnings with yours, however, creating the risk of falling margins.)

The accounting for money in the bank, then, can create a situation where pressing company needs remain unmet because the expenditures required would cause margins to fall, yet at the same time, the company is actively investing its cash hoard *outside the company*, in other businesses, because those investments do not show up as current operating expenses. Thus, the accumulated earnings of a company, the ultimate result of its success, can benefit any venture *except* the one that made the money in the first place.

Sound familiar?

Margin vs. management

When it's new to you, some of the ways accounting affects companies such as Autodesk can be difficult to comprehend. However, it's essential for understanding the situation we're in.

Management strives, quarter by quarter, to meet the sales and earnings expectations of the Wall Street analysts and to avoid erosion in the margin which would be seen (rightly) as an early warning, presaging problems in the company. In the absence of other priorities this is foremost, as the consequences of a stumble can be dire. Remember when Autodesk's stock lost 25% of its value in a single day last January not because the company lost money or because sales fell, but simply because they didn't go up as expected? Just imagine what it's like when things get really bad. Or better, don't try to imagine; you probably can't.

But management has a more serious responsibility to the shareholders; to provide for the future of the company and its products. Focusing exclusively on this quarter's or this year's margins to the extent that industry averages

dictate departmental budgets for our company is confusing the scoreboard with the game. We've seen how management strives to deliver numbers each quarter that fall close to the expected results. But management is *required* to protect the future of the company. When these two priorities conflict, it is time for management to make those difficult choices they frequently speak of, and do what is best for the company, not to behave as if their freedom of action were constrained by numbers cranked out by somebody in an office overlooking Wall Street.

Again, it comes down to the need for management to *act* when necessary, using the enormous resources at their command, summoning the courage to take the heat, if necessary, for adverse short term consequences that serve the longer term interest of the company.

The incredible shrinking budget

To illustrate the difference between doing what's best for a business and doing what's best for the numbers, I'd like to tell a true story that happened not long ago at Autodesk. I'm singling out this case because it demonstrates both how accounting can affect decision making as well as the difference between treating the numbers as a master versus simply as a reflection of the underlying reality.

I attended a meeting in early 1989, where I heard a discussion of how, over the coming year, it would be necessary for Autodesk to reduce its sales and marketing budget to lower and lower levels. Walking in from the outside, I found this more than a little puzzling. After all, weren't we in the midst of a still-unbroken series of sales and earnings records? Wasn't this year expected to be the best ever? Weren't we finally achieving substantial sales of AutoCAD to the large companies and government?

True, but there was this little matter of accounting, you see. From time immemorial, most copies of AutoCAD have been sold by dealers. To simplify the numbers, assume the retail price of AutoCAD is $1000, the dealer pays $500 for it, and all sales by dealers are at the full list price. So, for every copy of AutoCAD that ends up in a customer's hands, Autodesk gets $500 and the dealer gets $500. Autodesk reports the $500 as Sales, deducts expenses, pays taxes, and ends up with earnings, say $125, corresponding to a margin of 25%.

But suppose, instead, we sell the copy of AutoCAD to a Fortune 500 account: Spaceley Sprockets, perhaps? In that case, the numbers look like this (again simplified for clarity). Autodesk ships the copy of AutoCAD directly to the customer and invoices Spaceley Sprockets for the full list price, $1000. However, the sale was not made directly by Autodesk; the order was taken by one of our major account representatives, the equivalent of dealers for large accounts. When we get the check, we pay a commission to this representative. Assume the commission is $500.

Regardless of who bought the copy of AutoCAD, the financial result, the fabled "bottom line," is the same. There's one fewer copy of AutoCAD on our shelf, and one more installed on a customer's premises. Autodesk receives $500, and our dealer or representative gets $500. But oh what a difference it makes in the accounting! In the first case, where Autodesk sold the copy of AutoCAD to the dealer, that was the whole transaction; whatever happened to the copy of AutoCAD after the dealer paid for it has no effect on Autodesk's books. Autodesk sells, dealer pays, end of story. But in the second case, when Autodesk sells to Spaceley Sprockets, that appears on Autodesk's ledger as a sale of AutoCAD for $1000. The instant the $1000 shows up, however, we immediately cut a check for the commission, $500, and mail it to the representative, leaving the same $500 we'd get from the dealer. Same difference, right?

Not if you're an accountant! In the first case, Autodesk made a sale for $500 and ended up, after expenses and

taxes, with $125, and therefore is operating with a 25% margin (125/500). In the Spaceley sale, however, the books show we sold the product for $1000, yet wound up only with the same $125. So now our margins are a mere 12.5% (125/1000). And if we only kept $125 out of the $1000 sale, why that must mean our expenses were 1000 – 125 = 875 dollars! Of that $875, $375 represent the same expenses as in the dealer sale, and the extra $500 is the representative's commission which, under the rules of accounting, goes under "Cost of sales."

Or, in other words, comes out of Autodesk's marketing and sales budget.

That's why the marketing budget had to be cut. *To the very extent the major account program succeeded, it would bankrupt the department that was promoting it.* If we were wildly successful in selling AutoCAD into the big companies, Autodesk would make more sales, earn more profits, then be forced to cancel marketing program after marketing program as the price of success! All because the rules of accounting would otherwise show falling margins or a rising percentage of revenue spent on "cost of sales."

The purpose of this discussion is not to complain about the rules of accounting. You have to keep score somehow, and while one can quibble about this or that detail, as long as the rules are applied the same from company to company and people don't lose sight of what's really going on, there's nothing wrong with the way these different transactions are recorded. After all, business is supposed to be about making money, and after all the adding and subtracting, Autodesk made the same $125 from both sales.

Instead, what disturbed me so much about this incident was the way management seemed to be taking their marching orders from the accounting rules rather than the real world. Budgets were actually being prepared on the assumption that marketing and sales efforts would have to be curtailed to offset the increased "cost of sales" from the major account sales anticipated over the year. Think about it: here we were planning for what was anticipated to be and eventually became the *best year in Autodesk's history*, and yet were forced to cut our marketing and sales *as a direct consequence of its very success*. Carried to the absurd, if the major account program astounded us and began to dwarf dealer sales, we would have to lay off the entire marketing and sales department to meet the budget.

This bothered me.

It seemed to me that what was called for here was not a plan for the orderly dismantling of marketing and sales department, but rather some effective outreach marketing of the company's own plans to the shareholders and analysts. Rather than sitting in our offices and *assuming* that changes in the numbers would be interpreted in a certain way, what was needed was to contact the analysts and major shareholders and, if necessary, go visit them in person and explain precisely what was going on. In essence, we'd be saying something like this. "Look, for years you've been hoping we'd crack the Fortune 500 in a big way, and we think we're going to pull it off this year. But because of the crazy laws in the US about pricing, we have to structure the transaction like this, and so every time we make a new sale, it looks as if our marketing budget went up when in fact nothing of the sort occurred. We know you're concerned about eroding margins, but we can't afford to pass by the Fortune 500 because of an accounting rule, and neither can we let our success there kill off our existing marketing and sales efforts. Here are our forecasts with and without the Fortune 500 program; you'll see how much it will really contribute if it works. To make things clearer during this period, every quarter we'll break out the effects of this accounting rule in our financial reports so you can see we haven't really let our cost of sales get out of control."

There are two different ways management can react to a problem; either passively: seeing their freedom of action constrained on all sides by history and expectations, or actively: looking at how best to deploy the enormous assets of the company to do what must be done. This incident illustrates how much outlook can affect outcome.

I don't know what ultimately happened in this case. I was so appalled by what I heard that I vowed to never

attend another management meeting, and I never have.

Business Development

> A wise man will make more opportunities than he finds.
>
> —Francis Bacon, "Of Ceremonies and Respects," *Essays*, 1625.

As we've seen, if we use any of Autodesk's cash hoard directly in the business, it increases the expenses we report, reduces our margins, and makes the company look less profitable in the short term. If we just sit on the money, after a while investors quite reasonably become restive. "If you can't think of anything to do with the money, why don't you just give it back to us," they say, even though paying out profits as dividends subjects them (in the United States) to a second round of taxation.

The only way to use the money without directly increasing expenses is by investing it. These investments can consist of buying other companies outright, making minority investments in ventures, or purchasing products or technology which Autodesk can incorporate into its product line. Autodesk has, over the last several years, made investments in all of these categories.

Once it became obvious that Autodesk's growth expectations could be met only by finding additional products that generate revenue comparable to AutoCAD, using our strong cash position to acquire those products outside the company became a strong priority. This is as it should be; after all, Autodesk has no monopoly on good ideas for products nor on people able to turn ideas into reality. However, we must look closely at the kinds of products being sought and the criteria being used in the search to decide whether the candidates for investment we'll identify have a chance of succeeding in the software market of the 1990s.

Unfortunately, unless the goals and priorities of Autodesk's current Business Development effort have been seriously miscommunicated, it seems to me embarked on a quixotic search for something which in all probability does not exist: "The Next AutoCAD." Autodesk needs additional products that contribute results comparable to AutoCAD, but to expect them to share the price, customer profile, and distribution of AutoCAD excludes any product within the mainstream of currently successful software packages.

We are said to be seeking to increase our sales by hundreds of millions of dollars a year by finding products which "sell for $1000 or more per copy and can be sold through our AutoCAD dealer network." So, in other words, we're betting the future growth of our company on our ability to consistently identify products which *sell for more than any other widely-distributed software* and will be sold exclusively by a distribution channel which has demonstrated itself *incapable of selling anything other than AutoCAD.*

What's wrong with this picture?

When you adopt unrealistic selection criteria, you find unattractive alternatives. The desiderata that Autodesk is seeking in the products on which the company's future will be bet would have excluded every single successful product introduced since 1982 by Microsoft, Lotus, Ashton-Tate, Word Perfect, and Borland. What are the odds Autodesk will find not one, but several products that these companies have missed?

You can always find an investment that meets your criteria, but if your criteria are out of whack with reality, you might as well blow your money at the track where at least you get to smell the horses. A literal search for "The Next AutoCAD" always ends up with dorky stuff like overpriced high-end project management software. What a concept: jumping into the very top end of a market where the entry level is dominated by Microsoft Project,

then slugging it out with a company five times our size, selling a product at more than twice the price, through a distribution channel a fraction as large. Why we could blow them away just like Boeing Calc (I'm not making this up) obliterated Lotus 1-2-3! Yeah, sure. And I am Marie of Roumania.

I'm all for business development; just look at how many products and investments I've brought in the door. But when we seek "The Next AutoCAD," as we must, we have to use a little more imagination. When we find "The Next AutoCAD" it will look just like the *last* AutoCAD did back in 1982—a non-obvious product in a market waiting to be created, with a large body of potential users who haven't ever really thought about how useful such a product might be. It's that kind of product, whether it sells for $50 or $5000, whether it's sold in bookstores, by dealers, or door-to-door, that promises the kind of exponential growth we seek. Most companies never find a single product that grows the way AutoCAD has. If we hope to find a second, then a third, and then more, we're going to have to look for products that play as large a rôle in defining the PC software industry in the 1990s as AutoCAD did in the eighties. Those products won't look like AutoCAD at all; they'll seem, at first glance, just as unlikely to have a future as AutoCAD did when we started working on it. But seen through the right kind of eyes, in the context of where we're leading the industry, they can be chosen with confidence because they're going our way.

Winning

> A great part of courage is the courage of having done the thing before.
>
> —Ralph Waldo Emerson, *The Conduct of Life*, 1860.

The paradox of Autodesk's situation is this. Despite having spent more than thirty pages describing deep-seated and serious problems with our company, I continue to believe that no company in our industry possesses the opportunity that Autodesk does today. Autodesk can, by seizing the moment, changing as required, and resuming an active rôle in the industry, build its success in the CAD industry into a much broader position in the software market and, in the process, resume the rapid growth of the early years which some believe is impossible in a "large, mature company."

For this to happen, Autodesk must step back from day to day events and look at where the industry has come, where it is today, and where it is going. In this paper I've presented my views; whether you agree entirely, dispute this point or that, or consider my entire world-view wrongheaded, you'll probably concur, after reflection, that it's highly unlikely an industry that has changed so rapidly in the first 45 years of its existence will conveniently cease to evolve at the very moment Autodesk becomes set in its ways.

Some people may welcome change, but most of us hate it. We prefer a quiet, normal life, doing the things we have become accustomed to. But sometimes change is necessary. Almost 10 years ago, I started to think about what was wrong with Marinchip, the company I started in 1977. Perhaps, I thought, it was time for a new company, a new way of doing things. What was wrong with Marinchip was that it got stuck in 1978, but the times, and the game had changed—by 1982, the PC market was becoming something very different. It was time to do something new. It was painful to change—painful to even think about raising money, working with lots more people, dealing with distributors, etc., but it had to be done. It was done, and Autodesk is the result.

Now it's time to consider whether Autodesk has become stuck in the past; whether it's time for Autodesk to change and how. The changes may be unpleasant to contemplate and difficult to carry out, but they may be just as necessary and, if successfully made, as rewarding. As I hope I've convinced you through brutal repetition if not by artful rhetoric, if and when Autodesk wishes to change course, it has the resources at hand to accomplish

anything we wish.

With the imagination and resolve to use those resources, how can the future be anything but bright? AutoCAD owns the market for the creation of geometric models and preparation of drawings from them. We have just placed solid modeling in the hands of hundreds of thousands of people for the first time, and we're poised to follow that up with even more powerful surface and solid capabilities. With Generic CADD and AutoSketch, we cover the CAD market from the bottom to the top, on all popular computers.

We sell, with AutoShade, the most comprehensive tool for producing lifelike images from the models we build, a rendering engine created by the acknowledged world leaders in the field. We own a majority interest in Xanadu, a hypertext system conceived by the person who invented the concept and coined the word for it, and developed by a group of people who have devoted years to designing a knowledge storage system for the ages that is as much of an improvement over anything in existence today as books were over oral tradition. And along the road to Xanadu, they have developed what may be the most comprehensive and innovative object oriented development system ever built.

We own a majority interest in a company that has developed the first totally automatic, computer mediated information market. If ours is, indeed, the "information age," then an information exchange will be as fundamental a part of that age as a stock exchange in the age of capitalism. . . and Autodesk owns the only one in existence. We have acquired exclusive marketing rights to the only molecular design software that spans the price-performance spectrum from laptops to parallel supercomputers; positioning us in another market at the very beginning of its rapid growth.

We market the very best paint package for the IBM PC, which also happens to do animation. With a few technical tweaks and a major market repositioning, it and its successors could own the entire raster graphics segment on the most widely used computers. We sell the first totally integrated 3D modeling, rendering, and animation software for mass market machines. If sold at a mass market price, it could begin to build this new market just as AutoCAD did years ago. We have $140 million in the bank, a thousand of the best people in the world, presence in every major market around the globe, and a channel of distribution dedicated to selling our products.

These are resources as great, or greater, than Microsoft has used to launch their last *five* successful products. What is lacking? How can a company with such assets have problems? What is needed is simply a clear statement of where to go, and a commitment to get there.

How to take over the whole graphics industry in a year or so

> A good plan, executed now, is better than a perfect plan executed next week.
> —George S. Patton

Here is the kind of strategy I think a reinvigorated, aggressive, Autodesk should be unleashing on the industry. I have plotted this strategy based on what I know Autodesk *can* accomplish, not constrained by what Autodesk has convinced itself is "realistic." My plan combines short-term, remedial steps aimed at reducing risks created by our slow progress in recent years, repositioning of existing products to better fit today's market, and development of new products to close gaps which endanger our competitive position. These recommendations are a starting point, not a complete prescription for turning Autodesk around; they are intended to highlight the extent that Autodesk truly controls its destiny and to suggest other similar moves to consolidate and expand our market position.

None of these proposals would survive scrutiny based on the first third of the criteria I call the Stainless Steel Web; implementing any of them (or indeed, doing anything at all) requires, as a prerequisite, the will to act. And that is the hardest part of the whole scenario; the rest are all things we know how to do and have done before.

Manage our products. If we are to redirect our products and treat the market as something we control rather than react to, we will need not only direction from senior management but close day to day line management at the product level. Our products are too important not to have a single individual who can speak for them and promote them both within the company and without.

☞ **PM1**: **Appoint a strong product manager for every product.** Appoint or recruit a product manager for AutoCAD, and for every other product in Autodesk's line. That person should report to the President, and will be given essentially complete discretion over the development, marketing, and sales resources for the product, constrained only by the budget allocated to that product.

☞ **PM2**: **Implement product-level profit and loss accounting.** Structure our internal accounting so it becomes possible to monitor the costs incurred and revenue generated by product, allowing us to track the contribution of each product to our overall goals.

☞ **PM3**: **Integrate development and promotion budgeting.** Undertake no new product development efforts without a comprehensive plan, adopted in advance, covering both the development phase, the marketing roll-out, and the first two years of post-launch development and marketing support. Autodesk must never again abandon a product developed at great cost; doing so squanders the morale of developers as well as the company's cash.

By "product manager" I mean an individual with line profit and loss responsibility for the product; a person delegated the authority to decide what goes in a product and what does not, when releases are to be made and what they will contain, and who bears the responsibility for achieving the schedules associated with that product. The current function called "product management" would remain within whatever department it best fit.

Help the dealers. I'm concerned about the health of our dealers' businesses, and about the degree to which Autodesk relies upon them as our only channel of distribution. Still, I continue to believe that we should do everything we can to strengthen our dealer channel, and should abandon it only if its collapse imperiled Autodesk's survival. Autodesk and our dealers depend on one another, yet the nature of our businesses are very different. When our dealers are in trouble, it is incumbent upon us to look beyond the obvious in seeking ways to help them. Here are two examples of ways Autodesk could help our dealers survive.

☞ **DE1**: **Provide dealer inventory on consignment.** Autodesk is cash-rich; our dealers are starved for capital. Yet Autodesk requires its dealers to tie up a substantial amount of their working capital keeping copies of AutoCAD in stock. In addition, dealers must carefully estimate inventory levels to ensure they are able to deliver our products without waiting to receive new stock from Autodesk. We could drastically reduce the capital our dealers tie up in inventory by moving to a consignment stocking policy. Any dealer in good standing, not on credit hold, would be able to stock a quantity of AutoCAD equal to his average monthly sales without paying Autodesk in advance. As each copy was sold he would report its serial number to Autodesk and a Net 30 invoice would be generated for it. As long as the dealer collected from his customer before the invoice came due, he would have no capital tied up in flooring inventory of AutoCAD.

Spare me a recitation of the ten or fifteen reasons we could never adopt such a policy. Yes, you'd have to explain it to the analysts, live with greater uncertainty, and trust the serial number tracking mechanism to prevent

cheating. But isn't this how a company with $140 million in the bank should behave when its cash-poor dealers are facing extinction?

☞ **DE2**: **Consider reducing the price of AutoCAD.** Pressure from dealers is often cited to justify increases in the retail price of AutoCAD. But it may well be that *lowering* AutoCAD's price is the best way to help our dealers survive. Autodesk has, over the last several releases of AutoCAD, continued to raise the suggested retail price and has therefore increased the price dealers pay for AutoCAD since this is a constant fraction of the retail price. Evidence suggests, however, that the actual price customers pay when they buy AutoCAD from dealers has increased, if at all, much more slowly than Autodesk's posted list price. This has resulted in a squeeze, where the AutoCAD dealer makes less and less on each copy of AutoCAD he sells, while being forced to bear ever-increasing costs to maintain an inventory of the product on the shelf.

For years, many successful AutoCAD dealers have said that the bulk of their profits come primarily from sales of computers and peripherals associated with AutoCAD, not the software itself. If this is the case, a primary reason our dealers are encountering difficulties now is that the margins on their hardware sales are falling, squeezing the segment of their business which accounted for most of their earnings.

If we were to reduce the price of AutoCAD and that resulted in increased retail volume, would that not benefit the dealers? If the majority of our dealers derive more revenue from hardware and services sold with AutoCAD than from the software, increasing the unit volume of AutoCAD would actually result in higher sales and earnings, since increased hardware sales would more than compensate for the lost revenue from a lower price for AutoCAD. There's no question that cutting the AutoCAD price would result in a short-term hit to Autodesk's sales and earnings. But what is the net present value of preserving the channel which has accounted for essentially all our domestic sales of AutoCAD since 1982?

This is a case where the "safe decision" is to do nothing, but where inaction may accelerate the collapse of our dealers. There are alternatives to a simple price cut; we could create a "2D-only AutoCAD" and price it at, say, $1895. Or, we could introduce the 286 version of Release 11 at a lower price, for example, $2195 (this would require a modification of recommendation **AC1** below—I trust you can see the obvious way to reconcile these goals).

Low cost marketing initiatives. In the early days of Autodesk, lacking any marketing budget whatsoever, we found a way to gain influence without spending anything more then the cost of goods in our products. Sacrificing such opportunities now in a quest for illusory short term sales is folly, especially when marketing budgets continue to be tight.

☞ **MS1**: **Free product for "opinion leaders."** A small number of individuals exert great influence in our industry. These columnists, educators, editors, consultants, and analysts form the opinions which echo throughout the market. In the early days of building the market for AutoCAD, we sought to make each and every one of these individuals familiar with AutoCAD, even if it required retaining them as consultants, flying them to Sausalito, and asking them for their view of the industry following, of course, a half-day indoctrination in our product line. But usually, a free "evaluation" copy of AutoCAD was all it took to get their attention.

Now, I discover, Autodesk has become loath to provide free copies of our new products to influential people in the industry. I presume this is a misdirected attempt to boost sales instead of an urge to self-destruction, but the results are indistinguishable. When the Education department was created at Autodesk, Mike Ford gave it this charter, "Extract as much money as you can, but never lose a sale." Seeking revenue in the short term ignores the multiplier effect of having a class taught using your product, having a book written about it, or having it

be the object around which a curriculum is developed. These benefits follow only when those who influence opinion get an opportunity to play with a product, and they're unlikely to buy every product that comes along to see which is worth their time. Providing free products to opinion leaders is a way in which software companies can create market presence comparable to the list price of their products, while incurring a cost equal only to the raw materials.

Near-term upgrade of AutoCAD. A $4000 list price product shouldn't look stingy. We should take whatever immediate steps are possible to make the purchaser of AutoCAD feel he is being treated as the elite customer he is; that he is dealing with a vendor who values the relationship with him.

☞ **AC1**: **Universal 80x86 release.** Include all operating system platform versions in the Intel architecture release. In other words, when you buy an 80x86 AutoCAD Release 11 you get 386 DOS, 286 DOS, Xenix, OS/2, and Windows executables all in the box. If any of those versions aren't available at the time we ship the product, include a coupon for ordering the others (just like the coupon Microsoft includes for no-cost ordering of 360K floppy or CD-ROM versions of their products). When you consider the costs of separate inventories, bills of materials, exchange order processing, etc., the cost of this to Autodesk may be *negative*.

☞ **AC2**: **Eliminate AME surcharge.** Include AME at the $3500 price point. We want to create a huge new market for solid modeling, and we have a unique opportunity to do so. Coming down the pike is ACIS-based AME-2, a major functionality upgrade. What better way to sell it than to get every Release 11 customer acquainted with what solid modeling can do in his application area? This also eliminates the expense of processing AME A-codes.

☞ **AC3**: **Promote solid modeling.** It isn't too late to beat the bass drum about what we've done for the industry by including solid modeling in AutoCAD Release 11. Even if we continue to charge extra for AME (especially, in fact), we should give it the launch it deserved when it was introduced, even though several months have passed.

☞ **AC4**: **Expedite Windows AutoCAD.** The existing Windows AutoCAD Product Plan Proposal should be implemented in its entirety as the highest priority project associated with AutoCAD Release 11. If diverting resources from other platforms or related projects can help ship this product sooner or make it more comprehensively integrated with Windows, divert them.

☞ **AC5**: **Expedite Windows-32 AutoCAD.** Assign resources appropriate to ensure that a 32 bit version of Windows AutoCAD will be available for delivery the day Microsoft ships the required version of Windows to customers. If more than six months can be saved and substantial performance improvements had by pursuing an interim 32 bit version (e.g., Watcom), consider it seriously.

☞ **AC6**: **Include CD-ROM(s) with AutoCAD.** Autodesk has everything in its possession today to include a compact disc with every copy of AutoCAD we ship. Six hundred megabytes... what could we fill it with? To start with, all the stuff on the existing drawing library disc, which needs only to be run off in sufficient quantity and included in the package. How long can that take? As soon as we can arrange it, we should make space on the CD available to all our developers to include sample applications and demos of their products. Within 45 to 60 days, we should be able to include a machine-readable version of the AutoCAD manual, hot-link indexed and connected to the HELP command in the product. If everything won't fit on one CD, then two or three. We'll have to get rid of that overpriced retrieval program on the current CD. There's no need to replace it; simply providing a High Sierra format CD and a directory map is enough to get the files off on any platform I'm aware of.

☞ **AC7**: **Upgrade AutoCAD documentation.** Re-design and re-print the AutoCAD Reference manual and Tutorial to equal the production values of the corresponding manuals included with Microsoft Word or Corel Draw. This is entirely a question of graphical design, use of colour highlights, etc. In the longer run, develop an "AutoCAD Encyclopedia" to supplement the existing reference manual, organised along the lines of the Microsoft Word or Excel reference manuals.

☞ **AC8**: **Direct support line.** I think it's shameful to ask $4000 for a product and then refuse to talk to any customer who calls with a problem. We should provide, at the minimum, one year of free telephone consultation. There's nothing wrong with asking who his dealer is and providing feedback to the dealer, but we should take the call and ungrudgingly provide whatever assistance we can.

☞ **AC9**: **User newsletter.** We should immediately start production of a quarterly AutoCAD user newsletter, to be mailed to all registered users. The content of the newsletter would primarily be meat and potatoes technical and application information about the product, questions and answers, and the like. For a prototype, look at the Cobb Group newsletters such as "The Expert" covering Excel. New product information, listing of interesting items available on CompuServe, and the like could serve as filler, but would not be the main purpose of the newsletter.

AutoCAD future development. Beyond the short-term actions to upgrade the quality of AutoCAD and its perception as a premium product, we must revisit our development plans for Releases 12 and 13. Does a release defined by a shipment date rather than customer requirements, one motivated by a hope that it will create short-term demand for the product and raise its "street price," keep faith with the customers who are responsible for our prosperity? How long can we get away with releases with less and less substance in each? What is an appropriate manpower commitment to development and maintenance of our principal product?

☞ **AD1**: **Developer product orientation.** Make the time and resources available, even if it means slipping other schedules, for every individual involved in the development of AutoCAD to become familiar, in depth, with a modern Windows or Macintosh application such as Excel, Word, or CorelDRAW! This should be viewed as an education in the standards of today's market and what users expect of products, not aimed at mastering the applications themselves.

☞ **AD2**: **Evaluate development and QA staffing.** Investigate the tradeoffs between manpower allocation, content of each release, and time to market, then propose staffing plans for various points on the curve. This investigation must include a review of development methodology and tools which permit more developers to work together without conflict.

☞ **AD3**: **Parallel Release 13 projects.** Take all of the contending plans for Release 13, set them up in parallel, and let them run for 6 to 9 months with the goal of producing, at the end of that time, a base suitable for all the requirements anticipated for AutoCAD over the next decade. These projects would, collectively, compete with the **NC1** project (see below), to become the base for future development. At the end of the parallel phase, if it isn't already obvious, an in-depth review will be made to decide which alternative(s) to continue to pursue.

Own the raster market. Multimedia's going nowhere. Why? It's too damned *expensive*. When you're trying to pioneer a new market, you have to recruit a small cadre of "early adopters" who become the fanatics who discover new applications for the product, build upon it, and generate, through their efforts, the first success stories for the product which are echoed by a well-designed promotional campaign. This is how we got AutoCAD going. If we had introduced AutoCAD at $3000, I am convinced that very few if any of the people who ended up so

influential in its early growth (many of whom now work here—ask them), would have been able to afford or have been inclined to take a chance on it.

The multimedia market closely parallels the early days of AutoCAD; both were considered outside the mainstream of PC applications, both were limited at the start by crude and expensive hardware, and both lacked the collateral support resources (books, training, user groups) that allow a small initial beachhead to expand to a much larger community of users. So what do we do? Raise the price on Animator. Wizard.

☞ **RM1**: **Re-price Animator at $149.95, add graphics modes, target paint programs.** If we want to *own* this market, and I cannot conceive of any reason we wouldn't want to, here's how to go about it. First, we have to reprice and reposition Animator. It's a spiffy animation program, but it also happens to be the best *paint* program available for the PC as well. Its only limitation is that the only graphics mode it supports is 320 × 200 VGA/MCGA mode. What I'd do is remove that restriction, and support all the 16 colour modes and SVGA 256 colour modes *for single-image painting only* (the easiest way to accomplish this is to license and use MetaWINDOW, as we used for *Chaos*). Then, we re-price the product at $149.95 and re-launch it, aiming it directly at Z-Soft's various Paintbrush products and Colorix VGA Paint. "For the price of a paintbrush, we give you the whole movie studio. . . ." That kind of thing. The re-launch and post-launch support will be expensive. Spend the money. Otherwise kill the product and cut your losses.

☞ **RM2**: **Re-price high-res animator at $275.** As the reborn Animator takes off, we roll out the high-resolution animator, code named PJ, at $275. Call it "Animator Professional" and harp on the way it effectively uses 386 mode and VCR control, etc. Continue to target paint programs as well as animation, and show how POCO and user-defined inks make this the first open-architecture paint program.

☞ **RM3**: **Move animator, PJ to Windows.** As quickly as possible, we should make both the original Animator and PJ work under Windows. In the case of PJ we may have to wait for the 32 bit mode Windows, but in neither case should we wait any longer than necessary.

☞ **RM4**: **Re-price 3D Studio at $499.95.** Don't touch the product. Just move the price down to where the early adopters can afford it, including all those people who'll buy it on impulse and find out only later that this is the product they've waited for all their life. Don't discount the impact of "corporate early adopters"—at $500, lots of companies will buy one and have somebody evaluate it. At thousands of dollars, it's a major purchase decision. Doubt me? Try ordering a $3000 software package to "look it over" around here. After repricing, re-launch much more broadly. Offer demo tapes at cost through 800 number. Maybe try a little cheap-o TV. Move the product to Windows as soon as technically feasible.

☞ **RM5**: **Launch an image-processing product.** Acquire, license, or develop a product that embodies the image processing functions not provided by PJ. (Quite possibly, these facilities could be integrated into PJ or made some kind of add-on to it.) This would complete Autodesk's product line in the raster graphics industry. The product should be targeted at a $499.95 price point, and could use comprehensive manipulation of scanned images as a means of establishing its initial customer base.

New CAD system. In parallel with the work underway on AutoCAD, we should immediately begin a project to produce its successor; a thoroughly modern product that does everything AutoCAD does and provides a reasonable level of compatibility, but which is freed from the truly stupid baggage of the past. This project would target its initial product release for Windows, with subsequent platform versions thereafter based on market demand. This development project would be staffed comparable to the AutoCAD project and assigned similar priority.

☞ **NC1**: **Develop AutoCAD successor.** Immediately begin development of the next-generation CAD system—

the replacement for AutoCAD. The outline, specifications, scope, pricing, and timetable for such a project are given in the "Nightmare Scenario" on page 24. The project would be chartered to take as much or as little code from existing Autodesk products as its developers wished, and to use whatever development environment and methodology they believed best suited to the task.

The initial release of this product would require a 386 or better and the 32 bit version of Windows. Other platforms would follow. The product would be able to read and write AutoCAD **`.DWG`** and **`.DXF`** files, but would not be required to maintain absolute compatibility in other aspects. For example, the command line could be entirely absent, menus might be totally different, and AutoLisp may not be provided. This would differentiate the product from AutoCAD, so when it was introduced at a lower price with broad distribution it would not be perceived, at first, as a replacement for AutoCAD. The product would, however, serve as the base upon which such a replacement would be assembled in the future.

All existing Autodesk resellers would be authorised to sell the new product at the date of its introduction and would be encouraged to sell it to prospects they are currently losing due to AutoCAD's price. The product would also be placed into general distribution, using the channels which already carry Generic CADD, plus others we may develop in the meanwhile. If the fear generated by the existence of this product (which will be done by somebody in the next 48 months anyway, I am sure) cannot be overcome, I suggest it may be easier to take if the product is named "Generic CADD 7.0."

☞ **`NC2`**: **Continue product line integration.** Building on the initial release of the successor system, which will already integrate illustration, 2D and 3D wireframe, surfaces, and solid modeling in a modern application framework (providing multiple document architecture, clipboard, a full function macro recorder and editor, background generation, and inter-application hot links just as Excel 3.0 does), continue to roll in other components of the product line as pluggable pieces. Two or three releases down the road, it should be possible to paint, do image processing, create animations, and perhaps build worlds for cyberspace or spatial models for Xanadu all from the user interface (and, just as important, application linkages) of the product.

A Bodyguard Of Fears

Whenever change is suggested, particularly changes to the assumptions that have guided an organisation and are embedded in the very way it goes about its business and in the style of the products it builds, it's only human to resist, to dispute the need for change, or to characterise the changes as too risky or impossible to achieve. These objections often come neatly tagged with phrases embodying supposed disadvantages of the proposed course. I'd like to address some of these reason-killing labels head on, before they're dropped into the debate over the issues I've raised herein.

"Betting the company"

Any major change can be seen as gambling with the billion-dollar market capitalisation of the company. Yet most companies that attain great value then lose it do so by *failing* to adapt when technological progress or the market demand they change. Part of the art of running a company is making a number of small bets, each with a limited downside and unbounded potential gain. This is how you bet on the future without betting the company; rarely need a current revenue stream or key product be put squarely at risk—there's almost always a way to structure a transition so the new is allowed to compete with the old, with the market rendering the ultimate verdict as to which is better.

Since markets embody the wisdom of thousands or millions of people, and management contains but a handful, providing a variety of alternatives and seeing which succeeds allows a company to lead an industry while following the market. To do otherwise is to "bet the company" either on the judgement of a few individuals or, even worse, on the market's suddenly ceasing to evolve. You can bet the company by doing nothing.

And lose just as much.

"Fiduciary duty"

Over-cautious managements often rationalise their fear of change by appealing to their fiduciary duty as custodians of the company's assets. Deploying the company's resources, redirecting priorities, and taking actions which might have adverse short term consequences are claimed to violate the trust they exercise in the name of the shareholders.

Yet is not the duty of a fiduciary to manage the assets entrusted to him "as a prudent man would dispose of his own assets?" What is "prudent" for a bank trust officer or pension fund manager may constitute a freeway to oblivion for the management of a company that leads an industry in the midst of a technological revolution—especially if that management has signed up to deliver compounded exponential growth in sales and profits for the foreseeable future.

It's easy to become obsessed with fiduciary duty when guarding $140 million. But it's essential to never lose sight of the fact that the most fundamental and profound fiduciary duty—the ultimate act of the prudent man—is to use that money, when necessary, to protect the future of the company that earned it. Fiduciary duty is often cited as a excuse not to act.

Yet when change is required, the prudent man adapts.

"The human wave"

Suggestions that the manpower devoted to development and maintenance of our products is inadequate are often greeted with the claim that one is advocating a "human wave" approach to software development. An image of ranks of mediocre programmers stretching off the horizon is summoned up, and contrasted against our hardy band of Stakhanovite geniuses able to achieve a greatness to which no large team can aspire.

I believe this is one of the central myths of the software business, destructive of products which must, as demanded by the market, grow to such a scale that a handful of individuals can no longer do all the work by themselves. Further, it avoids facing the issues of structuring a product and project in ways that can accommodate additional human resources, including those not immersed in every detail of the entire program.

There is no indication that the user demand for additional capabilities in products is going to abate in the near future. Forget something as complicated as CAD, where it's obvious to anybody that we've hardly scratched the surface of modeling the real world—just look at spreadsheets and word processors over the last five years, and see how they've grown to meet escalating user requirements.

Although software development methodology, improved tools, and faster machines have increased the productivity of individual programmers, it just isn't realistic to expect these advances to allow a tiny group to maintain an ever-growing product. Indeed, overwork and the necessity to stay immersed in the details of the product just to

keep up may cause developers in that environment to lose sight of developments which could benefit their work, or simply lack the time to step back and implement them.

Nobody is arguing for mediocrity. It's a cheap shot to assume that the work of a larger group need be inferior in quality. By subdividing a product along functional lines and parceling out work in a manner that takes advantage of individuals' expertise rather than forcing each person on the project to learn the intimate details of every corner of the product, it may be possible to increase the net productivity of many individuals.

But regardless, in a market which expects products which are far more comprehensive than those of a few years ago, surrounded by much more support material, and closely integrated with other applications and the underlying software system, the old drag racing maxim applies: "there's no substitute for cubic inches." A development team with 3500 cubic inches of neurons will, unless things are utterly screwed up, leave the lean, mean team with only 1500 in the dust and smoke, regardless of how bright the smaller team is, how many hours they work a day, and whatever the marginal efficiency and better communication they benefit from by being so few.

An ultimate determinant of how much software goes in the box as well as the quality of that software is how many man-hours were expended to create it. I believe this is a little-appreciated but important factor in the success of Japanese products. A new product launched by a Japanese company typically embodies several times the engineer-years of a comparable product from a U.S. or European company. The refinement and freedom from problems that customers have come to expect is simply a reflection of all the work that went into initial design, finding problems, and fixing them before a customer ever saw the product. Attempts to surpass the quantity and quality of a much larger team through pure cleverness and long hours seldom work outside the pages of fiction.

Learning to do things on a grander scale is part of growing up in an industry. Certainly nobody would suggest that Autodesk should try to run its business today with the staff that sufficed in 1986.

What makes us think we can develop modern software that way?

"Throwing money at problems"

The programmers' fear of the "human wave" has its parallel in the accountants' spectre of "throwing money at problems." Like most evocative phrases, this expresses both a legitimate concern and an irrational penumbra of fear. Certainly we're all aware of examples where spending more on a project only makes things worse. But that's all the more reason to treasure those rare problems which *can* be solved with money, particularly if you're a cash-rich company with the money it takes. Treasure them, but don't endure them.

Increasing the budget of a software development project in an attempt to expedite its completion rarely works. A larger group can do *more* work in a given amount of time, but additional manpower does little to compress the length of the development cycle. But if the problems one faces are insufficient staff, inadequate tools, poor production values, and a lack of promotional presence in the market, these *can* be solved by judicious spending. Enduring problems which risk the company in an attempt to conserve cash doesn't make sense when your company is valued between 20 and 30 times present earnings. Management's job is to identify the places where spending can benefit the company and apply the resources at hand to the company's needs, not to consider the bank balance more valuable than the company's future.

Conclusion

Writing this letter has not been either easy or pleasant. Researching these issues has forced me to question many of the comfortable assumptions I've lived with for many years, some dating before the formation of Autodesk. I'm aware that many may read these words as an attack on the company, or on the managers to whom we have entrusted it. That is not my intent. When I was personally involved in running the company, I was just as blind to trends outside the company, just as loath to act, and just as happy to retreat into the details of daily crises or the minutiæ of product design to escape the larger issues facing the company. This is only human, and only natural since we are human first and managers second.

Only rarely does one both have the time and the opportunity to step back far enough from the details to see the larger picture. When that picture appears hostile to the continued existence of the way you've become accustomed to doing business, it's a shock. It takes a while to sink in, and even after it does it's hard to resist the temptation to pick at little pieces of the arguments I've presented here and justify remaining on the current course, believing that it remains the prudent, low-risk path. Being prone to such argumentation myself, I expect that many people will greet what I say here in much the same way. I urge you to weigh their words against the fundamental questions I've put on the agenda.

They will dispute this or that assertion I make in this paper. I am sure I could question just as many facts and premises in a document presenting Autodesk's current strategy, were there a strategy to document, a document expressing it, or a willingness by management to share their vision of the company's future with the individuals who ultimately must turn it into reality.

They will claim their actions are moving the company in the same directions I urge, but in a "prudent, low-risk, evolutionary manner." They will paint the course I recommend as fraught with immediate peril.

After you have heard their response, ask yourself the following questions.

Is Autodesk on the right course?

Is AutoCAD as excellent a product as it could be, given the human and financial resources of Autodesk?

Is AutoCAD receiving the marketing and promotional support that befits the principal product of a top-five software company?

Is Autodesk investing adequate resources, human and financial, to maintain AutoCAD's lead in value for the dollar?

Is Autodesk acting like a leader of an industry, seeking to create new markets and broaden the use of its products?

Are Autodesk's pricing, channels of distribution, and focus on market segments consistent with the emerging trends in the software marketplace?

Is Autodesk today what I had hoped to create in 1982—a company that can turn a great piece of software into a great success in the marketplace?

Are Autodesk's plans for new business development likely to succeed?

Is Autodesk acting in keeping with the opportunities before it, as a highly profitable multinational company with a strong position in a revolutionary industry, two hundred million dollars a year in turnover, and more than one hundred forty million dollars in the bank?

Were Autodesk to be faced with a well-funded, accurately targeted assault on the heart of its market, could the company react quickly enough to fend it off?

Epilogue: The Final Days

> We are all at a wonderful ball where the champagne sparkles in every glass and soft laughter falls upon the summer air. We know, by the rules, that at some moment the Black Horsemen will come shattering through the great terrace doors, wreaking vengeance and scattering the survivors. Those who leave early are saved, but the ball is so splendid no one wants to leave while there is still time, so that everyone keeps asking, "What time is it? What time is it?" but none of the clocks have hands.
>
> —Adam Smith, "Supermoney"

One thing is beyond doubt: we are living through the final days of the original Autodesk. Whether the problems we're currently experiencing herald the waning days of Autodesk's leadership of the industry, or are merely the birthing pains of a new Autodesk, ready to accomplish as much in the 1990s as the old Autodesk did in the prior decade, will be determined in the next weeks and months.

To management I say this. The resources are at hand. The Autodesk team can and will accomplish whatever tasks you ask of them. The financial strength amassed by years of success allows overcoming any short-term barrier we may encounter. All that is needed is that you act. Act now. Act while the opportunity remains. Act while we still lead the market and the industry. Act while the customers and the market wait, in silence, for your response. Act while you still can.

If this message is understood and accepted, then the next few weeks should bring the first signs of change. In a few months, the first evidence of the new Autodesk will begin to appear in the marketplace. Things will start to get better. It will be obvious to everybody that Autodesk is again on the move, that the spirit, the confidence, and the energy that vaulted Autodesk into the front ranks of software companies in 1983 and 1984 and 1985 is now, in the early years of this new decade, carrying Autodesk further, toward leadership among the next generation of software companies.

If management does not act, this too will become obvious. It will be reflected in falling sales, declining profits, eroding market share, and eclipse of the company as an industry leader—loss of the ineffable sense that here is where the future is being built. If this happens, we will know what opportunities were squandered at the very moment Autodesk held the future in its hands, and we shall never forget.

Summary Of Recommendations

The following specific recommendations for action are made in this paper. They are summarised below for your convenience, cross-indexed to the page on which they are described.

Code	Description	Page
AC1	Universal 80x86 release.	36
AC2	Eliminate AME surcharge.	36
AC3	Promote solid modeling.	36
AC4	Expedite Windows AutoCAD.	36

AC5	Expedite Windows-32 AutoCAD.	36
AC6	Include CD-ROM(s) with AutoCAD.	36
AC7	Upgrade AutoCAD documentation.	37
AC8	Direct support line.	37
AC9	User newsletter.	37
AD1	Developer product orientation.	37
AD2	Evaluate development and QA staffing.	37
AD3	Parallel Release 13 projects.	37
DE1	Provide dealer inventory on consignment.	34
DE2	Consider reducing the price of AutoCAD.	35
MS1	Free product for "opinion leaders."	35
NC1	Develop AutoCAD successor.	38
NC2	Continue product line integration.	39
PM1	Appoint a strong product manager for every product.	34
PM2	Implement product-level profit and loss accounting.	34
PM3	Integrate development and promotion budgeting.	34
RM1	Re-price Animator at $149.95, add graphics modes, target paint programs.	38
RM2	Re-price high-res animator at $275.	38
RM3	Move animator, PJ to Windows.	38
RM4	Re-price 3D Studio at $499.95.	38
RM5	Launch an image-processing product.	38