

Paul Saffo and



At the recent TED3 conference Paul Saffo explained why we don't know which way to jump with new technology; which roads are potential thoroughfares and which are dead ends. Not only do we not have the mapbook, we overlook the history book that has the answers, albeit ones from different eras. But parallels can be drawn, beacons are aflame. And remarkably clear they look when seen through his eyes.

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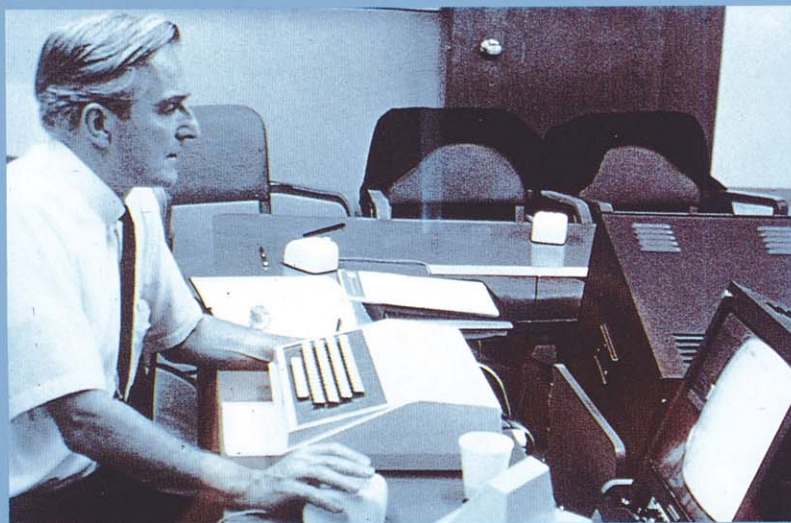
A TED2 visitor from 1990 who called by today might be a little surprised by how little of what seemed so imminent then has actually come to pass. There's certainly a lot more multimedia technology around, but we also know there are still a lot more multimedia developers than users. Virtual reality remains virtually inaccessible and HDTV is as remote as ever.

the 30 year rule

Even a time traveller from TED1 might react with some disappointment. We have lots of multimedia capacity available today, but at a considerable price. Meanwhile, the majority of our personal computers still run DOS and the majority of workers are still waiting for the computer because the majority of desks don't have computers on them at all. And television remains one-way and largely fuzzy NTSC. Yet the world has changed. A feature animation just got nominated for an Academy Award despite the fact that much of what was in it, its cells, were hand done in the old fashioned way. But new media exotica have become very exotic design tools in our lives. More importantly, the PC era seems to have run its course. My suspicion is that in a few years we will look back at the PC as the horseless carriage of the information revolution. And we will remember that its wake was held last fall in San Francisco with the announcement of the Apple/IBM alliance. Fortunately both companies are not going the way of the PC, but furiously doing new things. So I expect we'll have them both around for some time. But most importantly, it feels as if a lot is poised to happen in the next two to three years.

It seems that an expected, anticipated future from TED1 and 2 is arriving late and in utterly unexpected ways. And bigger surprises are waiting in the wings. Overall, less has changed than we would have expected. But much more is in the wind than we imagined. A good barometer of this is in the name 'TED'. At TED1 the 'E' was clearly for entertainment. At TED2 it was still entertainment, but there was also the suggestion that it was education. At TED3 what the 'E' stands for is anyone's guess.

I'm going to engage in a little information archaeology—Tedology if you will—and look at some of its history and see what clues might lie there that will help inform us about what lies ahead. My departure point is: 'Why is it that some of the best ideas in the history of the information revolution seem to take forever to catch on?'



A lesson in speed

This is Doug Englebart holding one of the first 'mice'. It was not taken in 1984, when mice started to spread into user consciousness, but in 1963, soon after Doug invented it. And yet we wonder why it took so long, not only with the mouse but with Doug's other ideas. And when things don't happen overnight, we conclude that something must be wrong. In the case of Doug, he was elevated to the status of tragic hero. Well, someone who was brilliant but blinded by obsession.

Or consider Xerox's forays into end-user computing. The Xerox Star, which was the commercial cousin in 1981 to the Alto (developed in the 1970s at Xerox), is the root of the family tree that lead to the Macintosh, Microsoft Windows and the various multimedia workstations that are around today. Xerox pioneered but never broke into the PC market, and it has been pummeled ever since by commentators for being an incompetent company. It is a bad rap.

We assume if things go badly it must be someone's fault. When in fact,

especially in the high tech world, the slowness of change is the rule, rather than the exception. For example, the patents had almost expired on the process of xerography by the time the first Xerox copiers made it into our offices in the early sixties, and the computer itself followed a very long and tortuous path from the monster calculators of WW2 down to the mainframes of the 1960s and eventually to the PC.

It was a path filled with false starts and blind alleys and all sorts of confusing technologies. Recall the competitors to the microprocessor; at one time we talked seriously about fluidics. Too often we confuse surprise with speed. We just have terrible memories. Things take much longer than we are ever prepared to admit, and no amount of effort can speed it up.

The lesson that we constantly forget when it comes to new technologies is: you should never mistake a clear view for a short distance. It's that sense of standing on a ridge, looking out across a great forest at a distant mountain goal.

The peak is so close it seems you could reach out and touch it. That is, until you get in among the trees and start beating your way towards the mountain. This is, by the way, the mortal sin of not only entrepreneurs but people in my profession, forecasting.

Change isn't just slow, it's also slow in getting started. Ted Nelson once remarked that it took HyperText twenty years to become an overnight success. He coined the term in the 1960s and we didn't get it till the mid-1980s. He's absolutely right. Most ideas take twenty years to become an overnight success.

'Macro-myopia' is a strange phenomenon that causes us to overestimate the potential short-term impacts of a new technology. And when the world fails to conform to our inflated expectations, we turn around and we underestimate the long term implications. First we over-shoot and then we under-shoot. A good example is that of home-computing. During 1979-80 everybody said very soon every home was going to have a computer in it. When it didn't happen by 83/84, the computer companies abandoned the home market, said it would never happen. Then one company set out to create a special purpose machine for the home that did one thing that people really wanted: entertainment. The company was called Nintendo and they're in 35% of American households today.

Exploring the assumptions that lie behind macro-myopia can tell us much about the pattern of how change occurs; how the exotica that will be discussed will eventually become reality. And it will help us distinguish why some of the exotica are likely to remain technologies of the future forever. It turns out that it takes about 30 years for a new idea to fully seep into our culture. There is a cadence to change that we can ignore only at our peril, because technology does not drive change at all. Technology merely enables change. It's our collective cultural response to the options and opportunities presented by technology that drives change.

30?

Why thirty years? It's about a generation and a half. In my more cynical moments I think what happens is that we don't change, we just grow old and die. We form our ideas between 13 and 17, we carry those on to the management stage and we have 20 years to implement them before we're shoved off by the next generation with ideas of its own to implement. In Silicon Valley engineers joke that you can find out whether you're on the cutting edge or not by answering the following question : 'What came first, your first kiss or your first program?' If it wasn't the latter, forget it. You'll make a great manager.

It turns out that this thirty year pattern is something of a constant in the history of Tedology. It has not changed substantially in four centuries. The information revolution today very closely resembles the period between the Gutenberg invention of printing in 1457 and Aldus's definition of publishing in 1501.

est anima ei? ubi ea: mitemq; delinunt
blanditijs: et pugnans ad eum præn-
sui. accipe inquit michi puellā hanc
dingen. Quod cū audisset iacob: ab-
stergens filijs et in partu pecorū occu-
patis silens donec rediret. Egrediente au-
tem eum pater sicuti. ut loqueretur ad
iacob. ecce filij eius veniebāt de agro:
auditoq; qd acciderat. irati sunt valde.
eo qd sedam rem opatus esse in ista:
violata filia iacob. rem illiusā pepe-
rasset. Locutus est itaq; eum ad eos.
Sicuti fili; mei ad hęc anima. filie
vestre. Dat eam illi uxorem: et iunga-
mus vigillum nubia. filias vestras
tradi. et nobis: et filias vras accipite.
et habitate nobiscū. Terra in portabat
vestra est: et ecce. negociamini. et possi-
det eam. Sed et sicuti ad præn et ad
fratres ei? ait. Inveniā gratiā coram
vobis: et querūq; statuis dabo. Fu-
geat domū. et munera postulāre: et libe-
re tribuā qd preceritis: tantū dare nū-
tū puellā hanc uxore. Adpōderūt filij
iacob. sicuti et pater eius in dolo: seu-
entes et ob stuprū sororis. Non possu-
mus facere qd petitis: nec dare sorore
nostrā hominī in circūciso: qd illi cū
et nepharū est apud nos. Sed in hoc
relebam? fecerari. Si voluissis esse sile-
nobis: et circūdat i vobis oīs mātū-
lini sequi: tunc dābim? et accipiemus
mutuo filias vras ac nras. et habitā-
bim? vobiscū: et simulq; vni? pps. Si
autē circūdati nolueritis: tolle v? filiā
nostrā et recem? Placuit oblato eum
eum et sicuti filio ei? nec distulit ad-
lectans quin statim qd prebat repleret.
Amabat enī puellā valde: et erat in-
cūctus i omni domo patris sui. Ingressi-
q; portam urbis locum suū ad pfm.
Viri illi partem hūc: et volūt habitare

Conjectural sixteenth
century portrait of
Johann Gutenberg.



nobiscū. Regredite
iancipite hanc ob
Dige. filius vni? pps
nrae illa debuit
ranā bonū. Et
nobis. cū in p
stanoa eum: p
nobis mī. T
et habitare hūc
Abūm: sicut
maris. Et
rūs volūit
filij iacob. In
dys. ingressi hūc
innotabilij p
sicuti pater n
de homo sicuti
egredis. in
iacob. et d
quan dūpū: t
afinos. m
nibus et
et uxores hūc
peperant
innot
sum hūc
habitare hūc
mū: illi
hor ego et
ut homo
nrae locū
iacob. Sicuti
ibi: sicuti
quāto fugit
vero com
Abūm de
sicuti et
ta vna. Sicuti
ut fatigat
uir me i
sicuti m
dos alimos

This greatly reduced reproduction of Gutenberg's original 42-line Bible, produced in 1456 and generally regarded as Europe's first printed book, illustrates how, in the early stages of a new process, we tend to adhere to elements of the old ways, even though they may no longer be relevant or necessary. Type that diverged from the calligraphic style of the scholars of the time was to come later.

Before Gutenberg, books were beautiful but had very low information density, particularly if you come from an ASCII world and don't value the information content of graphics.

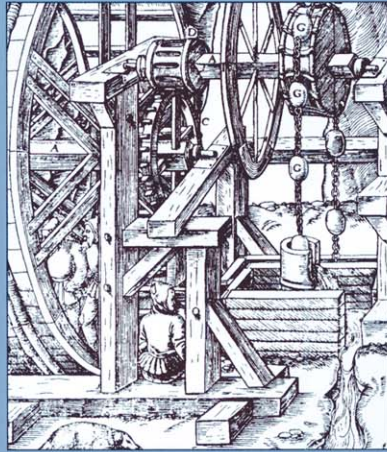
Gutenberg made a big advance in terms of information density, and it was quite beautiful but hardly modern. If you look at it closely, you'll see that it's basically a simulacrum of what the copyists were doing by hand, all the way down to the contraction of the word endings that copyists got into the habit of doing in order to avoid medieval carpal-tunnel syndrome from wielding quill pens in poor light.

Lots of conventions remained to be invented: author, audience, title page, page numbers, punctuation, even typeface design for ease of reading. Gutenberg's Bible is the information equivalent of the early days of plastic when everybody spent their time trying to make Bakelite look like tortoiseshell and wood. They weren't comfortable with it being plastic.

What this period offers is a distant mirror on the current information revolution. What ensued after 1457 was forty years of wild experimentation by a bunch of entrepreneurs on shoe string budgets lacking adult supervision trying every crazy idea they could think of to turn the technology of printing into something else. The first team to put it together was Aldus's team in Venice at about 1500AD. Aldo and his colleagues liberally borrowed the best ideas from the previous forty years and produced what we might call 'publishing for the rest of us'; a book small enough to be carried in a saddle bag and, with respect to the typeface and leading, essentially a modern book.

What did people print after they printed the Bible? Cheap thrillers and 'how to' books. In 1580 the contemporary equivalent of *Popular Science* published the wondrous machines of Augustino Ramelli: everything from a method for pumping water out of mines (the economic problem of the time) and breaching castle walls with canons (the political problem of the time) to a reading aid for gout-ridden scholars (the lifestyle problem of the time).

The lesson is, it takes thirty years to tame a raw technology and turn it into a compelling information medium.



The ongoing problem of removing water from mines gave rise to innovative ideas which printing made it possible to share. Technical books such as *The Wondrous Machines of Augustino Ramelli*, and *De Re Metallica* (the first major work on mining and metals, published in 1556 by Georgio Agricola, from which this illustration is taken) became popular once printers started to widen their scope beyond The Bible, their initial focus.

This is also the essence of the revolution we're in the middle of today. It's even defined by a word. An incunabulum is a book from the cradle of publishing, and I suspect that today we live in a period of electronic incunabula; a moment between two revolutions. The first is one of print, four centuries old and not quite spent; secondly one of electronics, two decades old and not yet really under way.

But one thing is certain; everything is up for grabs. Very little makes sense and we're surrounded by incredible opportunities. The good news is that history can be a guide, for the forces that shaped change then are not so different to the forces shaping change today. Part of the reason change takes so long is revealed in a consistent pattern; inventors are generally utterly clueless about the use for their inventions.

Alexander Graham Bell once thought the telephone would be a way for people to talk to each other; someone in Chicago talking to someone in New York. But investors quickly set him straight, saying, 'That's ridiculous, what would someone in Chicago have to say to someone in New York?'. His revised concept for the venture capitalists of 1900 was: 'Well, we're going to use it to send audio to towns too small to have their own theatres'.

It was what we'd call broadcasting, although the word didn't exist then. It led to a wag in New York drawing this cartoon around the turn of the century, showing a very modern fear of a single phone shouter influencing a passive audience around the world.

Similarly, Gutenberg was an unwitting inventor who was merely seeking to lighten the load of the copyists. He'd do the dull monochrome parts so that they could fill in the coloured capitals and the like. And Aldus was obsessed with reviving the classics in what he perceived to be a modern, dangerous time where the youth were forgetting all the good old Latin

and Greek words. That is why his first book was a reprint of Virgil.

It isn't just inventors who get things wrong. Our collective misimpressions as users can slow things up. We tend to pin our hopes and expectations on the nearest new technology to come along. Take, for example, visions of the year 2000 penned in the 1890s. We're fortunate to have them thanks to a book that's still in print called *Future Days*. It features the photograph as letter substitute, both being dictated and being delivered by the DHL of the time, adolescent males acting as couriers. The photograph was eventually seen to be a newspaper substitute. This is the newspaper of the 21st century. Keep in mind that newspapers were pretty new-fangled devices then, even though they'd been around for 100 years.

At first newspapers carried long stories and local information, but with the advent of the telegraph and then the wire service, they carried short stories, information from elsewhere. The users loved them, but they said the ink rubbed off on their fingers. And the propeller heads of the 1890s said, 'Don't worry about it. The paper's just temporary. We're going to replace it with photograph disks in no time at all.' Our expectations as users add an intrinsic cultural perversity to technological change.

Most future visions never ever come to pass as expected. We flew in our minds before the first aircraft ever left the ground. And the vision was one of personal transportation. Imagine it's

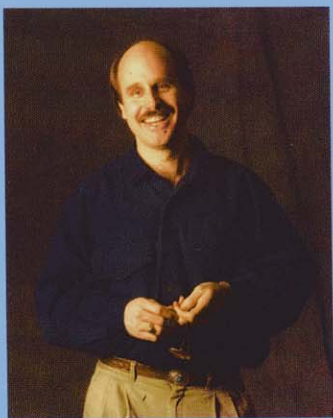
1903 and the Wright brothers have just landed at Kitty Hawk, and the waiting press corps rushes up to them saying, 'It's great. When do we all get our personal airplanes?' And the Wright brothers pause, and then say, 'Well, you see, it's only wealthy hobbyists and captains of industry who'll have their own personal aircraft. The rest of us are going to fly around in these huge devices made of aluminium (aluminium was about the price of gold at the time) that will crisscross the country with such regularity at such speed that people will be furious when they're two hours late from Boston to San Francisco.'

We would probably have lost five years on the aviation revolution because the two Wrights and their bicycle parts would have been locked up in the nearest nut-house, and that would have been that.

More remarkable is that the vision of personal transport persisted well into the 1940s. Alex Tremulus, with his tongue planted only tentatively in cheek, pictured what the military industrial complex would produce for us all once we finished building Spitfires and bombers. This vision of personal transport persisted in spite of the fact that we had clear signs of what was coming; the civil aviation revolution.

The question for us to ask is, as innovators on the spot, how are we misinterpreting the future of technology and Technology today? How are we getting things like multimedia, virtual reality and information appliances wrong? Well, it is users who make collective sense of inventions. It occurs as a co-evolution of technology and culture, and is a dialogue between inventors and users. And it takes about a decade for innovation to really begin in earnest.

Consider the example of radio; young Marconi with a wireless set. The first radios were seen as being 'wireless'; a substitute for telegraph and telephone wires. The notion was that every radio had to be both a transmitter and a receiver. Big, awkward, complicated devices and not very accessible to the general public.



My favourite inspirational story for larger thinking is a somewhat apocryphal tale of the microwave engineer who, in the early 1960s, looked up from his desk where he was designing microwave circuits, and asked, 'What in the world are we going to use these things for? The phone company wants to get rid of phone wires, as they always have, and this is a great way of transmitting voice. Let's use this for getting rid of phone wires. We must use towers because microwaves don't go through buildings, and travel in a straight line. The earth curves. So I'll buy mountain tops.'

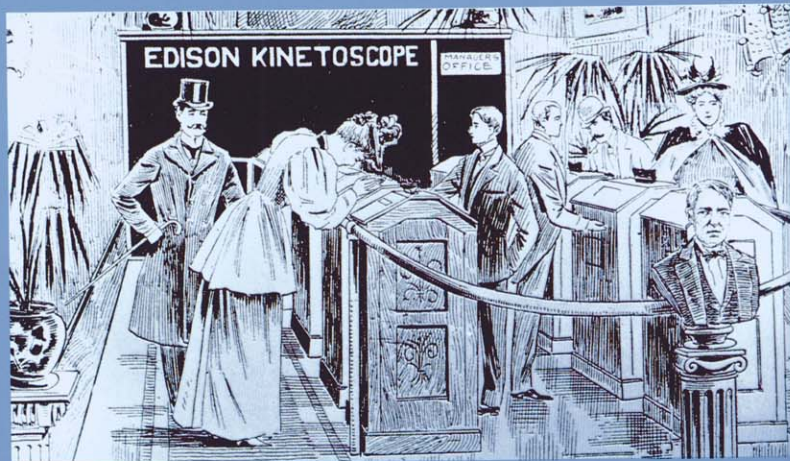
In fact he was even smarter than that. He said, 'I'll rent mountain tops', figuring some other technology would come along. So he got a map of the west US, figured out the best route for microwave tower lines between urban centres, negotiated 100 year leases on the prime mountain tops for a song. (His only competition was impoverished astronomy departments, and how many mountain tops do they want anyway?) He retired in the mid-1960s clipping the rent cheques from the phone companies who paid for the privilege of assembling their microwave towers on his mountain tops.

Well, now it's not just mountain tops. There is a whole new mountain range in the information revolution appearing on the horizon. You all are already in the foothills and you're going to be the first explorers into this new area. Now the question is, how do you explore without getting lost?

As the wireless operators talked to each other, a couple of experimenters began to eavesdrop. A couple of entrepreneurs noticed, and the result in 1922 was radio station KDKA — the shift from the technology of wireless to the medium of broadcast. It was the birth of a whole new industry.

In 1922, using a rough constant dollar calculation, a radio cost about the same as a PC in 1981. Radios were actually harder to use than a PC. You had to string an antenna from the house to the barn. Thank goodness engineers in Silicon Valley don't have a sense of history. They'd probably have added that as a feature to our computers.

It turns out that there's more to this thirty year rule than the mere fact of slow change. There are three distinct periods, as is demonstrated by another historical TED innovation; movies.



Thomas Edison patented the kinetoscope in 1891. Similar technology appeared in France about the same time, and for the first ten years we paved the cow paths. It was so amazing that we could make movies at all—a man sneezing, a horse jumping—it was so amazing that it took us ten years to realise just how dull this really was. By 1903 a photographer in Edison's laboratory, Edwin Porter, shot *The Great*

Train Robbery. It was one of the first films shot outdoors and the camera was mobile rather than stationary. This was the beginning of cinematography.

This inspired the second decade, the decade of the skunk-works, in which period shoe-string entrepreneurs without a lot of adult supervision were trying crazy ideas.

My favourite example (it inspired so much innovation) is a film shot by Selig in 1906 of Columbus's landing in the New World. If you were to look carefully at the sea you would notice there are no waves. That is because it was shot on a lake in Chicago. They quite literally dragged some potted palms from the hotel across the street, dressed some unemployed friends in what they thought Spaniards would wear, and tried to please the local archdiocese with the sanctity and piousness of their film.

Eventually this creative chaos grows and becomes more complex, entry levels begin to rise, roles become clear, and the cost of entry rises. People get specialised jobs. The industry matures, fleshing out, and patterns are established. The skunk-work age starts to draw to a close by 20 years out.

Then we enter the third decade, which is the decade of the financiers and the moguls.



Opening night of Al Jolson's *The Jazz Singer*. A crowd of people stand in front of a special purpose building to see a film they've never seen. They're taking a great act of marketing faith that uses technology that cost quite a lot to develop. This final decade is where the resources are committed to fully integrate the technology back into our society and get wide penetration. Other examples abound. Television took 15 years from its invention, plus time out for a war. And long before the image of *Felix the Cat* was broadcast from the Empire State building in 1931, users were impatiently awaiting this.

In 1915 we thought that television would be a way to talk to each other. Our impatience took other forms too. In the 1930s an article from a radio magazine was headed 'Television is not yet a radio success'. They sure were right. By 1949 it was still exotic enough that *Popular Science* could have a special issue on what we were supposed to know about television.

The question to ask with today's new media is, 'Which development era are we in?' I should add that the slowness is not entirely due to culture and habit. It takes time for inventors to refine their inventions. Sometimes a very long time.

It is amazing how long an incomplete technology can sustain itself in the marketplace. Almost every computer operating system in the last decade, and almost every computer application, points to that incompleteness. Let me borrow an example from another industry: aviation. It was not until 1915 that the first autopilot was demonstrated by John Sperry. He was the one saying 'Look, monsieur, no hands' as his colleague wing-walked across the plane. But the autopilot never made it into airplanes because there was another piece missing. And the piece was control surfaces: wing flaps and ailerons. When the Wright brothers pulled the stick on their plane, the entire wing warped. Wing flaps and control surfaces remained a curiosity until the 1930s.

Today we're puzzled why our multimedia workstations aren't being

used by everyone, why our PCs aren't being used by everyone. The question I ask myself is, 'Is it all catching on slowly because we are trying to "fly" our workstations before we've invented "control surfaces" for them?'. The central task ahead may be how to tame our technology with control surfaces.

If you map the thirty year rule against the classic (Ed Rogers) diffusion curve, it looks something like this. First decade: lots of excitement, lots of puzzlement, not a lot of penetration. Second decade: lots of flux, penetration of the product into society is beginning. Third decade: 'Oh, so what?' Just a standard technology and everybody has it.

We are just ten years into the personal computer revolution, the latest phase of a larger information revolution. We have now paved all the cow paths we are going to pave. It is now no coincidence that all sorts of strange things are happening. The future lies wide open before us, ready for the making by people who want to participate. It is certain that we are in for even greater change ahead than we've

had in the last twenty years; change is a constant.

The reason life feels so much more rapid today is not that individual technologies are accelerating. It's not that things are happening more quickly. It's that more is happening simultaneously. More technologies are coming up at the same time. It is the unexpected cross-impact of maturing technologies that creates this powerful acceleration that we all feel. Incidentally, it is what makes my miserable profession of forecasting especially miserable, because forecasting cross-impacts is very hard to do.

How do we thrive amid all this change? The best way is to gain a larger perspective.

A Zen Buddhist monk once observed that the fish does not know the extent of the water it lives in; the bird does not know the extent of the air it flies in. Marshall McLuhan was more blunt. He observed, 'I don't know who discovered water, but it was not a fish'. The trick is not to be a fish at all.

Epilogue

One piece of advice is expressed very nicely in the printer's mark of Aldus Manutius, the dolphin and the anchor. I should add parenthetically, this was the equivalent of the smiley-face button in the middle ages. Everybody was well and truly sick of it by 1600, but we've had four centuries to forget. The dolphin and the anchor are the icons for the epithet, 'Make haste slowly'. Make haste for, as Aldus said, time passes. But do so slowly, lest you hasten into an area which will take some time to become real. For the change ahead will be later to arrive than we expect. But when it arrives, it will be far more fundamental than we imagine.