

A 25 page guide to the future

Just occasionally, everyone else is wrong

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This summary article is based on my blog output from 2005 to 2007. It was internal to BT during that time, but now I am independent, here is an aggregated version.

Games

Games are a new focal point for convergence. Games and films have been converging for years, and we are now seeing a lot of on-line games that are effectively converging with socialization. People meet each other regularly in on-line game environments. Think of it as the 4th place. This implies that some new social group oriented services will be discovered and developed in games environments. It is likely that videoconferencing will enter the home on the back of games - people want to see their opponents, especially at the point of defeat.

Games are also converging with marketing and will soon enter the shopping

experience proper. A few companies have started using product placement in on-line games too, providing virtual meals for the game characters. Virtual goods are regularly exchanged on eBay. Most manufacturers have been remarkably slow at understanding virtual products, even though they have a real price, but no production costs and no distribution costs. Only the design and marketing costs money. This virtual market expand greatly as people start to realize the opportunities.

Games will soon start converging with real-world shopping too. We are already seeing geographic electronic games, where electronic game play is mapped onto the physical environment (people run around playing Pac-man in real city streets). Shopping malls will soon start introducing game play into the shopping experience, with virtual monsters chasing the shoppers. Virtual environments and augmented reality will greatly enhance shopping. Additionally, entrepreneurs can try out some real world business ideas first in on-line game environments, e.g if they are successful at selling their designs for furniture in virtual houses, there is a good chance of success with real furniture in the real world.

Fashion

Fashion will also converge with games and with the cyberspace world generally.

Characters in games need outfits to wear just like real life people. These are designed today by games designers rather than fashion designers, and the selections are poor. Games like The Sims already have a thriving market for people to exchange their own designs for outfits. The fashion world will soon move into this field.

Also, augmented reality will allow people to choose their appearance in the AR world. It doesn't need to be the same as their real world appearance, and can be totally dynamic, changing frequently according to context, or being different for different viewers. A digital mirror could be used to choose virtual appearance for on-line communication, games, or urban AR.

PS3 Games machines

The new Sony Playstations will have in excess of 3 TIPS processing power. To put that into perspective, a PS3 is over 2 million times faster than the old VAX780, which BT used to provide word processing and computing to 50 people back in the late 80s, with just 0.9 MIPS!

These machines will be networked to allow people to play each other across the net. If a million of these are connected together in a P2P network, they would give a central controller access to 3×10^{18} instructions per second, about 3000 times as much as the human brain. Hackers routinely hijack large numbers of PCs to send bulk spam, converting the PCs into zombie machines. Doing this with a high volume of PS3s would present a large security threat. Apart from denial-of-service attacks, there is a good chance they would be used to crack encrypted messages. A more exotic possibility is that they could be used to experiment with strong AI and machine consciousness. We might imagine clever neuroscience students linking with computer science students to attempt to produce a conscious machine, purely for

mischief or curiosity, but we have little idea what the result might be.

Hippy revival

We have identified a number of trends that are already under way that are likely to result in a revival of the Hippy movement or something similar, over the next 5 years. Example contributory trends are generally increased acceptance of public emotional display, dissatisfaction with materialism (especially coupled with high debts), downshifting, new ageism, 21st Century piety, and an anti-science undercurrent.

Cyberdrugs

Some recent experiments have shown that parts of the brain can effectively be closed down by means of strong oscillating EM fields, affecting perception, thinking and memory. It is likely that some people will start using this technology recreationally in the next few years.

Also, new drug delivery systems are able to deliver drugs to exactly the right part of the body for chemotherapy etc. Some use spherical gold capsules with very thin shells that are easily ruptured by ultrasound or EM fields. Again, these could be developed for recreational purposes. We might imagine people pre-injecting drugs and then having them released at a club later under DJ control to synchronise effects with other clubbers.

H2G2 device

Douglas Adams Hitchhikers Guide to the Galaxy is almost with us. Converging on a games console with a large display, good comms, positioning, storage, camera, MP3 etc. All coming in a single device. In 2006

Globalisation of the elite

As all the rest of the population find themselves globalised, competing against outsourcing to anywhere in the world, the elite are also being globalised with opposite effect. With truly global class talent, people find their value increasing dramatically in a highly competitive market for talent. If you are only top 1%, there are 65 million people as good as you. The top 0.000001% have only 65 peers, and are highly sought after. Even if you allow for there being 1000 market fields, you still have to be top .001% in your field to benefit. Everyone else is a commodity that you can easily find cheaper somewhere else.

Relationship of employers to staff

The elite have realized that they have very valuable talent and are often choosing to be entrepreneurs, selling directly to the market rather than working for other companies. The relationship of companies to their staff is thus changing. The people most essential to a company's future are probably not full time employees but people setting up small companies that your company will buy or buy from or form an alliance with.

Dating technology

Using information technology to find dates is becoming much more common. Web dating sites are much more popular now. Expect lots of devices that broadcast people's merits to other badges in the vicinity. Ego badges will filter out people of no interest and introduce you to people who are.

Trust/familiarity/simplicity

The nature of the market becomes clearer every day. The success and failure of a whole generation on web and consumer electronics companies has shown that there are three key factors in success: trust,

familiarity and simplicity. Think eBay, Amazon, Google. Then think how difficult it is to figure out how to use many other company's sites, or whether you trust them as much, or simply that you haven't used them enough to be sure how they work. Cultivate trust, make elegant and simple services that all work in similar ways, and introduce new services only as fast as people can familiarize themselves.

QoL v time

Technology will get better into the distant future. However, some problems such as water, energy, environment and disease will worsen - for a time at least. The overall effect is that life will get better but we will still have problems. The benefits and problems will be unevenly distributed. Much later in the century, we will see a huge technology payoff as the benefits finally start spreading to everyone and the problems get solved by advanced technology. If we can prevent deliberate misuse of technology, the world will soon be a much nicer place.

Biodiversity

Biodiversity is declining as habitats are wiped out. Gene banks will capture some important gene groups but many other natural genes will be lost. However, in a few decades, we will start reengineering life forms, and biodiversity will start increasing. Humans will design a wide range of life to occupy many diverse niches. So nature mk1 might take a severe battering. But then we will start bioengineering an improved version of nature.

Singularity

Talk of the singularity is increasing. Positive technology feedback means that each new generation of technology will help more in the design of the next generation, so it will come along faster. Kurzweil calls it the law

of accelerating returns, same thing. NBIC convergence will happen much faster than most people think. BT is in great danger of missing out on this. We currently don't have any expertise, but can start exploring via our people in telemedicine.

Wiki economy

Wikipedia is an embryonic global encyclopedia of everything. Anyone can add or edit articles on anything. Collectively, a large proportion of knowledge will eventually be available in this form, and Wikipedia will be one of tomorrow's Googles in terms of impact and value. However, as high quality information becomes available for free, people will be less willing to pay a premium for professional information. Then, over more time, the information gradually will become democratized, with the opinion of the masses often overriding the opinion of the expert, so the quality will start to drop.

New Dark Age & the Age of Magic

An anti-science undercurrent in Europe is combining with the rise of new age and pseudo-eastern mysticism to create a new dark age. A hippy revival is likely in the next 5 years (august bulletin). Over the same period, we will see much more miniaturization of technology, and much will disappear totally into the urban infrastructure, our clothes, gadgets etc. With much less understanding or direct awareness of the technology, but with smart services everywhere, an age of magic will dawn. As Arthur C Clarke said "any sufficiently advanced technology is indistinguishable from magic". This is actually quite dangerous. Over a period of time, the distance between people and basic life tools will increase, making us more vulnerable. Superstition will surround many services, and may even be cultivated by marketers. It makes an anti-tech backlash more likely and makes it harder to

avoid misunderstanding by customers. Accusations of cover-ups and conspiracy theories will be harder to eradicate

Disability and access

Ambient intelligence will have a big part to play in providing augmented reality based interfaces to the world around us. For disabled people, this will mean a much more level playing field, since they can adapt the information to any form they wish. Augmented reality takes raw information from sensors, processors, stores and transmitters in the local environment and processes this into a useful form for the person. For most people this might be visual information in their field of view via a phone, PDA or head up display, but for blind or partially sighted people, it can be translated into audio or tactile input. Virtual environments are also important for disabled people. When people meet in a virtual environment, the images are mostly computer generated, although real video can be incorporated too. With the option to portray themselves just as they look in real life or to modify their appearance, some people in wheelchairs might well choose to appear as perfectly able people. This removes a common obstacle that disabled people find, that people talking to them see the disability first rather than seeing the person. In a virtual environment, everyone can be seen for who they are, rather than being labeled as able or disabled. Not all disabled people would choose to change their appearance however, as many strongly believe that other people should treat them with proper respect in any case, and that it is society that should change, not them, so they would refuse to hide their appearance. These two camps will treat available technologies in very different ways. But the technology will certainly make lives much easier for the pragmatists

who don't want to wait for the utopian society to evolve.

Legal

Although artificial intelligence is already making good progress in automating the low end legal work such as will writing, conveyancing and simple legal advice, there will be a need for more legal experts in the near future. Technology pressure is changing almost every industry, creating new business structures, procedures and business models. It is also pushing ethical boundaries and creating a strong demand for legislation across a wide field. NBIC convergence will create a great deal of debate in coming years that will need legal resolution in due course. There will also be new kinds of crime, as computers get more sophisticated and increasingly networked. Large P2P communities may be used to attack encryption, evolve viruses, implement DOS attacks etc. Eventually corrupt AI might be able to design and implement crime all by itself. Such issues are mostly in the far future, but it will take a long time to design legislation to deal with them.

Internet advertising

Bill Gates was the main draw for the Internet Advertising Bureau conference. I was one of the earlier speakers. The future impact of virtual environments and ambient intelligence are the main issues I spoke about. With marketers using every trick to get their messages into our field of view, digital filters and digital bubbles will be among the most important new products, and these are areas where BT could play a lead role. Tools to create and manage virtual environments are also a potential BT market area.

Retinal display

Brother, a company that makes a range of SME and home office equipment, is now working on a retinal display. This uses low powered laser beams to write the image straight onto the retina. I am personally rather pleased with this as I invented the active contact lens almost 15 years ago. However, the Brother system uses glasses mounted lasers in this first instance, so they still have some way to go..

Breast implants

The Sun gave almost a whole page to the idea of smart breast implants, which was then picked up by much of the rest of the media, eventually resulting in about 20,000 web articles. While most articles appreciated the fun side and built on it, a few took a more politically correct line and criticized BT for looking at such technologies. It also generated a few radio interviews where I was able to build on the idea of wearable electronics, telemedicine and active skin.

Running faster to stand still

Just a casual observation, but we are all working harder just to maintain market share. As we work harder, so do our competitors, so we have to work harder still, and so on. Neither gains market share, but both end up working very hard. There is already a downshifting movement and a go slow movement. As it gathers momentum, we may see this feedback going into reverse, with a future where people accept that they can't ever win and so just accept a lower pace of life.

Broadband home videoconferencing

I am increasingly frustrated that we still don't have a means of videoconferencing on our TV sets with friends and family. Broadband can cope, the display can cope, all we need is a black box to connect one to the other in a simple way that even granny

can do it. It mustn't need a PC or a games machine, just a cheap web cam, broadband, and the box. If we can do this, old people who have little or no social contact can have emotionally rich communication with their families and friends even when they live far away. This will make a big dent in loneliness, which is perhaps the biggest social problem in the UK.

The Microsoft alliance will allow people to see each other while playing games across the network, but of course, most old people don't and won't own games machines, and many don't own PCs either.

The other group who need more social contact are young kids. Their parents won't let them out in case they are abducted, and as only children, they get lonely as soon as they leave school for the day. Video links to screen in their bedrooms give them a virtual sleepover.

Banking security

At least one bank has started to give key-ring PIN devices (secure ID tokens). Another technique that I have requested several times from banks is that they should offer a password to the customer, so that they know they are visiting the bank's site rather than a spoofed one. That would be cheaper and probably just as effective. So when you log on, the site displays a password to you. A hacker couldn't know the password you have agreed with the bank. Therefore you know you are on the right site and can proceed safely.

Trust Brokering

Dotcoms are still emerging. One big sector that will emerge over the next few years is trust brokering. While today, Google lists sites that contain certain keywords and ranks them by numbers of hits and links, the most important data about a site is whether the information it holds is

trustworthy. Sites that take users to trusted information will be among the hottest companies. There aren't many serious existing contenders, but the net has shown us that a new approach implemented well can achieve meteoric growth.

Ebay v Amazon v Google v Microsoft - The battlefield is drawn

Ebay has certainly marked the way in trust establishment with its reputation markings and easy access to feedback from previous customers. Ebay, with its purchase of Skype, now has a communications suite, the auction site, a comprehensive electronic shopping mall (seamlessly linked into the auction site), electronic cash via Paypal, and pole position in trust brokering, as well as a very well established community and tribal loyalty. The one web capability it doesn't yet have good access to is a search engine. In the physical world, ebay is also limited since it acts as a platform for other suppliers rather than as a supplier itself, so has no means to penetrate the distribution markets which will become strategically important over the next few years

Amazon on the other hand is very good on the sales, logistics and distribution fronts, and is rapidly building its second-hand business. Via strategic alliances, it is rapidly becoming a one-stop shop. It has a very strong customer base. However, it has no communications, e-cash or search engine, community, and is much weaker than ebay in its trust brokering capability, only having a basic customer review capability on its products.

Google of course is top dog in search capability and has huge customer loyalty. It is in pole position to add trust brokering since that capability is similar to one of the foundations on which it was built, indexing by number and quality of citations. It provides a shopping platform (Froogle), and various tools such as Google Earth. At the

moment, it has a lot of cash to spend on acquisitions. Google earth is superficially an interesting form of entertainment. On closer inspection, it is a key factor in mapping the internet onto geography. If it were to purchase a company like streetmap or multimap, it would be able to link geographic search to web search. Each of these two companies allows users to find and book rooms in hotels close to a particular location for example, while showing the user a map of the area. That would be a natural extension of Google earth, and would allow Google to index real world facilities by geographic location (what BT calls Whereness). They could be in the best possible position to capture a large part of the augmented reality market. Google don't have electronic cash, communications (apart from Gmail) or their own tribal community.

Microsoft has some of these tools but isn't top in any of them, so would seem to be the weakest contender. It also has acquired a level of dislike from its customer base which it will find a severe impediment in playing the trust brokering game. On the other hand, it has a trump card in having its own games console, with games very likely being one of the strong focal points for future convergence. However, unless they start making a mobile games console too, this will not help them on the street with augmented reality.

Walmart, Tesco, News Corporation, Sony and a few other household names will probably be also-rans as far as net power is concerned. Sony has its PSP and Everquest, Sky has control of a lot of TV screens, and the supermarkets have managed to develop strategic alliances in most areas of everyday expenditure. None of them has good web skills though.

Chocolate chip cookies

RFID will add more functionality to supermarket packaging than just replacing barcodes. We will soon (next 18 months) see e-ink display panels in packaging. This brings the prospect of labels on rival brands reacting visually (and potentially audibly) to each other's presence. It will be quite good fun buying both Coke and Pepsi just to see them arguing with each other in the trolley!

Also on the subject of packaging, I suggested to a blue chip grocery company that they should print a code on the bottom of labels. When these are typed in to an on-line game such as World of Warcraft, they give the player a free item, such as a magic sword. People pay real dollars for items in these games on ebay, so this is a cheap way of giving people real added value at almost zero manufacturing cost.

The Stepford Society

William Rees-Mogg's recent column in The Times (Jan 16) pointed out that the UK has 25% of all the world's CCTV cameras, and comments on the civil liberties effects of the increasing use of surveillance technology by government. BT has for some time been concerned about the potential for an anti-technology backlash if technology intrudes too heavily into people's lives. Speed cameras are already a source of heated debate but likely to be replaced after 2009 by the use of the Galileo positioning system, which will be used to collect road tolls, detect speed on sections of all roads, help to track 'criminals' and detect other examples of 'bad driving' in conjunction with CCTV and number plate recognition systems. The positioning system is likely to be linked to the engine management system in your car to prevent your car from exceeding the speed limit.

However, this will only affect generally law-abiding people, who will have valid number plates on properly equipped and fully

registered cars. Professional criminals won't. Meanwhile, surveillance of internet use to make sure you don't access illegal sites, monitoring of electronic messages to make sure you don't breach sexual harassment or 'hate crime' legislation (wouldn't it be a lot easier for the police to prosecute if all public meetings had to be audio recorded and made available to pressure groups for automated parsing in case of potential offense?). We will have extensive use of identity cards for almost all significant transactions, possibly backed up by biometric systems. And of course, DNA analysis means that it is easier than ever to identify crime culprits, since the police keep DNA records for people who cross their path, even if they are not charged with an offence. We are even seeing the emergence of rubbish police, monitoring how much rubbish is produced by households, and the proportion recycled. The maximal use of upcoming technologies to reduce crime will soon make it almost impossible to commit a wide range of offences and get away with it. But criminals will carry on using identity theft, spoofing, encryption and anonymity servers to hide while they commit crime.

We are heading towards a Stepford Society, where conforming people won't be able to commit even trivial offences without penalty, and will have no choice but to live squeaky clean lives, their free will effectively taken away by technology. Meanwhile there will be a parallel underworld of career criminals who just ignore a wide range of laws so that they can hide, ignoring all these constraints with a low risk of being found, using false identities, e-ink or LCD number plates, and stolen credit cards, then presumably use loopholes in legislation to minimise their punishments if they are caught. The film Demolition Man portrayed this kind of society for 2030 Los Angeles. It may happen much sooner in the UK.

The sanctimonious elite just parrot the same expression – 'you have nothing to fear if you obey the law'. And so the Stepford society will roll out. It's not just that punishment would be inevitable. We won't even be able to break the rules.

But unless we have the freedom to do wrong, surely we have no freedom at all!

Welfare and pensions problem

Many taxpayers are becoming more sceptical of the benefits system. They perceive that too many benefits are paid too easily to too many people who don't really need them. They particularly object to paying for what they perceive as lifestyle choices. There are three main problem areas.

Firstly, there is a growing resentment of the support for parents. Single people often don't see why they should subsidise other people to have children, with paid maternity leave, 'flexible' working, preferential treatment over holiday leave, time off to look after sick kids, and so on.

Secondly, there is growing potential for inter-generational conflict. Young people are paying high taxes to support old people, and having to work longer, whereas they are told that the state won't be able to afford to look after them in the same style. As health costs are almost all incurred in old age, this is also where most of the extra health spending is going, which of course accounts a large chunk of taxation.

Thirdly, because of the parallel growth of both benefits and means testing, there is a decreasing incentive to work. This undermines the long term economy. In particular, people perceive that there is no point in saving for their retirement, since anything they save will be lost in means testing but if they don't save they expect that the state will bale them out with

benefits anyway. This produces a long term threat to economic wellbeing.

Brain Drain

The pension problem is already recognised, but usually understated. The UK's pension problem will manifest itself around the time that the economies in South America, India and China will be catching up. These regions will offer abundant lucrative opportunities for young people to emigrate from what will be our very high tax region. We should certainly expect that the influx from India and China that has supported us through our own skills shortages will reverse, with many people returning to their or their parents' homelands where they can be at least as wealthy. With our best young people disappearing in a large scale brain drain, we will have a very poor economic base, large skill shortages, and mainly low wage taxpayers trying to fund a large but greatly under-funded retired population.

With increasing recognition of this problem already, many taxpayers are likely to start rejecting the welfare system in order to look after their own interests. The internet is starting to provide powerful tools for grass-roots democracy, so we may expect some very successful campaigns to fundamentally reform the welfare state.

Tribalism

Instead of the universal welfare system, we may well see the emergence of community based welfare systems, effectively electronically extended families. These would provide benefits only for people within a community, funded by other members on a long term mutual insurance principle. This principle can be extended to business too, where business becomes much more entwined with local communities than today. But of course the communities don't have to be geographically based, they can just as easily

be electronic ones. In fact, electronic communities are much easier to police in terms of expelling people who are perceived to be undeserving for whatever reason. Such communities could become a viable across-the-board alternative to public services when they become large and powerful enough.

Cyberfashion

I've written before about the potential for fashion in augmented reality and on-line environments. This recognises that people can have a dual appearance, looking very different in augmented reality than they do in the physical world. Meanwhile, we will see the emergence of new electronic fabrics, smart materials, and even electronic makeup that converts any patch of skin into a full feature video display surface. It occurs to me that this might go to extremes for many people. Social tribes are very likely to use cyber-fashion to distinguish themselves from the population at large. Whereas I focused earlier on the enormous potential for people to differentiate themselves, perhaps the members of a tribe might actually chose to all look identical in the augmented reality world. They could be identically dressed with identical faces. So it may be that while for some, virtual fashion could be exciting and individual, for others it might be the first steps towards the Borg. Or a visual reaction to the Stepford society.

Politics badge

Web badges, ego badges and digital bubbles and just a few ideas for electronic jewellery. In this era of increasing political activism by pressure groups, even while most of the population seems to ignore most politics, there is a growing market for politics badges. These express people's political views digitally. Badges such as this could interact with electronic business and political systems in the environment, such

as shops, corporate headquarters, town halls etc. They would be used as part of ongoing campaigns, keeping various issues in the limelight. The best analogy today is the rubber wristbands favoured by young people. A digital equivalent would be able to periodically trigger events in the electronic world, such as SMS waves or coordinated email bombardments.

Improving social contact

As TV, games, the web and communications all start converging thanks to large, high resolution displays with broadband connectivity, we will start seeing a lot of people using their TV screens for video communications. It has always been my view that videoconferencing has never really taken off in the past because it has been implemented on small displays with difficult interfaces. People are used to high quality pictures on TV, and are naturally reluctant to accept poor quality, flickering images on a tiny screen, whether on a PC or a videophone. Making it difficult to set up a call certainly hasn't helped. Web cams are now fairly common on PCs, and their use in play station games is taking them to the TV set too. As broadband rates improve, the video streaming could be done with much higher quality, making large images and continuous unbroken video possible. As people get used to seeing people when they talk to them from afar, it will rapidly become the norm.

People who are socially disconnected due to poor health or lack of a car, or simply a lack of friends nearby, could have a great deal more social contact once this technology becomes routine. Most of this group are older people, who are often reluctant to mess about with tricky interfaces, so it will need to be very intuitive. But if we can make an easy interface, the TV could essentially be like a

granny flat, allowing people to stay in close contact with their families. Young children also could have virtual sleepovers via displays in their bedrooms. Security needs to be watertight before we can connect webcams into kids bedrooms and network them to friends rooms, for obvious reasons.

Community involvement

Apart from keeping in touch with family and friends, the TV could become the natural platform on which to deliver services such as telemedicine, allowing consultations with a doctor (or NHS Direct) via a vide link rather than having to travel to a distant clinic. It could also allow people to remotely attend meetings associated with their hobbies, or perhaps council meetings, thus enabling involvement in local politics too.

BBC License Terms

Given the recent discussion about the BBC License Condition changes, it is likely that the BBC will be encouraged to develop social and political involvement services as part of their remit. This might include a range of community TV activities, and also developing technology that allows local politics to be integrated into TV and web services. These changes will happen while internet becomes a regular platform for TV delivery, so it will expedite the convergence of TV, computing and the net.

The BBC could be a strong content provider for augmented reality and ambient intelligence. That would fit very well with the proposed terms, and would be a natural extension of what they already do on their site, and their old idea of making the Hitchhiker's Guide to the Galaxy into a real device.

E-ink, lightweight displays

Additionally, we might also see lots of TV coming into magazines, via e-ink display

panels. These will converge all media into one place, making all of the content industries converge with computing, games and web services, along with shopping banking, socialising and political activity. So e-ink isn't just about electronic newspapers and books, it could be the final step to making full convergence possible. The e-ink itself isn't significant, it is the ability to make very lightweight interactive personal display terminals.

Socialising on the net v ego badges

The stigma of using computer dating agencies seem to have vanished completely now. A very large number of people regularly meet new friends and dates on the web. Recent figures suggest 35-40% of people have already tried it. This has mostly risen over the last 6 months as people have become more aware of the potential. It might rise a lot higher and become something that most people do sometimes. While this can help people in bad relationship find better alternatives, thereby contributing to relationship break-ups, this will be far outweighed by the increase in good social contact.

Happiness springs mainly from high quality social connectivity and contact and this kind of technology helps that enormously. The next stages are the means to take it onto the high street and into the night club or even workplaces and conferences. The ego badge and the digital bubble are examples of the sorts of mobile technology used for mobile electronic matchmaking. These will radiate people's personalities and sexual preferences, and interact via smart filters with other people's badges. People will be introduced only to people that are probably compatible. These are likely to greatly improve people's social and business lives by electronically mediating introductions.

Emotional jewellery

A few fashion designers are already prototyping electronic jewellery that responds to emotional cues. Jenny Tillotson at Central St Martin's is developing jewellery that emits scents according to electronic stimuli. That makes it possible for jewellery to be an active part of the smart environment, responding to context. So women might smell differently according to where they are and whom they are meeting. Similarly, Sarah Kettley at Napier University has developed badges that respond visually according to how emotionally close the other party is. It is also possible to measure some emotional states via skin conductivity and nervous system activity.

The Future for CIOs

The business environment is going faster and faster and won't ever slow down. IT doesn't confer a business advantage; it just lets you stay in the game. But there is always the chance that your competitors will make a mistake.

IT is not a cure for bad business ideas. Conversely, don't blame IT when you aren't competing, the basic business is probably wrong somewhere. Most companies use IT inefficiently and waste a lot or all of the gains elsewhere. We need CIOs to think things through more systemically and be more integrated into the business so that it can react more quickly without misusing IT.

The worst IT abuses are micromanagement and centralization. You need to know the cost of the system as well as the benefits. What are you losing as well as what are you gaining. How much of your people's time are you spending while gathering that useful information for head office?

Ambient intelligence, simplicity, and virtual worlds will bring enormous opportunities for those companies still in business.

Convergence will cause boundaries to blur between industries. As edges become blurred, some parts of the company will expand organically into new territories while other parts shrink as they either become obsolete or captured by competitors.

Boundaries are also blurring between different kinds of employees, with much more dynamic relationships between employer and employee. There will be lots more freelancers, and most of the elite will freelance and charge high fees, working for several companies at once will be their norm. Virtual companies will increase, and open source business software could provide a platform for these virtual companies.

So the business environment will change very quickly and there will be a great deal of evolutionary pressure. There is a strong need for adaptability. Therefore, 5 year plans are history, companies need to be very agile, so there is no point in developing a system that needs 5 years of stability to pay for itself. Even 3 years is pushing it.

The CIO can evolve into an advisory service, running a federation of IT instead of centrally controlled systems. This avoids the perils of centralisation but still keeps the company working together in the same direction.

CIOs need to be much smarter about security. Need to accept that people will come into the system from all angles but they still need to work, so need a system designed to cope with 'friendly strangers'. But there is no point in security if it cripples the employees so that the company dies.

Magazines

Magazine companies such as PPA, Reed and internal communication groups such as CIB are starting to worry a lot about technology

change. Convergence will mean a lot of changes for them too. In the short term, they are panicking about blogs and amateur news-gathering, but they seem confident that a professional market will remain for high quality news and media.

However, it is likely that magazines will start to become interactive, two way devices that allow a wide range of media such as video and computer games, ambient intelligence and web access all to be incorporated into a multimedia magazine. E-ink panels will come in over the next few years, bringing these new media into paper magazines. Meanwhile, mobile data via wireless LANs or 3G will enable magazine articles to become part of everyday life on the move, advising and entertaining the reader in real time according to profiles and context. Competition will come from the web and computer games, as well as from other media companies more established in TV and radio.

Dating sites impact

In spite of dating sites being some of the very first ideas for the web, it isn't until the last 3 years that they have been properly developed. This was due to the critical mass needed, and now enough people use home computers with fast internet access to make the market viable. They have since become immensely popular. We should expect that as the use of these increases, it is likely to start causing significant social problems, as well as providing solutions for people looking for dates.

Because people can just browse through the people listed in these sites, people can do this just for fun, even if they are in an existing relationship, and many do. However, a lot of relationships have existed for many years and were formed between people who met each other from a relatively small pool. By contrast, dating

sites can have millions of members, and since people can easily check several, it is relatively simple in principle to search through almost all available people for good matches. Statistically, it is almost inevitable that most people would be able to find potential partners who are much better suited to them than they originally found in their small social pool. Someone casually browsing through a dating site, who just happens to find a few very attractive and available people nearby who are looking for someone just like them, might well be tempted. Certainly, it would make the threshold of tolerable problems in a relationship before people might consider leaving it. So we should expect a lot of people to 'upgrade to a better model'. On the other hand, we should also expect that expectation will become higher, and that with so much choice available, there will be less willingness to commit to a single partner for a long time. Shopping around is normal for young people, but we might well see it much more in older people too.

So, we may find that dating sites reduce loneliness by helping people to find dates, but we may find the opposite, that people become to willing to engage in more superficial relationships in order to try out as many alternatives as possible, but at the expense of emotional involvement, commitment, and eventual happiness. In which case, loneliness would be expected to increase. Initial studies suggest that younger people are much less willing to make commitments already and will appreciate the increased dating volumes, but are likely to want to settle down later, and may find it much harder. Differences between age groups will be very marked, but relationship strains are much more likely to cause break-ups across the age range as it becomes easier to shop around.

In parallel with the dating sites, on-line chat similarly gives people the ability to socialise on line and meet new friends, but also for

people to cheat on their existing partners by engaging more easily in secret relationships. As on-line games, chat rooms, and dating sites continue to grow, we should expect an increasingly fragmented and loosely bound society, with an ongoing decline in family, marriage and long term relationships generally.

Synthetic Biology

Biology has established a wide variety of tools and techniques to create and maintain life. Engineers have become capable of modifying genes and even assembling them in order to partially customise organisms. This harnesses the rest of a biological system such as a bacterial cell without having to build it all from scratch. Some engineers are talking this new skill set to heart and are taking a more radical approach, treating the basic cell as just a platform to build on, and rather than making minor modifications to existing organisms, intend to build entirely new ones. This is not easy so it is an industry of the future, rather than of today. Nevertheless, a lot of the conceptual work is already being done. Synthetic biology will still take inspiration from real nature, but will happily build on this inspiration, in much the same way as an aeroplane is inspired by birds, but bears little resemblance apart from basic shape.

Replacing rain forests

Mankind is doing a great deal of damage to the environment, and a great many species are being lost. Combination of conventional biotech and synthetic biology will one day allow us to redesign and rebuild entire ecosystems such as rain forests.

Duality

However, if we take the decision to begin a wholesale redesign of life, this will offer much more scope than conventional

biology provides. It will be well beyond 2030 before synthetic biology progresses top that sort of level, and in that time frame we will have very sophisticated network technology, and a wide variety of intelligent conscious machines. It would be possible to link the two together. We could link cyberspace life to organic life. There are many possibilities once we start doing that.

The first will be smart bacteria, containing circuitry in each bacterium, linked to other bacteria, allowing the formation of large networked colonies, and further allowing them to be connected to on-line resources. This development alone would make security systems much more difficult. Bacteria could intercept people's banking details and passwords, perhaps even thoughts, before they even get to the computer. Smart bacteria could be a scalable intelligence that is totally global.

After that, we will start to see more sophisticated organisms with a partial existence in the networked world. Some very simple creatures could thus be linked to very sophisticated networked intelligence. For example, tiny insects could be used as sensors for an on-line intelligent entity.

Migration

Then it gets really fun. Imagine a futuristic version of The Sims in such a world. They might start life in the computer game, possibly as fully conscious beings, with their own society and culture. Sometimes, they might invent things for the 'real world', or do some information work, such as creating music or theatre. They might run real world companies and get rich. They might well decide to start spending some time in the real world and migrate into a robot, or two. And of course we would be building conscious robots anyway, so they might just blend in nicely. But if they could have a real organic body just like real animals, and still

keep a foot in the cyberspace world, they would essentially be immortal. And that immortality might eventually become available to humans, who might also want to migrate into the cyberspace world.

Some environmental thoughts

We have had a few debates recently about environmental concerns. It seems that some fairly obvious solutions are not being picked up by the green groups. Here in East Anglia, there is a major coastal erosion problem. The conventional approach is to make huge concrete blocks (making concrete produces large amounts of CO₂) and dump them in the sea. Meanwhile land fill sites are filling up fast. And meanwhile, green groups are obsessed with recycling stuff to make carbon neutral systems. And meanwhile, other people are trying to figure out how to sequester carbon into carbon sinks. So... why not take a lot of the waste paper, plastic and other rubbish, partially convert it to carbon via adapted charcoal processes, compress it into blocks, and dump it in the sea? We lock up carbon, solve coastal erosion, reclaim land, solve landfill, and greatly reduce CO₂ production, and reduce sea pollution by absorbing pollutants, all in one go.

Our futures team also has proposals for using IT in transport infrastructure in radical new ways to greatly increase the capacity and utility of road and rail transport.

Even more locally, there are regular issues with the amount of car parking in Adastral Park, local traffic congestion and access times onto and from the site at peak times. A lot of the cars come from the village opposite, and many of the rest come from concentrations of BT people in other nearby estates. So, if BT provided a shuttle bus to these locations at peak times, many people might use it. A bus going round and round Martlesham Heath would take only 10 minutes per cycle, but could replace a good

number of cars. Other large BT sites may be able to benefit from similar potential economies.

Art

Art galleries such as the Tate Modern reckon that only 3% of the population ever visits an art gallery, and they are wondering how to get people more involved. I was asked to address a meeting of international gallery curators recently. There are of course lots of ways of putting galleries on-line, and they already do this. In the near future, augmented reality (AR) will offer a whole new platform for people to appreciate art, which extends to the entire city environment. People could see art in the AR overlays, via video headsets that we expect a lot of people to be using soon. Indeed, with an almost infinite amount of space, give that endless layers can be superimposed in AR, galleries do not need to hide thousands of works in their stores, but can display them all, together with all the amateur art being produced in every village in the country. Copyright is an issue for some works of course, but most people are happy to let others see their works, so the art world will flourish. Physical galleries will remain, but will be less significant part of the art world. Either the curators grasp these new opportunities and lead people, or they are in grave danger of becoming irrelevant.

Rise of the polymath

As the material cost of living falls, more and more of our expenditure goes on what Maslow called self-actualisation. We seem determined to do more with our lives than our ancestors and this self-imposed activity is the source of much of our extra stress and increased pace of life. But self actualisation is a key factor in our self image and gives us a purpose in life that is worth all the stress it causes, so we are not going to stop any time soon.

IT is helping people to do far more in self actualisation terms. For example, although I am a rubbish musician, I am just about to buy my 7th keyboard. It will have far more capability than its predecessor and hugely more than my first one in 1983. With it, and some basic software on my computer, even I can compose and play music, store it, edit and mess about with it, and make something that I can be proud of. And I still can't even read music! Other people are using computers to learn new languages, learn to play chess and other activities.

But the really big advance is that people from all walks of life are discovering that the software available off the shelf today, coupled to numerous web sites, allows them to run home businesses or become social entrepreneurs. People who never thought they had any business acumen at all are now enabled. All they need is an idea, or even just something to sell on ebay, and suddenly they are doing a second job. Hobbies are being upgraded to professional standard by this extra IT. The network puts people in touch with others that they need to fill in the gaps in their own expertise, so that collectively, people can link into virtual enterprises and take on some of the market that was once only addressed by big business.

As artificial intelligence progresses over the coming years, we will see an increasing level of entrepreneurship open to everyday people. AI can essentially do the job that was once done by the company, so that people can concentrate on the bits they want to do and leave the rest to the machine. By starting with hobbies, and bringing them up to professional standard by adding AI capability, we will enable the rise of the polymath. Many people will become highly competent across a range of skills. They may still have a 'day job', but also operate on a number of other platforms too.

The consequences of this will be that the economy will develop, and so will society. People will start more business, business turbulence will increase and poor quality businesses will be wiped out. Society will benefit because many people will use exactly the same skills to develop activities helping society. We are already seeing a significant increase in social entrepreneurialism across the UK.

BT is already helping in this field by doing such simple things as bundling network security stuff into our broadband offerings, making people's PCs a relatively safe platform whereas people used to be terrified of doing financial stuff on the net. By adding business and e-commerce tools over the next few years, we can do a lot to encourage this business and social development. Bring it on!

Women in business

I made a couple of comments in a press interview a few months ago about the changing role of women and the interest in that issue has snowballed, with several women's conferences and numerous subsequent press interviews. In a nutshell, the argument is that just as power tools have reduced the economic advantage of being physically strong, so future AI will reduce the economic advantage of being smart. What is left is essentially emotional skills where traditionally women dominate.

The consequences of AI are mainly influenced by the fact that few jobs are 100% information processing or intellect. Some is usually interpersonal interaction. Administrators will find that the pen-pushing and decision parts of their jobs will decline, and they will spend more of their time on the human side, the emotional side. Professionals will find that they spend more time with clients dealing with the relationship. Managers will spend more time on motivation, leadership and

nurturing. Interpersonal skills, emotional skills, empathy, sympathy, caring, leadership, motivation – these are the primary skills human will provide in the AI world. The information economy will decline and gradually be replaced by the 'care economy'. Although men can and do offer some of the skills in this list, it is clear that many are more associated with women, so the clear conclusion is that women will acquire an increasing dominance in the workplace.

Additionally the marketplace is essentially gender neutral and customers generally don't care whether a business is run by men or women. Turbulence accelerates levelling of the playing field. By contributing to accelerating change, IT thus acts in accelerating the downfall of a patriarchal business environment in favour of one based purely on merit.

Another trend in favour of women is that with increasing restructuring or businesses around small cooperatives of complementarily skilled people, networking is an increasingly important skill.

Finally, with the pensions crisis growing daily, it is inevitable that people will have to work longer than today. Social skills tend to grow with age and experience in contrast with intellectual speed and agility which tends to decline with age. This is a fortunate trend as it enables work to be done by older people at just the time that retirement age will have to increase.

Rebellion afoot

Weak signals are important when looking at the future. Most big trends start off as just a few small events. I have long been concerned that IT use by government will create an anti-technology backlash at some point, and have determined that 2010-2012 is the most likely period for this to happen. An earlier bulletin warned of the Stepford

Society. Since then, we have seen some significant progress down the road to rebellion, with the triple error of moving to bi-weekly rubbish collections, charging by rubbish weight using chips in wheelie bins and thirdly, threats of fines for anyone leaving bins slightly open or putting them out too early. The emphasis is on fines and taxes, rather than improving service to customers, so will be seen as a very negative use of IT. Information technology will be a key factor in implementing and policing this, but as always, criminals and anti-social types will have little difficulty in bypassing it by simply dumping their refuse in other people's bins or on the street. We are also seeing further movement towards road tolling and congestion charging, again enabled by IT, but with very clumsy implementation guaranteed to anger motorists, who find it almost deliberately designed to maximise the number of fines rather than to make it easy to pay.

The anti-technology backlash just moved two steps closer!

Memory stick capacity

Memory sticks are now becoming widely available in 8GB and 16GB sizes. This is enough to hold all the files a typical worker needs for their work. It means that they can now take all their documents with them everywhere they go and can think of any PC as theirs. The application environment is gradually migrating on to some memory sticks, e.g. the U3 environment. It will probably be another year or so before we see memory sticks designed to carry a user's entire application, profile and file environment. Another year after that will see the inclusion of their photos and MP3 tracks, and another two years all their videos. I would expect that wireless USB will start to make serious impacts in the two year time frame, after which we will start to see the rise of memory stick networking and

the evolution of pod casting into organic distribution.

Global politics collides with web critical mass

One of our first futurology predictions in BT was that when we have a mature information superhighway (obviously now the web), we would see a restructuring of power around on-line communities. So far, we have seen a few minor demonstrations and flash mobs organised via web sites, and a growing realisation of the potential for information warfare via the web by our security forces. And one or two politicians have tried to use the web effectively in their election campaigns. But like everything else on the web, there is a critical mass that must be exceeded before very significant effects begin.

This week I finally noticed an article in The Sunday Times echoing our own comments on critical mass and reflecting that we are not far away from net based power becoming significant. I would say that when we start seeing journalists starting to write articles about it, we must be very close indeed. In another year or two, most people will be using the web every day, on the move as well as at home or the office. As it becomes more deeply woven into people's everyday lives, it gradually becomes the default platform on which politics will also happen. But with the instantaneity of the web, we will see power wielded more quickly and more effectively, and there will be no need to go via the old political structures. In fact, as people globally lose ever more confidence in their corrupt and inept politicians, they will simply bypass them and their actions will be quick, direct and effective. The network and IT infrastructure will come under increasingly frequent and more effective attacks. Once such actions start and are seen to work, they will very quickly grow.

Green turbulence

Environmentalism is evolving quickly. Greens are losing the political initiative and scientists are finally taking hold of the problems, though conspicuously fighting about details. But power never shifts quietly, and there is growing conflict about the best ways to address climate change. The traditional environmental groups are fragmenting into pro-nuclear and anti-nuclear camps, and other fractures are appearing around issues such as the ethics and environmental wisdom of bio-fuels and wind power. Exploitation by authorities as a means to increase taxation is causing yet more turbulence. It is already obvious that carbon markets are being exploited for commercial gain rather than to improve the environment. The mess is likely to get a lot worse before it starts to improve, and I for one am not brave enough to pick winners yet. But the one certain loser from the turbulence is the environment. We need to agree on the best course of action and start on it. Soon!

The new renaissance?

I have often written about the care economy, where advanced AI takes away the economic value of intelligence and forces people to focus more on their human side, and more recently on the rise of the polymath. The care economy derives from the contrast between the value placed on human and machine involvement. We take it for granted that one coke can or a plastic cup is identical to another, and is actually a very high precision artefact in spite of its low cost. By contrast, hand made items command a high premium even though by comparison to mass produced machine-made items they could be considered shoddy workmanship. Essentially, we often value human involvement far more than any physical measure of quality.

It seems reasonable to assume that intellectually superior AIs will eventually be able to invent, create art, and design stuff

better than humans. But even if they meet our ergonomic and aesthetic requirements perfectly, we will still place far more value on the works of other humans. This does not take anything away from the value of AI though. When AI is used to assist humans to create art works, it increases their effective skill level. Craftsmen have always used tools, and such AI may be considered just as a sophisticated creative tool, even though in one sense AI might do almost all the work. With ordinary people enabled to create great works by using great tools, and with more time and money available for self expression, we will see the arts flourishing as an important part of the care economy. As a core part of the self actualisation layer, arts are one of the pillars of human nature. As AI progresses, we will see a new renaissance in human artistic expression.

Calendarising the important component technologies, the age of the arts is likely to arise about half way through the care economy, in the mid 2020s.

The Ages of Man (and woman)

It is a futurist's curse that target audiences sometimes find it difficult to internalise simultaneous opposing trends and so accuse futurists of self-contradiction. The problems is worsened by the fact that futurists often talk about very different time periods during the same conversation. It is important to understand how trends interact, and which ones are big enough to characterise an age, and which ones are significant but only involve a small proportion of the population. Economic trends such as migrating from the information economy to the care economy are almost independent of less important social trends such as anti-technology backlashes, the new dark age and the new renaissance etc. So just for the record, and for fun, let's calendarise some of these trends:

The Information economy started in earnest about 1990 and will start to decay about 2015 as we see AI catching up with many administrative and intellectual processes.

Virtual anthropology is already becoming noticeable, perhaps dating in first significant effect to 2006. Many people, especially the young, spend a great deal of their time on-line with other people in virtual environments, games, chat rooms and profile sites. New ways of socialising are evolving already, and will eventually evolve into new ways of doing business and new ways of wielding influence and political power. Getting to grips with the anthropology of on-line groups will be very important for companies and government. This will not level off but will grow in importance into the very far future, culminating in the unification of man and machine in the 2070s.

The Hippy Revival is already feasible today, with a few weak signals here and there that it is just starting to happen. Expect it to hit us by about 2010

The Care economy will start to become obvious by 2020 as these AI related effect take a strong hold, and will quickly replace the information economy. I think it will run until at least 2035. I still haven't quite figured out what will replace it, but I will.

The New Dark Age began in 2005 with the explosion of on-line information sharing sites, and the establishment of the default position of Google and Wikipedia as the sources of knowledge. It will worsen over the next 20 years and bottom out probably by 2030.

The Rise of the Polymath will start around 2010 as high quality web-based tools make it easier for people to engage and become skilled in a wider range of activities. By 2020 it will have run its course simply because

too large a proportion of the population will have such diverse skills. It will no longer be worthy of comment by then.

The Age of Web-Based Power will begin between 2010 and 2012. By then, there will be ubiquitous broadband and critical mass across the web and across the developed world, with a wide range of mobile devices keeping people in the loop all day. A few earlier demonstrations and web campaigns will have demonstrated the capability, and we will see the rise of the first true web leaders who will orchestrate their political power on-line. Geo-politics will be forced to engage with on-line communities.

The Anti-Technology Backlash is most likely in 2012 and one of the first on-line political campaigns, reacting to loss of privacy and over-use of surveillance by governments and big companies. People will strongly resent their politicians trying to bring about The Stepford Society, locking law-abiding people in a digital open prison while criminals bypass 'the system' and roam free.

The New Renaissance will start around 2025 as the care economy starts to mature and AIs with strong emotional skills start to interact more positively with human artistic potential. There is no reason to suppose a decline in the effect, but it will eventually be lost among other growing trends.

The Rise of Women will become very obvious as we enter the Care Economy. Many of the jobs done by men will be automated but few of those done by women. As human skills become more important in future jobs, women will start to dominate the higher levels of the workplace. This will start to take effect around 2012 as AI reaches critical level. It will be a mature effect by 2020 and reach a plateau by 2025. It will very slowly revert to a more equal economy thereafter.

The Future of the Bicycle

As someone who loves cycling (in spite of common belief), is impatient, often lazy, and who spends far too much time in airports, the moving walkways that we see in airports inspired me to wonder about the economics of adding bicycle conveyors on commuting roads. I have no real idea how fast I can ride, but let's say 7.5m/s. If there was a conveyor belt moving also at 7.5m/s along the local road, it would halve the time it take me to get somewhere, and also greatly reduce the speed differential between me and passing traffic, making it safer to ride.

At first glance this looks a ridiculous idea, because we immediately think as engineers of the obvious fact that the first falling leaf would clog the system up, rain would cause havoc, cars encroaching onto the path would cause mechanical stress because of the speed differential between a conveyor and the road surface, and pedestrians would also try to step onto it and cause yet more havoc. The idea ought to be a total non starter.

However...

Suppose instead that we add a metal plate to the bike, close to the road surface, and add linear induction motors to the idea! Maybe even the wheels would suffice as the plate, or widening the wheel rims, or flattening the tyres, someone else can do the physics. Suddenly there is no problem with clogging, rain, cars or pedestrians. There is a small problem of vandals trying to send metal objects at high speed along the road of course, but it is an easily soluble one.

Since roads usually have good electrical supplies along them for street lighting and cable runs, this ought to be worth looking at. If it could be solved, it would be a good way of encouraging cycling as a viable

transport solution, and reducing carbon production. It can be rolled out gracefully according to demand, works well with cycle paths alongside roads, even those shared with pedestrians.

The amount of extra force given to the cyclist could be variable. Bicycles could be given RFID chips to identify them and the personal tastes of that cyclist indulged alongside billing. Some people might want lots of assistance or to go very fast, other want less assistance or to go slower. Since induction plates can be individually controlled, and the bicycle plates can also be tweaked for height or inductance, it is easily customisable in real time.

Invisible is the new black

We will soon live in an age of dual appearance, using head-up displays to see computer generated overlays on what we are looking at in the real world. Dual architecture will emerge and in this world, invisibility will become the peak of cool. Buildings will be designed deliberately to be extremely plain in the physical world, and also appear to people in the dual world as very plain unless they are in the select target group, such as members or the 'right' customers. The buildings will be therefore almost invisible to people outside of this select group. That only some specific people can see the 'true' hidden identity of the places and the proper appearance will make them highly desirable.

Directional messaging

Hanging around in airports and getting very bored, I wondered why it is not possible yet to send text messages to people just by pointing my phone at them? Apart from the obvious flirting capability this would give, it could also allow people to send messages to people in other cars. And going down that avenue of thought, it then becomes

obvious that as well as directional messaging we also need instant voice messaging because you can't type messages while driving, but you can certainly shout "get out of the way you moron". I'd buy it! But what I'd really, really like is the phaser upgrade!

Sticks

Now and then I get irritated when something I invented yonks ago comes to market from a different company. In 1992 I reinvented the stick, something that man evolved to be adept at using over countless millennia and which would therefore be the most intuitive interface possible. I figured that a generic 3d interface to computers for drawing, sculpting or playing games could be based around a stick. With a simple stick and a reflector on each end, a simple transmitter/detector system using LEDs or a laser could triangulate the 3d coordinates of the ends of the stick. It could thus substitute for a pen, golf club, gun, paint brush, chisel, or basically anything that you ever hold in your hand. It would cost pennies to make. Sadly, BT didn't consider it core business so we never developed it. Now of course the Nintendo Wii uses a hand-held device to do much the same thing, albeit in a much more heavyweight expensive and complicated way. In another couple of generations of their device, I feel confident that they will end up using a much simpler stick with reflectors too. And because it is so lightweight, it wouldn't smash your TV if you let go of it and didn't put the strap on right.

The main technology trends

Last issue I calendarised the major socio-economic for the next few decades. I promised this time to look at the equivalent changes in the technological foundation.

Moore's law will continue for at least 3 more decades, based as always on a

succession of technologies as each individual approach eventually reaches a limit. Digital jewellery will provide just about any function in almost no volume. Already multiple cores are the norm, and this will run to the point of billions of cores by 2025, though each might be much simpler than today's. This will necessitate using the full 3 dimensions, and the most likely solution is suspending processors in gel with free-space optical links, which will likely start around 2015 and be mature by 2025.

Making things simpler is at least as important as miniaturisation, and recognises that we have wasted three decades making electronics and software far too complex, unnecessarily. Simpler and more elegant solutions to processing will yield far more power than Moore's law on its own. Much of today's operating systems can be replaced by elegant use of simple physics for example.

We should also expect that analog processing will make a huge comeback. Digital has huge advantages for many purpose but it is not suited to everything, and I would expect that the vast bulk of processing, especially AI, will happen in the analog domain again by 2020.

In the 2025 time frame, custom proteins will do the assembly work from the bottom up instead of lithography, which will hit the limits by 2015. By then we would expect a wide range of molecular sized electronic components to add to the carbon nanotubes of today.

Given the simultaneous progress of reverse engineering nature and re-engineering synthetic biology, the smart yoghurt will arrive around 2025, with proteins in the bacteria creating and assembling electronics within their own cell and communicating with others nearby to produce highly scalable self organising

electronic circuits. Of course, nature uses some excellent self replication mechanisms, and synthetic biology will harness these to greatly reduce the costs of electronics manufacture – just stick one smart bacterium in a food supply and wait and very soon you will have billions of them.

Self replication would be used in other fields too, but wouldn't necessarily have the same grey goo problems imagined as nanotechnology was popularised, though it still yields some powerful WMD capabilities.

Also in parallel, reverse engineering of the brain assisted by nanotechnology based probes will link neuroscience and IT progress intricately, resulting in strong AI and synthetic intelligence approaching and even exceeding human levels between 2015 and 2020. For obvious 'terminator scenario' reasons, some people will have to have strong links to this synthetic intelligence using implants so that the machines can't gain a huge advantage over humans. During development, we will inevitably produce some superhuman chimps too!

The production of smarter-than-human machines creates a very rapid positive feedback in technology development that is called the singularity. We should expect this between 2020 and 2025, and it will be technologically equivalent to ET landing and giving us all of the toys from his space ship. Some of the developments are predictable, even as far out as 2040 or 2050, such as fully transparent links between our brains and machines, the end of death via electronic immortality, network enabled telepathy, global consciousness and so forth. Amazingly though, most of the really big changes in the 2050 time frame are probably beyond our capability to imagine in just the same way that DVDs or internet chat rooms were unconceivable before the invention of the transistor. Virtual worlds will grow and grow and converge with the physical world, with dual

appearances and augmented reality as a platform for major change.

So much for electronics. Biotechnology will give us ebaybies by 2025 - the ability to take a genome listing from any two people, merge them on a computer, simulate what the prospective babies might turn out like to create a shortlist, and then after some more detailed simulation and customisation, to assemble the actual genes and implant them so that the baby can be made.

Space technology will rocket ahead from 2010 as it becomes more commercial. Space tourism will be common by 2020 and the moon will be a holiday destination for the mega-rich by 2040. Arthur C Clarke's brilliantly conceived 'space elevator' could come along any time after 2030 thanks to positive feedback loops in technology development.

Sustainability via intelligence

Energy and material resources will be in abundant supply by 2040 thanks to a range of technology developments – superconducting cables that will allow power to be shipped between continents; Saharan solar farms, (enabled by nanotechnological enhancements to photovoltaics that increase efficiency and reduce cost); geothermal production, wind and wave and of course large scale nuclear installation. The ability to transmit power over long distances or to convert it to hydrogen will be truly transformational. In parallel, electronically driven transport will enable almost carbon free (and congestion free) transport systems.

Meanwhile the environment will be being repaired rapidly by technology based on synthetic biology, such as customised bacteria. High technology will bale us out and the global warming problem will have proved to be a short term one in much the

same way as the population scares of the 1960s and 70s. This achievement of high sustainability by using intelligence to develop advanced technologies will allow a very high quality of life for all while protecting and rejuvenating our environment. It is an inherently better approach to sustainability than trying to stop progress to reduce environmental impact.

Bed and breakfast romances

Having gone through a divorce recently, I read with dismay that our government is considering applying divorce type laws to non-marital relationships too. After two years of going out with someone, they would be entitled to a financial settlement. Obviously, this will force many people to break up relationships before the 'deadline'. But of course they might want to restart it again after a week or so. I wonder what the rules will be on the interval required between calling it all off and starting legally afresh. A year, a month, a day? Is a quick tiff sufficient? A few years ago people used to sell shares at the end of one day and buy them back next morning to reduce capital gains tax. It was called 'bed and breakfasting'. Are we heading for the 'bed and breakfast romance'?

The Future of Privacy

I feel oppressed by the increasing surveillance all around us. I am amazed how many people use the argument 'if you have nothing to hide, why should you object?' when faced with increasing surveillance. I am no saint, but I have never had a speeding ticket or a criminal record, so still fit officially in the 'nothing to hide' category, but I still feel that the amount of surveillance in the UK violates my privacy and makes me feel like I am live in a digital prison, while the criminals roam around

free. I don't have to hide, but neither do I want to be watched all the time.

It occurs to me that the best place to hide is in right in the open, as evidenced in every spy film. In the future augmented reality environment, our digital auras can be as bright and well populated as we like, but still be invisible to everyone except those with the right profile. So we can be seen by the people we want to be seen by, and do what we want with them digitally, but be just another face in the crowd to everyone else.

In this future, there is diminishing physical privacy, policed and invaded intensively by cameras, microphones and various sensor, recognition and tracking systems, but also much better potential to avoid digital surveillance. As our lives move further into cyberspace, this works in favour of our overall privacy levels.

The key factor here is that cyberspace is not just the world wide web, and never has been. The WWW is just one platform for communication and networking. It is entirely possible to build other platforms in cyberspace, and they do not have to be connected to other parts of cyberspace at all. This offers an excellent social solution to achieving the networking potential of the WWW without the surveillance it brings with it.

One such way of doing this is to use memory stick networks, exchanging information directly among memory sticks based on organic networking, random passing of strangers in railway stations etc. These networks can be used in such a way that only people in the right peer group can access the information being shared by particular sticks. So we will be able to network as much as we like and do as much as we like digitally and no-one will know anything about it if we don't want them to.

Time-wise, I would expect that the capability to do this will arrive by 2009, and the incentive to do so will grow significantly in that time frame, so we should expect alternative, surveillance free networks by 2010.

The future of music

We often see actions by the music industry to prevent copyright theft, and they constantly moan about the loss of 'their' revenue because of piracy and unauthorised downloads, but what is increasingly clear is that we no longer need the big companies in this industry at all. They were certainly necessary in the 20th century to enable bands to produce and distribute high quality music. But that is no longer true. Today, reasonable quality recording equipment is cheap and easily available, there is certainly no shortage of good quality bands, and the internet provides a near perfect distribution platform. The so-called 'music industry' is now simply getting in the way, making it more difficult for on-line music sharing sites to work, while adding no significant value. Many groups want to produce and share their music, and some neither expect or even want to be paid for it, content to receive occasional compliments from fans. Since there are so many good bands around the world, there is a huge potential supply of high quality music in every genre, so the demise of the big music companies will make very little difference to the availability of good music. They are little more than expensive marketing engines today, and the web can offer far more value-add, for free.

Smart cash

We have various forms of electronic cash in use now, such as Oyster, Paypal, Linden Dollars and so on. What is still conspicuously missing is a versatile platform for holding, managing and interchanging all the various forms of money that we use.

This could include our air miles and supermarket loyalty points, baby-sitting circle tokens and so on. Once we abstract money away from simple pounds and pence, it is obvious that we can add a lot of value by associating various algorithms with the money, making it vary in value according to context, time or location. We could track it, noting who has used that money before, making it collectable if a celebrity has used it or if it was used for some special purpose. Such electronic value add is relatively simple to provide so it is a surprise that the market doesn't already provide it. We should not have to wait much longer.

The context explosion

Life is much more complex today than ever before. We exist in many more contexts than we used to, mainly because we are much more networked than our ancestors. We have various on-line identities, we belong to more clubs and societies, social and political groups. Increasing social diversity has opened new cultural and social opportunities. And there are more demands on us as individuals to be seen as complying with cultural demands, such as environmental responsibility, being seen in the right web networking sites and so on. As a result, we are seeing an explosion in the number of contexts that we have to manage. Each requires some maintenance and decisions.

The virtual uniform will be a tool to assist with this. We are very familiar with police or nurses, who are normal everyday people whom we relate to differently when they wear their uniform. When they are in uniform, it is mainly their official role that we are interacting with, rather than them as individuals. Virtual uniforms can identify us in any particular role, and we could wear as many of these at once as we wish. People would see us in their augmented

reality in whichever guise is most appropriate to them at the time.

Sustainability and welfare

I have just moved house and need to dispose of a lot of furniture and white goods that I am replacing. It is much more difficult to dispose of than I expected. It seems that the falling costs of material goods, coupled with a generous welfare system, mean that most people buy stuff new now, certainly everyone I know. As a result, a lot of perfectly usable devices and furniture will likely end up in landfill. It is simply too hard to give stuff away. And yet there must be people who would like it, so there should be websites where I can advertise what is available and people could come and collect it.

Dilution of Love

With all the new social networking sites and the innumerable ways of meeting new friends now, people have many contacts and friends, but still only the same human capacity to deal with them. In fact, probably less, since we have so little free time with our busier lives. This means that we have less time to allocate to each of our friends and so our love is being spread more thinly (of course some would say that love is not finite, but we do only have so many hours in a day to think about everyone, so it simply is). As one consequence, we have more superficial relationships, that are easier to jettison when new friends come along, when we move, or simply when we tire of people. So although we may be more networked than ever, our relationships are probably more superficial and shorter lived than long ago. This might help to explain the oft-quoted observation that happiness levels are no better today than 50 years ago in spite of much better economic conditions.

Cheating

Anthropologists mostly agree that people are polygamous, and since our cultural conformance, at least in the UK, dictates a single partner at a time, people who want multiple partners have to cheat, or join sub-groups where such behaviour is the norm. Social networking sites make this much easier of course. Of course, when it becomes the norm that people have multiple simultaneous partners, it is no longer cheating. Should we expect that the cultural norms will change to adapt to the new world of multiple partners, or will we see the cultural norm being monogamy, with technology enabled cheating rising continuously? My expectation is that cultural norms will adapt, and in a decade or two, it will be considered normal and acceptable to have multiple partners. People who want monogamy will then have to negotiate it instead of assuming it as the norm. Such attitudes already exist in some social groups and cities, but it will take more time for them to spread throughout the population.

Meanwhile, cheating requires increasing care since privacy is declining. It is easier to google people and find out who they really are, what their situation is and to explore their social connectivity. One obvious solution to this is to create multiple aliases. Of course, each of these ideally needs to be usable, for credit cards, licenses, passports etc, and this is currently illegal. Many people would like several officially recognised identities instead of just one. So what is missing now is the right to have multiple legal identities, or at least sub-identities. This should be entirely workable. I could be completely traceable by the state for legal purposes regardless of how many different sub-identities I carry, provided they are all officially registered to me. Meanwhile, my separate aliases would all remain useful and apparently unconnected to everyone else, provided that the state databases are secure and access is suitably restricted and policed. I wonder how many

separate ID cards the government will let
me buy?