Ian Pearson

The Future of Fashion

Fashion is really just starting to interact with the IT world. Today there are already 'cool' gadgets and wearables, but tomorrow, we will see whole new domains where fashion can play a key role. The biggest of these is the duality of appearance, where we may appear one way in the physical world, and have a whole range of digital appearances in the augmented reality and virtual environment worlds. These new worlds will need to be designed, and fashion will play a similar role to that in the real world. However, new tools that use artificial intelligence, coupled to local manufacturing, are likely to mean that much of the future design can and will be done by people themselves. How much this affects the market for professional fashion designers will depend on how much relative skill and creativity they really have, as well as on how much effort people can be bothered to invest in designing themselves.

Along the way, electronics will continue to shrink in size to a point where it no longer significantly need affect the form of the object that carries it. Form and function will be separated, at least as far as IT is concerned.

New Materials and Devices

Fashion is often at the forefront of technology usage. Often new materials and technologies are used in textiles and accessories when they are still too expensive or primitive for other uses. Technology development is accelerating quickly and shows no sign of slowing down in the foreseeable future, so fashion designers will have a lot of fun over the coming years. The next decades will see the gradual convergence of nanotechnology, biotechnology, information technology and cognitive technologies. Typical results will be materials with different tensile, thermal and optical properties, integration of information technology into fabrics, and linkage of our bodies to the network for medical and communication purposes, via clothing or skin-wearables.

Thin flexible displays are becoming available already, and we will undoubtedly see them built into clothing with increasing frequency. This will be both for body adornment and functional uses. A wide range of electronic devices can already be built into clothes and this will increase. New fabrics are already being developed to provide power generation, using solar power, electromagnetic, thermal and mechanical means.

Storage technology is improving extremely quickly and we may expect massive amounts of storage to be available in very small volumes, so that people can take all their files, music and videos with them, integrated invisibly into small devices or clothes.

Haptics technology (the technology of enabling the remote sensation of touch) will also become available as part of clothes. A variety of electro-responsive materials exists already, albeit sometimes in primitive forms (for example, muscles wires, polymer muscles, shape memory alloys, etc), and these will progress quickly into routine fabric technologies.

Ambient Intelligence, Smart Environments

Clothes will be part of the ambient intelligent environment we will inhabit in a few years time. There will be myriads of chips all around us, in building infrastructure, furniture, gadgets, clothes, foods, packaging, even on our skin and inside some peoples' bodies (for medical and security purposes). Chips in the environment or on our person will offer processing, storage, sensing identity and communications. The resulting smart environment will know who we are, what we are doing, where we are, to the nearest few millimetres, and all about us, subject only to our own preferences and privacy or security laws. Identity chips knows as *radio-frequency identity (RFID) tags* will start replacing bar-codes in packaging over the next few years, and some will be used to add data to clothing, which might be intended for use by smart appliances in our homes – smart washing machines, dryers or irons. More likely, they will be used for sales and marketing purposes, allowing better stock control and sales processing efficiency. But these chips could be detected by shops well after the sale unless they are disabled, electronically linking the detection of a particular garment

Chips in the environment or on our person will offer processing, storage, sensing identity and communications.

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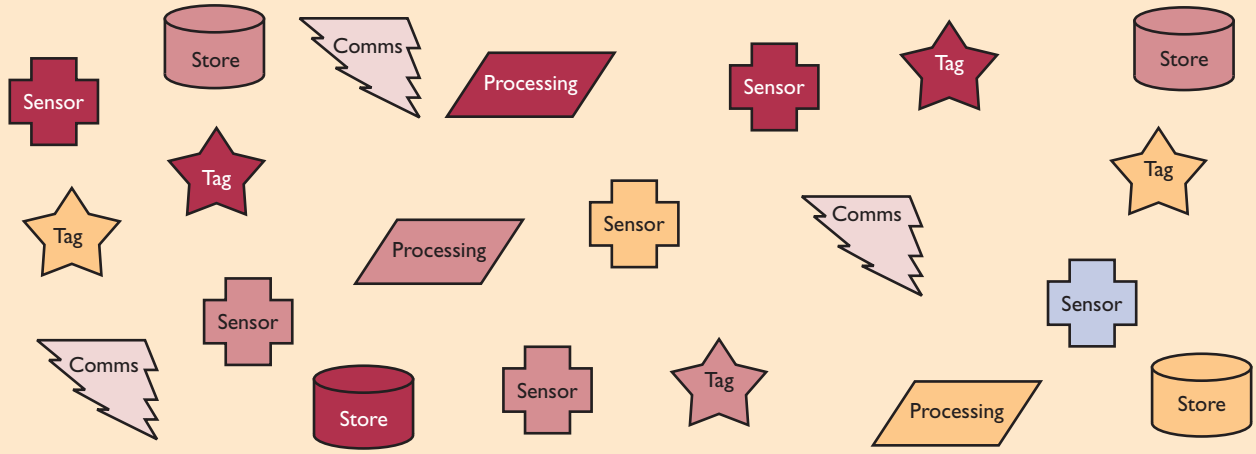
Figure 1 Smart environments



to the database records of the human being wearing it every time they go into that shop, or any other. Even though a shop might not know who the wearer is, the shopper can still be targeted by marketers just based on recognising their trousers.

Form and function

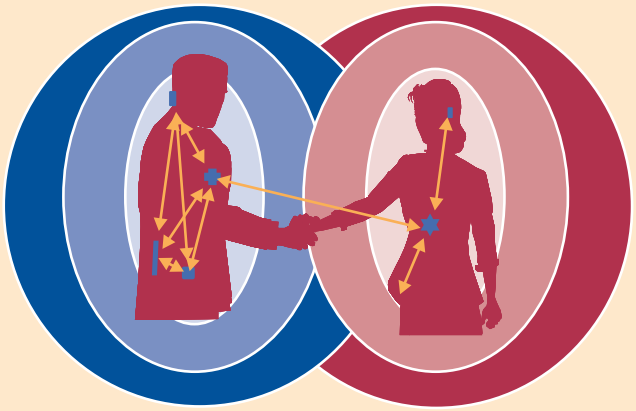
As we head down this smart environment road, we will see an almost total decoupling of form from function. Almost any amount of electronic functionality can be associated with something without necessarily affecting its form. Chips will be physically very small, so can be hidden anywhere, and any functionality that won't physically fit into a device can be accessed via the smart environment. This means that fashion designers can add a wide range of functions to something without needing to change its design. However, people often carry physical tokens of functionality with them as fashion accessories in their own right. Apple's iPod is such a fashion accessory, as are often the latest mobile phones. What we might see as people get more used to separating form and function is a range of tokens that aren't directly linked to the functionality, but indicate the various personality attributes of the wearer. We already have many such tokens, such as the ribbons people wear to show empathy with cancer or aids sufferers, or to indicate their sexuality. We should expect more.

Digital bubbles

The smart environment could offer many advantages and disadvantages for people. Potential abuse by marketing departments will necessitate the development of digital bubbles that protect us from the flood of unwanted electronic information coming at us from all angles. These bubbles will act as an electronic force field, and personal firewall. But of course we will want some information and want to communicate to some degree with the smart environment, so it must be a semi-permeable force field that allows information through it selectively. What we want and need depends heavily on context, so large amounts of artificial intelligence (AI), security and profiling technology will be needed.

Our digital bubbles will interact not only with the fixed environment, but with the bubbles of other people. They will exchange information with them, very selectively, and iteratively. Many people want to broadcast some information about themselves to all and sundry, which they do on web sites today. Tomorrow a personal wireless web server can do that on the go as part of our

Figure 2 Digital bubbles



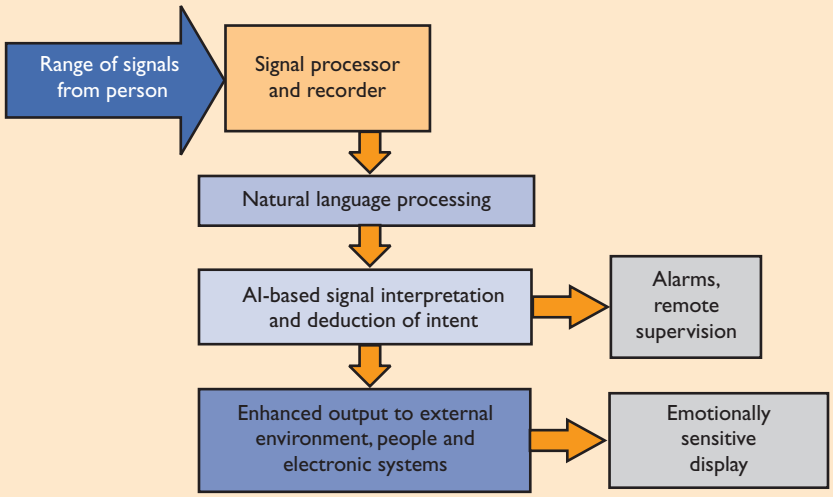
Bubbles can link to emotion detection, medical monitoring, thought recognition.

Communication via skin, or radio.

Powering needs nanoscale devices for energy harvesting or use of fuel cells.

Intelligent data exchange between multi-layer bubbles and between appliances within bubbles

Figure 3 Personal signal analysis



digital bubble functionality. Again, this can be fully context sensitive, responding to our emotional or medical state, or who the other person is.

Duality of Appearance

Various sensors on and about our person will monitor our behaviours and physical characteristics, and respond accordingly. One of the areas that computers may want to share with other people's digital bubbles is that of personality characteristics. An ego badge would alert us to other people that are likely to be of interest to us so that our social and sex lives would improve. A related device is the active contact lens, which uses tiny lasers and micro-mirrors built into a contact lens with circuitry and power supply, to raster scan a high resolution image onto our retinas. This is called *direct retinal projection*.

Any computer-generated images could be superimposed on what we see in the real world. We would be able to modify how we see other people so when you meet someone who has a nice personality but who does not appeal physically, a digital image could make them look the part too. We could digitally remove all the ugly people from our field of view and digitally replace them with more attractive alternatives. Beauty will be quite literally in the eye of the beholder.

This brings us to the heart of how fashion will change. Suddenly we have to worry about our digital appearance as well as our physical appearance. And digital appearances can be infinitely diverse. We will not be limited by the properties of physical materials, or have to have the same appearance for everyone looking at us, nor even have the same appearance all day. Our appearance can be different to each viewer, and different each time they look at us. So fashion designers will need to design virtual fashions, and these will need to be dynamic and context sensitive. Dual appearance dictates dual fashion.

One of the accessories that we might need in such a world is the digital 'aura generator'. This will act as a sort of wireless web server that radiates our digital appearance into the nearby space. It is almost like the hologram generators that science fiction fans will recognise from Red Dwarf. The main difference is that it will make us look different to different people.

Fashion for the virtual world will undoubtedly evolve different rules and conventions. Even without any of the physical constraints of the real world, design cultures will nevertheless emerge. How will people choose to display themselves when they have an infinite choice? Will appearance fashions come and go more or less quickly in cyberspace? How much will they depend on age, gender, race and so on? Sadly, details of these future cultures are far beyond my ability to predict. All that is clear is that when anything is possible, only some things will be done.

Virtual Environments

As we get used to digital fashion on the high street, we will also begin using virtual environments for communications. Any environment can be digitally emulated by a computer, and we can meet other people in these environments. They may also be inhabited by machine personalities too. Again, these environments have to be designed, as do the many processes and rituals that will be used.

One of the tools people may use to customise their digital appearance is the digital bathroom mirror. This would be an interactive device that allows someone to see their digital appearance, and to edit it using various graphics tools and virtual make-up until they are happy.

Figure 5 Digital mirror

Smart make-up

Interestingly, it will eventually become possible, probably around 2020, to build nanoparticles into actual physical make-up that can be aligned with an electric field. The smart make-up could effectively become a liquid crystal display. Colours can be created by light emission, absorption, or diffraction, just like butterfly wings. Any of these techniques could be used in digitally controlled make-up. So a woman might just smear this smart make-up all over her face, without any care about where it goes, and then push a button. The electronics then controls the appearance of the make-up throughout the day, depending on where she is, who she is with, and what she is doing. We will have to hope that it is secure against hackers, who could otherwise write messages on her skin.

Active skin – sensory design and sex

The electronic layer that controls this make-up is called *active skin*. It could be used for hundreds of different purposes such as security and medical monitoring, but body adornment is certainly one of the most interesting applications.

Thin flexible displays can add video tattoos to the skin, or be used as wearable

Figure 4 Active contact lens

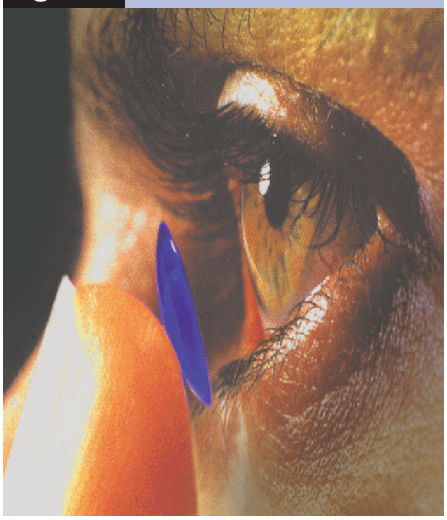


Figure 6 Active Skin

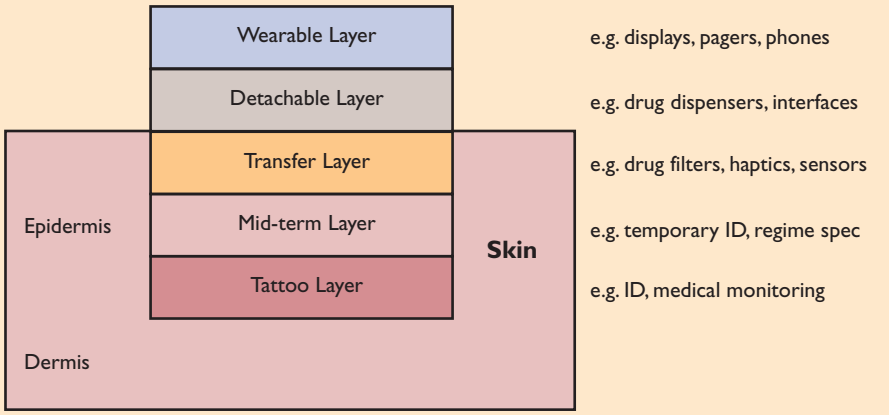
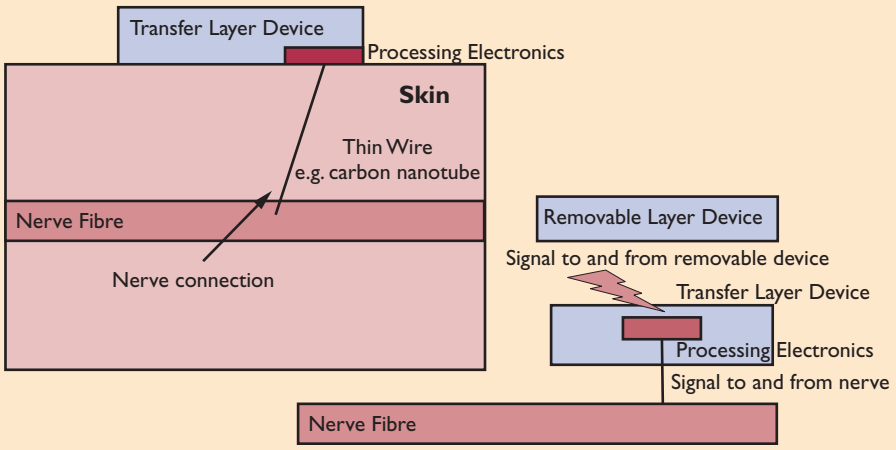


Figure 7 Nerve connection

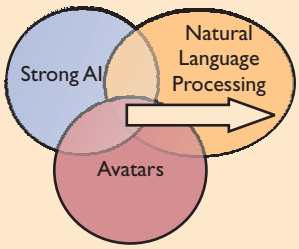


computers or video players. The lowest layers of active skin would be in contact with blood capillaries so could monitor blood chemistry, including hormones, so these could give extra clues to emotional states. These layers will also permit connection to the nervous system.

This might make it possible to record the nerve signals associated with any sensation and to replay those signals later to recreate the sensation. Imagine recording a hand shake, or a kiss. In fact, this nerve linking technology allows sensations to be treated like any other computer data. They could be modified and enhanced, transmitted across a network or translated into another kind of sensation altogether. We could have a much closer link to our computers than we have today. And because these sensory signals can be processed and modified, there will be some areas that are open to meddling by designers. Perhaps we could redesign sexual behaviours. We could certainly design our virtual partners, including their synthetic personalities in the future to match our wildest fantasies.

In principle, any physical sensation is just a series of nerve signals, and this could be initiated by the computer as a response to any physical act. So just as form is decoupled from function in our gadgetry, so sexual response is totally decoupled from stimulus in principle. Sensations could be included as just another emoticon in a text message. In fact, Samsung has already released a mobile phone that allows a range of different vibrations to be included in messages. Linking directly to the nervous system is far away but is a natural progression of this type of service.

Figure 8 Redesigning lovers



Virtual partners can change appearance on cue, and have any personality desired. Can indulge any fantasy.

eBaybies

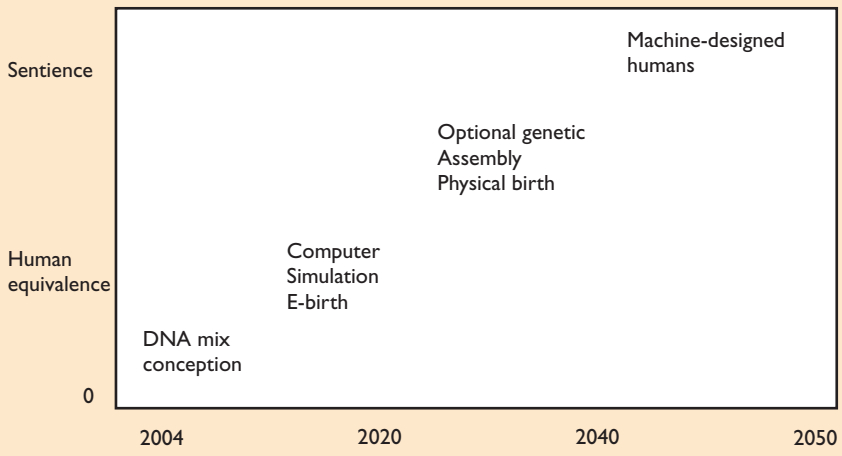
The current horizon for fashion is the designing of babies. Today, people can choose the sex of their child, or select on the basis of the presence of a single gene (normally one associated with a disease). Being able to select a set of genes to dictate a particular appearance is far beyond current technology. But the technology to allow that will probably eventually come too. In fact, if we are prepared to look far enough ahead, we can imagine being able to simulate the protein behaviours in an embryo to evaluate a whole range of potential offspring. Today, people can already have their genetics analysed and take home their genetics listing on a CD. Using a computer, they could randomise an almost infinite number of potential offspring with any potential partner whose listing they also have. In fact, having made a listing, it is the actual genetic code of a potential human being. The listing could be legally traded on eBay, so we might call these listings *eBaybies*. Today they are just a set of ones and zeros, but in the future, an actual baby could result from assembling the listing from genes available off the shelf, and injecting these using cloning technology into a human egg. So the eBaybies of today could be the real babies of the future. And yet they are no more than a frivolous item of techno-fashion today, that people might collect.

So perhaps even the organic world could be open to designers. If it is possible to design people, then how much more socially acceptable will it be to design pets and plants? Gardening has very much become a fashion domain in recent years thanks to TV make-over programmes. In the future, as well as various water features, decking and other ornamentation, even the plants and animals could be vulnerable to the whim of fashion designers.

Future Fashion at Work

Coming back to the closer term, we will see the nature of work change substantially over the next decades, with corresponding changes in work clothes fashions. In particular, machine automation of both physical and mental jobs as AI and robotics continue to progress will mean that people will have no choice but to focus on jobs where the role dictates that is must be done by a human being. One name for this era is the *care economy*, and it will bring the focus of work onto interpersonal interaction. Today's job of child care, nursing, policing, and teaching are good examples of the sorts of jobs that will dominate, but most people will gradually see their jobs containing less information processing and more contact with customers. This will change the demands for clothing in the workplace.

Figure 9 eBaybies



Some companies will encourage individuality while others will encourage uniformity in pursuit of control of their brand image.

DIY Fashion

Finally, with increasing assistance expected from artificial intelligence in all walks of life, we should expect that people will often want to design their own clothes, making most of the artistic decisions and letting the computer sort out the technical stuff. As local production becomes more widespread, self design may become very popular indeed. Many people are dissatisfied with the clothes designs available in the shops and would much prefer to have clothes made for them to their design, or at least have some major input. Of course, if they are becoming used to designing themselves for the digital world, then this would be a natural extension. If such a trend were to become too popular, the role of the professional fashion designer might be significantly reduced. Or on the other hand, when most people are walking around in amateur creations, the advantages of professional design should be more apparent. How much this affects the market for professional fashion designers will thus depend on how much relative skill and creativity they really have, as well as on how much effort people can be bothered to invest in designing themselves

In any case, with all these new digital and organic fields that need to be designed, it is very unlikely that designers of any kind will go short of work.

Conclusions

New domains are being added to the realms of fashion. The digital domain will bring augmented reality overlays via head-up displays and active contact lenses. People will have to choose how they want to be seen in cyberspace as well as in real life. A digital aura will surround people as they walk down the street, and they will regularly appear in virtual environments too. All of these appearances need to be designed, and fashion will have a premier role.

Even the biological world will become subject to design. We will one day have to technological ability to redesign plants and animals, even humans. Early generations will rely on a high degree of chance and selection, rather than deliberate design, but as genetic libraries grow, designers can take an ever-increasing role.

Given the enormity of interaction of the digital domain with fashion, including gadgetry, smart environments, virtual environments, smart make-up, active skin, wearable computing and so on, it is obvious that new telecoms-related markets will open up and expand. The days when a phone was a purely functional device are already gone and will soon be ancient history.

Biography

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Ian Pearson graduated in Maths and Physics from_Queens University, Belfast. After four years in missile design, he joined BT Labs as a performance engineer. He has since worked in areas from chip design to mobile telephony. He currently works as BT's futurologist, mapping the progress of new developments throughout technology, considering both technological and social implications across the whole of industry, government and society. He spends much of his time advising on the major threats and opportunities facing us in the future, at conferences and in the media. He still dabbles in research, currently in ultra-simple computing, conscious computing and social trends. He is a fellow of both the Royal Society of Arts and the Institute of Nanotechnology.

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