5 Edinburgh 2050: Technological Revolution

Learning points

- In order to understand the future of technological advancement, reality can be viewed best through the paradigm of science fiction.
- This chapter explains the key drivers of technological change, the interface with tourists and tourism consumption.
- Real and personal information will still be the number one influence on holiday purchases in 2050 even in a technological world.

Introduction: The Role of Technology

Graham Whitehead, the renowned BT futurologist said, 'consumers will see more technology change in the next ten years than was witnessed in the previous hundred years' (Whitehead, 2005a, 2005b). Exponential change in technology has altered how consumers use information and how this impacts on tourism. The internet has changed distribution patterns and mobile technologies are about to change how tourists 'see and book'. As Google's Claire Hatton (2009: 638) said '30% of hotel bookings in the cities of Tokyo and Seoul are on the day of arrival through the mobile phone and this trend can only grow'. Today's typical tourist is pointing their mobile phone at a hotel, using augmented reality (AR) platforms to view information and then making reservations via websites such as Expedia. The provision of information on tourism products is available through a variety of channels and technological platforms, bringing with it a range of benefits such as convenience with user-friendly interfaces, up-to-date information and affordability to the end user. These developments increasingly drive the integration of technology within our everyday lives with mobile internet, navigation systems and smartphones, which attempt to constantly keep us connected to the digital world. This chapter explains how future tourists will interface with technology through a scenario of the life of Maria who is

enjoying the Edinburgh Festival in 2050. The core of the chapter identifies 10 technological driving forces which will shape the future.

How Technology has Changed Everything

The internet is one of the main drivers of product design as many mobile devices are increasingly equipped with mobile internet capabilities. Connectivity to the internet allows faster and more immediate access to information. A survey conducted by TNS Global (2008) indicated that many see the internet as 'an encyclopaedia of information', where three out of the top five activities engaged by online users are related to information gathering. Survey results also indicate that 81% of respondents used a search engine to find information, 63% researched a product or service before, 61% visited a brand or product's website and 50% used a price comparison website. These figures suggest that consumers are increasingly turning towards the internet to obtain information on products, brands and pricing. Within the tourism industry, the internet is being targeted to become the most important channel for holiday sales, information and recommendation where two out of five reservations are completed online and 55% of all European travellers use the internet for information about their travel destination, travel providers and special offers (Isabel, 2009). Recognising this trend, in 2007 Tourism New Zealand shifted its marketing activities from predominantly print media, to embrace digital and screen technology. This includes advertising through televisions, cinemas, outdoor screens and billboards and more significantly, the internet and social media (Tourism New Zealand, 2010).

Technology has become part of our everyday lives, creating a digital society. While one of the main reasons for this is the exponential advancement in technology, another key driver is the presence of the digital generations (Generation Y onwards), and their demand for fast, innovative technology products. High-speed broadband with larger bandwidth have allowed greater capacity of network traffic and data sharing while new gadgets, increasingly equipped with mobile internet, reflect the level of demand and comfort societies have towards technologies. This trend is echoed in book sales with Amazon's sales of Kindle e-books outnumbering its sales of hard-covered books (Miller, 2010). Technology has also allowed the development of online user-generated content, altering the way information is provided, gathered and perceived. Information provision has evolved from the traditional single-directional push of information from suppliers to consumers to a multi-directional share of information between suppliers and consumers, and between consumers themselves. Deloitte predicts that in 2011, more than 50% of computing devices sold globally will not be PCs. Instead, sales of smartphones and tablet computers would come to 425 million, well above the sales of 390 million PCs (CNA, 2011a). This implies that

user-generated content will increasingly penetrate the online world of information, reflecting two future scenarios of a 'Free Information Society' and of 'Real Information Society' as proposed by Yeoman and McMahon-Beattie (2006). A free information society highlights that information is freely available and consumers no longer need to purchase information, whereas a real information society reflects how technology supports personal information rather than replacing it.

In today's society, digitised information is the norm. Many guidebooks such as *Lonely Planet* have embraced mobile devices by providing digitised guidebooks through the format of mobile applications designed for smartphone operators like Nokia, Apple, Google and Android (Lonely Planet, 2011). However, the continuous development of technology is bringing societies to a flip point, where technologies become increasingly integrated in our daily routine. Driving this is ubiquitous computing. Ubiquitous computing refers to technologies which interact with humanity out in the open rather than users connecting with the computer; it is the interaction of one user with many interfaces through technology that is interwoven into the external environment. This concept puts forth many possibilities for interaction with information technologies without the use of devices, for example, the possibility of gathering information through a pair of contact lenses. As technology slowly recedes into the background and becomes an invisible interaction in our daily lives, the future of information provision may no longer require mobile devices.

So, Imagine This ...

Maria, a 29 year old from Madrid loves culture, art and festivals and every other year visits the festivals of Edinburgh. She is thinking, what shall I do this year? Using her mobile phone, she watches the latest video on www.visitscotland.com, an interactive film which follows the exploits of Hamish, holidaying in Edinburgh, whether it is bungee jumping off the Forth Road Bridge, a performance of the Chicago Ballet at the international festival or the Russian veteran political satirist Vladimir Vladimirovich Putin. As Maria watches the film, she 'tags' the things she wants to do, places to stay and makes arrangements for flights, all of which is brought together as an individual itinerary. Maria then confirms everything speaking to Mary, VisitScotland's intelligent agent, a 3D hologram image on her phone.

On arrival at Edinburgh airport, Maria wants to check some local information; the cyborg information assistant is a wealth of knowledge advising Maria on local restaurants and pubs. Arriving in the city centre, Maria checks into her hotel using a biometric eye registration system.

Before leaving for a tour of the old town, she has purchased a 'witchery tour' app for her contact lens so that she can visualise what medieval Edinburgh would be like in 1650. This is all possible given the ubiquitous nature of the city's information network. That night, dinner is at the Rhubarb restaurant with friends before heading to the Festival Theatre to watch Mr Putin's 'vodka politiks' comedy routine. The evening finishes about 1.00 am with drinks at the Balmoral Champagne Bar, a seven star bar which features mind reading bar attendants who offer immaculate service.

Drivers of Technological Innovation

In *Physics of the Future* Michio Kaku (2011) demonstrates that in 2100 we will control computers via tiny brain sensors and, like magicians, move objects around with the power of our minds. Artificial intelligence (AI) will be dispersed throughout the environment, and internet-enabled contact lenses will allow us to access the world's information database or conjure up any image we desire in the blink of an eye. This chapter is not about 2100 but 2050 and considers the key drivers of technological innovation that will shape tourism. Ten drivers have been identified that shape Maria's scenario:

Driver 1: Ubiquitous computing and the urban environment
Driver 2: Gestural interfaces
Driver 3: Beyond Moore's law – Optical computing
Driver 4: Virtual reality and augmented reality
Driver 5: Biometrics
Driver 6: Interactive visitor centres
Driver 7: Technology and life
Driver 8: Artificial intelligence and singularity
Driver 9: Brain computer interfaces
Driver 10: Haptic technologies

Driver 1: Ubiquitous computing and the urban environment

Technologies in modern societies are highly interlinked with many of its urban elements, albeit in a rather haphazard way. Traffic cameras, for example, are connected to the internet allowing users to track live traffic conditions; transport systems timings are also linked to online systems providing information to users. Although technologies are highly assimilated in many of today's urban environments, it still requires some form of platform – such as a mobile device – in order to send and collect mobile data.

The concept of ubiquitous computing was first invented by a researcher, Mark Weiser, who developed the idea of 'invisible computing' – that is,

computing without computers (Greenfield, 2006). This concept is characterised as wireless, mobile and networked, where technologies are embedded into the external environment, allowing users to become more connected to their surroundings and other people. Ubiquitous computing allows integration of devices and technology applications, in a world where everything is enabled and shared. For Maria, it is the seamless working of technology which enhance her 'witchery tour' experience. Ubiquitous computing is sometimes also referred to as the post-desktop model of human–computer interaction or the third wave of computing. Quite opposite to virtual reality (VR), users no longer require a technological device to interact with technology; rather, this interaction is spatial and external. The evolvement of ubiquitous computing will create an urban environment that will see the disappearance of devices into a situation where multiple users are potentially interacting with multiple interfaces at a given time and place.

Adam Greenfield (2006) introduced the concept of a networked city, where elements of the urban environment such as the objects and surfaces of everyday life will have the ability to sense, process, receive, store, display transmit and even take physical action upon information. Elements such as clothes, architectural space and public spaces have information gathering, processing, storage and transmission devices capability (Lift Asia, 2008). A networked urban environment will empower people to have more control of the type and amount of information presented to them. For example, a user at present will be able to obtain information on the type of cuisine a particular restaurant offers, but in a ubiquitous urban environment, the user can choose to obtain information on whether the restaurant is open at that moment, or whether there is a queue for tables. In a world of ubiquitous computing we may eventually see the demise of artefacts such as maps and guidebooks as information shifts from 'way-finding' to 'way-showing'. Users enabled by technology, will be able to navigate their way through urban environments without the use of maps or guidebooks – a trend that is already present in Tokyo. Apart from that, the use of mobile devices to present contextual information over an object through the AR is already present. As urban environments become ubiquitous and increasingly networked, more of such information which is locked as conditioned data, will be available at the users' fingertips (Howells, 2009).

A networked urban environment empowers people in their process of information gathering. However, there are implications related to privacy, reliance on technology and social acceptance as society moves from a community to a network. It may take decades to synthesise the ubiquitous computing society. Nonetheless, we do know that the future urban landscape will be an interactive space where people and information seamlessly interact. The ubiquitous computing environment will not only affect the way we interact with information but will also influence the behaviours and movements of people within the built environment.

Modern urban environments also present opportunities for different forms of information provision. Korea, for example, launched the 'Haru 2010 Campaign', which utilises Korean drama media and technology to allow people to create personalised guidebooks (just like Maria in the scenario above). Visitors to the website can watch the drama and TAGs appearing on screen to gather information about tourism in Korea and their related travel interests. By watching the entire episode, visitors can also find out about their own tour styles and download guidebooks which can be easily transferred to other social networking sites such as Twitter and Facebook (Haru, 2010). This campaign, clearly targeted at Generation Y and beyond, is an example of how destination marketing organisations are utilising technology to engage with visitors from various platforms such as television media, internet and social networks.

Driver 2: Gestural interfaces

Developments in ubiquitous computing have led to innovations in gestural interfaces. A gestural interface is a platform that bridges communication between humans and machines by inventing measures which allow computers to understand human body language. The screens of these interfaces are embedded with optical sensors that track the movement of the user's fingers such that they do not have to come into contact with the display (Salton, 2009). Science fiction movies such as *Minority Report* illustrate the possibility of future gestural interface, where things can be controlled without devices. At present, products such as Kinect by Xbox 360 (www.xbox.com/Kinect) have incorporated gestural interfaces with sound, voice and facial recognition in its gaming console. This 'natural user interface' allows the system to track and interpret movement, creating a control-free entertainment experience. Future gestural interfaces will enable humans to interact with machines without having to use any mechanical devices; it is the next big thing in computer interfaces.

Information in its traditional form is typically confined to print media, or digitally on screen. However, with a gestural interface, information can be interacted with externally through simple hand gestures. 'SixthSense' for example, is a wearable gestural interface that augments the physical world with digital information, and allows natural hand gestures to interact with that information. It bridges the gap between intangible digital information and the tangible world and frees information from its confined state of paper or a digital screen. The gadget is comprised of a pocket projector, a mirror and a camera in the form of a pendant like a mobile device. They are connected to the projector, which enables surfaces such as walls and other physical objects to become digital interfaces by projecting information onto it. Users then can interact freely with this information with hand gestures. 'SixthSense' incorporates applications that help users interact with

particular information. For example, the map application allows a user to navigate a map displayed on a nearby surface using hand gestures; the drawing application tracks movements of the index finger, allowing the user to access their email account with the drawing of an '@' sign and a gestural camera allows photos to be taken when the 'framing' gesture is detected. The gadget is also able to augment physical objects to portray additional information (SixthSense, 2009) (Figures 5.1 and 5.2).

Certain gestural interfaces, like Microsoft's Kinect, use a peripheral embedded with a small camera to capture gestural information. However, this limits the sensitivity and performance of the interface at short distances. In order to overcome such limits, cameras need to be set far behind the screen, but this then makes the interface bulky and expensive (Salton, 2009). Developments are being made to alter gestural interfaces into a thin LCD device – such as a mobile device – and to enable interaction without gloves or devices. Although still in its development phase, gestural mobile devices are slowly being introduced into the market. These products are equipped with gesticulation-sensitive interfaces that enable the user to flip through a photo gallery, or zoom in and out using a fist (Shankland, 2011). The future of gestural interfaces may come in many forms; whether wearable or hand-held, these interfaces will enable quicker, digitised user interaction.

Figure 5.1 The SixthSense application with newspapers
(*Source:* Pranav Mistry and MIT Media Lab)

Figure 5.2 The SixthSense application with telephones
(*Source:* Pranav Mistry and MIT Media Lab)

Driver 3: Beyond Moore's Law: Optical computing

In order for innovations in technology to happen as described in the scenario above, a quantum leap is required in the terms of capacity processing power that goes beyond Moore's Law. The exponential advancement in technology is largely due to innovations and improvements made in computer science. Moore's Law is a trend that is typically used to describe the rate of long-term advancement in computing as a driving force behind technological changes. In 1975, a prediction was made by Intel co-founder Gordon E. Moore that the number of components in integrated circuits would double every year, increasing yields and driving costs per transistors down. This prediction, since dubbed 'Moore's Law', has been amazingly accurate (Intel, 2005). This law, premised on the quantity of transistors in an inexpensive integrated circuit, has defined a development path for chip makers. Today, the ability to squeeze more transistors into a chip is achieved by decreasing the size of transistors, reducing them to as small as 22 nanometres. However, physical miniaturisation cannot continue forever and new developments utilising new materials are evolving (Fildes, 2010).

Researchers are now looking at the use of optical transistors to improve the efficiency of electronic computing. An optical computer, or photonic computer, is a device which replaces the traditional use of electrons with photons of visible light. As light particles travel the fastest, the speed of processing

powers in computers substantially increases without incurring additional heat or electricity as was the case with the traditional use of copper wire electrons in computer hardware. This means that future computers would be able to perform operations more effectively, making it faster than a conventional electronic computer. Photons are ideal for piping information over long distances through optical fibres (*The Economist*, 2010). Although the high cost of using optics have prevented a wide-scale development of optical computers, demand for devices and processing powers is increasing and as a result, a number of new optical alternatives are emerging.

Intel, for example, has embraced the use of silicon-based lasers to boost computer processing speeds. The system which is capable of shifting data at 50 Gb/s, is achieved by combining four silicon-based lasers each carrying a 12.5 Gb/s data stream along a single optical fibre, at the end of which the beam is split once again and set to four photodetectors for decoding for a total of 50 Gb/s along a single fibre (Halfacree, 2010). This system potentially lowers the cost and size of optical use inside a computer. IBM has also developed optical interconnects by mounting fibre-optic cables straight onto chips that direct traffic between multiple processes to speed up the flow of data and processing power of computers (*The Economist*, 2010). Apart from optical computing, new developments in transistors – which are fundamental components in modern electronic devices – are also driving data processing, capacity and computer powers. Hewlett-Packard has built the memristors which can be used to crunch data and build advanced chips. In a traditional device, data must be transferred and processed between two separate devices; but on a memristor, these two functions can be done on the same device. The memristor's ability to mimic synaptic activity in the brain means that it can be used to develop real brain-like computers in future (Fildes, 2010). These developments in optical computing may move beyond the Moore's Law predictions, creating computers with super processing speeds at low prices.

Driver 4: Virtual reality and augmented reality

One of the strands in the scenario is Maria using a 'witchery tour' app to experience and interpret medieval Edinburgh. Maria's experience is driven by developments in VR and AR, which have blurred the defining areas of the real world and the computer-generated world. VR is defined as 'the use of a computer-generated 3D environment – called a 'virtual environment (VE)' – that one can navigate and possibly interact with, resulting in real-time stimulation of one or more of the user's five senses' (Guttentag, 2009: 638). VR scenarios and real-world scenarios are situated at extreme ends of a spectrum; this means that when a user is fully immersed in a VE, they do not have any interaction with the real world. AR on the other hand, is situated between a VR and a real-world scenario where technologies enhance rather than replace reality. AR adds graphics, sounds, haptic feedback and smell to

the natural world in which it exists, revolutionising the way information is presented to people (Bonsor, 2009). Provision of information through AR is not new, with many mobile devices such as the iPhone and Android capable of presenting information through mobile applications. For example, a mobile application, Layar, uses the mobile phone's camera and GPS capabilities to overlay information such as histories or photographs of nearby sites and restaurants on screen. Increasingly, many industries are embracing the use of AR for a variety of uses including information provision, medical surgeries and retail sales.

In the future, the use of AR in information provision may no longer require the use of hand-held devices such as mobile phones, but rather come in the form of wearable devices. Developments are underway to incorporate AR into contact lens – the project 'Twinkle in the Eye', undertaken by the University of Washington. The research on AR contact lenses will allow texts to be displayed, speeches to be translated into captions in real time, or offering visual cues from a navigation system. Hence, the story of Maria and the contact lenses. These contact lenses will be integrated with control circuits, communication circuits and miniature antennas using custom-built optoelectronic components, including hundreds of LEDs that are used to form images in front of the eye such as words, charts and photographs. The hardware will be semi-transparent, allowing the device to present information to the circuit and allowing users to navigate naturally in their surroundings at the same time. The potential of an AR contact lens will unlock a new platform of visual information, unfettered by the constraints of physical display (Parviz, 2009).

Besides contact lenses, AR has also been incorporated into other wearable products such as spectacles. In Japan, a pair of lightweight AR glasses – the AV Walker – has been created by Olympus and phone-maker NTT Docomo, and is able to overlay the world with digital content such as directions or a travel guide. Designed with a tiny retinal display at one arm of the spectacle frame, the display will be able to project text and images directly into the user's peripheral vision at the same time, allowing the user to be aware of their natural surroundings. Attached to the AR software, an acceleration and a direction sensor, the display will be able to project information on the object the user is looking at. This includes a virtual tour guide, directional information and even weather information and forecasts when the user lifts their head up to the sky. The AV Walker has an added benefit of accessing surrounding information without having to alter the user's natural behaviour (Fitzpatrick, 2010). Wearable products are increasingly being incorporated with electronic gadgets. The Lady Gaga Polaroid Digital Camera, for example, is a combination of digital camera and sunglasses. The camera sunglasses are embedded with two 1.5″ LCD displays which act as a wearable 12 megapixel camera with the ability to snap pictures, preload with pictures and videos and enable real-time photo sharing. The displays are situated below

the wearer's line of sight, enabling the combinational use of a sunglass, camera and a mobile display screen. The use of AR in information is not new. However, with advancement of technologies, this platform will be further integrated with our daily lives, revolutionising the way we interact with information.

Driver 5: Biometrics

The use of retinal eye scanners and biometrics is present in today's technology, but with the increased use of technology in security it is a trend that will accelerate into the mainstream, as Maria demonstrates in the scenario given. The concept of biometrics was first introduced in the 19th century by Alphonse Bertillon, who practised the idea of using a number of body measurements to identify criminals. By the late 19th century, this concept had gained much popularity from major law enforcement departments. Today, biometrics is not only used by enforcement departments, but also in various civilian applications such as medical industries. One of the key reasons for this wide-scale application is rising cases of fraud and identity theft, which came alongside technological advancement. A biometric system, which is a 'recognition system that operates by acquiring biometric data from an individual, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database' (Jain *et al.*, 2004: 2) can significantly decrease these numbers by increasing security measures. Today, biometric systems are used widely in commercial, government and forensic applications (Jain *et al.*, 2004).

Biometrics can be categorised into two forms – physiological and behavioural. Physiological biometrics identifies using physical traits of a person, such as fingerprints, hand geometry, the iris, voice and facial features. Fingerprints appear to be the most common identification method, accounting for 67% of all applications (TechCast, 2011a). The use of fingerprint identification is a common form of biometric authentication, with many countries such as the European Union, United States, New Zealand and others incorporating it as part of their biometric passport – a combination of paper and electronic passport – application. Popular biometric passport applications include fingerprint, facial and iris recognition for identity authentication. The convenience of biometric fingerprint scanners have encouraged its commercialisation, enabling additional security to mobile devices such as laptops and mobile phones where users can lock/unlock and protect stored data and access emails (TechCast, 2011a). Its application has also expanded with tourism operators such as Disney incorporating fingerprint scanning to fight illegally resold park passes and tickets (Utter, 2006).

Behavioural biometrics is based on the reflection of an individual's psychology, which includes aspects such as voice, typing rhythm and gait recognition. This type of biometric data is said to garner wider acceptability as

it is less intrusive compared to physical biometrics (Gamboa & Fred, 2004). Expanding on the scope of behavioural recognition, further developments have been made within this area of biometrics, including an attempt to direct a mobile robot under real-world conditions into a target position by means of pointing poses only. The reason for incorporating pointing as an action is because of its natural and intuitive nature known to humans. Gestures also allow an intuitive way for humans to instruct robots without any use of input devices (Martin *et al.*, 2010).

ABI research findings indicate that people are feeling increasingly comfortable using biometric security, which could result in a $3 billion spending increase in biometrics over the next five years (Blanco, 2010). Biometric identification methods will continue to evolve, with research on tongue scanning identification currently being tested at Hong Kong Polytechnic University (Blanco, 2010). However, there are issues which need to be further dealt with in order for biometrics to be utilised at its full potential. This includes issues of privacy and security as experts indicate that biometric theft has implications more serious than just forging a signature.

Driver 6: Interactive visitor centres

TNS Global (2008) indicates that one in 10 respondents connect to the internet at least once a day via mobile handsets. Among them, over a quarter of its Japanese and Chinese respondents access the internet over mobile at least once a day. In an Australian survey, 56% of respondents used their mobile phones to obtain information while 21% visit a website at least once per day (AIMIA, 2009). These figures reflect the rising rates of mobile usage and increased mobile penetration, coupled with developments of technology that has prompted the shift of traditional information to digital information; from passive to interactive. As younger generations of consumers embrace the use of mobile media to seek information, make bookings and navigate themselves in an external environment, destinations are incorporating technology with information provision to enhance the visitors' experience.

The collaboration between Google and New York City saw the launch of an interactive visitor information centre and a digital platform where visitors can retrieve information about the city, on the go. The website, NYCGO.com, is a Google-fuelled local search and reference site, which provides information on attractions and activities in New York City. The website contains useful visitor information such as maps powered by Google, travel deals from Travelocity and local content from *Time Out New York*, nightlife culture magazine *Paper*, the *New York Observer* and eco-living guide *Greenopia* (McCarthy, 2009). A unique characteristic of this website is that it allows visitors to download information on hotels, restaurants and access discount packages directly from their mobile smartphones such as iPhone and Blackberry. Users

are also able to send details of attractions and locations of activities to their mobile phones via text messages. These locations are powered by Google Maps, which then allows users to navigate the city on the go by quickly accessing walking, driving or subway directions to their destinations. This digital platform is supported by an interactive visitor centre which features interactive map tables that are powered by Google Maps API, allowing visitors to navigate venues and attractions, as well as create personalised itineraries which can be printed, emailed or sent to the users mobile device. The centre also features a gigantic video wall where users can view their personalised itineraries in virtual 3D – powered by Google Earth. This collaboration between Google and New York City shows that destinations are starting to embrace the use of technologies to explore and support the visitors' experience.

However, not only are destination visitor centres embracing technologies for service. The Ciudad Grupo Santander bank in Madrid has created a futuristic visitor centre encompassing robotic butlers, an AR model and interactive walls. As visitors walk into the bank's main lobby, knee-high autonomous robots, known as Santander Interactive Guest Assistants, will be available. The interactive system allows visitors to choose a language they are familiar with, and the robots then greet and guide them to their intended location, even within a crowded space. Within the building, walls are created with a motion, touch-screen-based interaction design that has the ability to sense and react to what is around it, communicating financial information in interactive ways. Besides that, a model of Santander's financial centre was made and built with an AR set-up using state-of-the-art lasers and a large database of photographs. With a digital information layout and mobile transparent-like screens, users can manoeuvre them and explore information, facilities and architectural tales of the centre, acting as a guide on its own (Ashby, 2010; YDreams, 2010). As public spaces become increasingly incorporated with digital features, as reflected in the New York City's visitor centre and Ciudad Grupo Santander, the future of visitor centres may see human staff eventually replaced by robotic staff for 24/7 service, along with digitalised platforms to present information in an interactive manner, as occurs in the scenario with Maria.

Driver 7: Technology and life

It is recognised that different generation cohorts reflect different attitudes and beliefs that are shaped by external factors. Generation Y, born between 1977 and 1997 have been heavily recognised as a generation wholly different from earlier generations with the key influencing factor being technology, to the point that life is lived through a screen (as Maria demonstrates in the scenario). Tapscott (2009) coined the term 'Net Generation' in relation to the Generation Y, because they have grown up in an era where technology

advanced at an exponential rate. Unlike the baby boomer generation, the Net Generation did not have to accommodate to new forms of technology; rather, they assimilated easily and without much difficulty to new and advanced technologies. In fact, the Net Generation has a range of unique characteristics, which up till today, are driving the innovation and developments of technologies and revolutionising the meaning and use of the internet. These characteristics, which include their love for customisation, desire for freedom of choice and speech and innovative ideas have transformed the internet from an information-provision platform, to an information-sharing platform; from passive media into interactive media. The Net Generation's high assimilation to technology is reflected from their ability to multi-task, such as talking to friends, listening to music and surfing multiple websites all at the same time (Tapscott, 2009).

Tapscott (2009) had also identified that this generation do not observe, but rather participate in online activities. Unlike previous generations of passive internet users, the Net Generation uses the internet to 'inquire, discuss, argue, play, shop, critique, investigate, ridicule, fantasize, seek and inform' (Tapscott, 2009: 40), which is what drives information on social media sites. Research conducted by Beresford (2006) on the usage of social media networks in the United States indicates that younger users aged 18–24 (Generation Y) consult social networks before making decisions and that no online activity (other than email) ranked higher in importance than online social networking. This indicates that social networking sites are increasingly being integrated into Generation Y's lives so much so that they become a trusted resource for their decision making.

The Net Generation is a generation which likes to share information and stay connected with friends and families, and they use technology ranging from mobile phones to social networks to do so (Tapscott, 2009). The advancement in mobile technologies, such as mobile internet, means that mobile phones are no longer perceived as just communication devices, but rather a vital connection to their social networks, enabling them to stay connected online wherever they go. Smartphones such as iPhone and Blackberry are mobile phones that have access to general internet and support user applications. According to the Australian Interactive Media Industry Association, 77% of respondents use their mobile phones for a purpose other than voice or SMS, 56% use it to search for information and 21% use it to visit a website at least once a day (AIMIA, 2009), reflecting the evolving role of the mobile device. Increasingly, users are also integrating smartphones into their daily lives, utilising it as an alarm clock, replacing computers and using it to access emails and surf the internet, using it as a GPS guide during trips, loading their favourite music on the go rather than listening to radios, as well as obtaining up-to-date, personalised news feeds through their mobile devices instead of reading the newspapers (Tapscott, 2009). It is forecasted that there will be more people accessing the mobile

web more than the desktop web by 2015 (Lock, 2010). The Net Generation contribution is what drives the increasing amount of consumer-generated content online as more people – at a decreasing age – contribute to innovations of mobile applications with the youngest iPhone application writer being nine years old (iPhoneTechZone, 2009).

As future consumers of tourism, Generation Y (or the Net Generation) has a distinct set of characteristics, attitudes and behaviours significantly different from previous generations. Technology and mobile devices are an assimilated part of their growing up years and have been highly integrated into their daily lives. They are absolutely comfortable in creating, interacting and utilising multiple platforms of media at the same time, relying on it as a significant platform for keeping in contact with friends and families. They are the main drivers behind the vast amount of consumer-generated information online, revolutionising the way information is presented to consumers.

Driver 8: Artificial intelligence and singularity

AI has been recognised as an attractive direction to the development of future technology. Alan Turing, who conceptualised the 'Turing Test' in 1950, described the defining moment in AI as when computer behaviour becomes indistinguishable from human behaviour (TechCast, 2011b); this is when *singularity* has arrived. In the scenario, humans are being replaced by Cyborgs in the Visitor Information Centre at Edinburgh Airport. The use of AI is increasingly being used in a variety of sectors such as medical and manufacturing, as well as software and technologies designed with part-AI systems. Google, for example, has used AI in their search engines and translation software, which allow the translation of words and phrases between different languages (Gomes, 2010; Saenz, 2010). The vast amount of information online from various origins in different languages means that Google Translator will be able to translate information within seconds, allowing users who are not proficient in a language to understand this information. Besides that, full AI systems such as the Smart Call Agents are powered by artificial general intelligence (AGI) engine or 'brain', which unlike automatic conversation solutions, reasons and learns from experiences and are able to generate personalised speech for each caller in a more natural conversation. This system had the ability to undertake and handle phone calls typically required by human operators, as it is equipped with speech recognition technology, integrated with an intelligence engine and able to recognise phone-quality speech input (SmartAction, 2011).

AI technologies are set to develop further in the future as more futuristic systems are being experimented with. For example, the research on telepresence systems is currently being undertaken. This research encompasses four different prototypes of telepresence systems, one of which allows people to communicate using interactive real-time 3D communication. It involves, for

instance, the development of a virtual human that can be sent in the form of an 'autonomous avatar' when the actual person is unable to attend a meeting. This virtual human will be able to recognise the real participants in the meeting, register what is being said and report to the absentee after the meeting. Other prototypes include the development of an 'avatar' – a mobile robotic mannequin that takes on the appearance of its far-away human host – that can be remotely controlled and navigated from a distant environment (CNA, 2011b).

It is possible that the continual development of AI may eventually result in technological singularity, which is a situation of intelligence explosions where humans will no longer be able to predict their future as intelligence entities surpass human biological intelligence. This possibility drives the rapid advancement of technologies encompassing the possibility of creating systems more intelligent than humanity. Although AI systems have significant contributions in terms of convenience and service to humanity, a technological singularity will have major social implications on society including issues such as population job loss, economic impacts and others. It is vital then that society ensures and manages the balance of negative and positive implications artificial agents bring.

Driver 9: Brain computer interfaces

Brain computer interface (BCI) is a 'communication system in which messages or commands that an individual sends to the external world would not pass through the brain's normal output pathways of peripheral nerves and muscles' (Wolpaw *et al.*, 2002: 769). Instead, these thoughts are sent through an external device which translates them into actions. BCI has been widely recognised within the medical arena for its capabilities to allow movements in people who may be paralysed or 'locked-in', or have severe neuromuscular disorders such as spinal cord injuries by replacing movements made from their nerves and muscles through producing electrophysiological signals which then converts them into physical actions (Wolpaw *et al.*, 2002).

The crux of BCI technologies is the development of a direct communication channel between the human brain and machines that does not require any motor activity (Leeb *et al.*, 2007). Two different BCI interfaces – invasive and non-invasive – exist. Invasive BCI typically requires an electrode implant into the user's brain, although this increases signal to the external device it potentially presents health risks as well. However, a more common approach is undertaken through non-invasive BCI that requires users to wear headgear covered in electrodes which has better signal (The Wheelchair Guide, 2008). Non-invasive BCI, or electroencephalography (EEG) is the most studied aspect of non-invasive interface due to its fine temporal resolution, ease of use and low set-up cost. It allows users to choose the brain signals they found easiest to operate the BCI. Research conducted by the University of

Rochester found that users are able to control elements to the external virtual world through EEG readings, including switching the lights on/off and bringing a mock car to a stop. A common application example is for wheelchair users, who, after being equipped with a BCI, are able to control their wheelchair through thought.

BCI has also been used to aid patients who are partially disabled, such as incorporating the use of a robotic arm. This form of invasive BCI, as mentioned earlier, requires an implant of electrodes into the user's brain in order to produce signals high enough to stimulate movement. Research conducted indicated the ability of a tetraplegic human to control an artificial hand using invasive BCI. The user was able to open simulated email, draw a circular figure on a paint programme, adjust a simple hardware interface such as volume and others with control of his robotic hand by thinking about these movements together with the computer cursor, lights and television (Hochberg *et al.*, 2006).

The ability for technologies to connect to brain waves has resulted in an emerging field of synthetic telepathy. This is demonstrated in the scenario at the Balmoral Champagne bar, where the bar staff have mind-reading abilities. Synthetic telepathy involves the development of a 'telepathy chip', which is a neural implant that allows users to project their thoughts and feelings, and receive the same thing from others without the use of verbal words or actions (Goertzel, 2009). The initial development of synthetic telepathy revolved around military use, when the US Army Research Office awarded the University of California, Irvine a US$4 million grant for research to work on the project 'Silent Talk'. The objective of the project is to allow soldiers to engage in 'user-to-user communication on the battlefield without the use of vocalised speech through the analysis of neural signals' (June, 2009; UCI, 2008). The research seeks to develop technology that would detect the signals of 'pre-speech', analyse and transmit the statement to an intended interlocutor, which then using non-invasive brain imaging technology such as EEG decodes these thoughts, translates them into brainwaves and eventually transmits them to the intended target (Drummond, 2009).

Although BCI technologies, to a large extent, have created possibilities to do things that were previously deemed impossible, it also entails a range of psychological, social and ethical implications. Hence, it is necessary for organisations to properly manage the effects of negative implications so that they can be effectively minimised.

Driver 10: Haptic technologies

Improvements in technology have revolutionised the way devices are designed, evolving from buttons to touchscreen interfaces. This evolution is greatly attributed to developments in haptic technology, which is defined as

'the systems required – both hardware and software – to render the touch and feel of virtual objects' (Harris, 2011). Haptic is derived from the Greek word 'Haptesthai', meaning touch. The concept of haptic technology builds on users' sense of touch, allowing them to touch and feel objects within the virtual world. For example, applications of haptic technology in video games have allowed players to feel and manipulate gaming tools where they are able to feel, for example, the resistance of a longbow's string as they release a virtual arrow in the game.

Haptic technologies form the foundation of the design of touchscreen mobile devices, allowing users to interact with the mobile interface with their sense of touch. Nokia, for example, created a touchscreen platform that creates the feeling of movement in and out when the user pushes a 'button' on the interface, creating an audible click at the same time. Apart from that, this form of technology is also widely used in teleoperation, or telerobotics, where the human operator controls the movements of the robot, or when they have a sense a presence located in the robot's environment (Harris, 2011). It allows the operator to control the movement of the robot even at a distance. Other sectors which utilise this form of technology include the medical industry for surgeries and the aviation sector for aircraft maintenance (Hillsley, 2004).

The field of haptic technologies is set to grow and potentially contribute increasing reality in virtual worlds. Haptic technologies have multiple advantages. Haptic interfaces integrate a much more satisfying user experience as our sense of touch conveys rich and detailed information about an object. When combined with the other senses, particularly sight, it dramatically increases the amount of information which is sent to the brain for processing. This increase in information eventually reduces user error, time taken to complete tasks, energy consumption and magnitudes of contact forces used (Harris, 2011). The possibilities of incorporating haptic technology and VR mean that future computer platforms will allow users to touch, grip and even manipulate 'impossible objects', significantly changing the way users interact with computer platforms. Users will be able to 'feel as well as see virtual objects on a computer, and so can give an illusion of touching surfaces, shaping virtual clay or moving objects around' (Hillsley, 2004). For example, researchers at the University of Tokyo have developed 3D holograms that can be touched with bare hands. Acoustic radiation pressure, for example, can be used to create a touch sensation, refuting the notion of holograms being made only of light. The technology adds tactile feedback to holograms which allows physical interaction with virtual images (as seen in the scenario with Maria's holographic mobile phone). In particular, it does not require a special glove or special control; users can just 'walk up and use', depicting how information provision may change in time to come (Physorg, 2009). Without doubt, haptic technology will continue to be largely infused into our daily lives, such as it being incorporated into clothing textiles so

that individuals can feel the texture of clothing when purchasing through the internet (Ruvinsky, 2003).

The importance of real and personal information in tourism

What if the technology does not work or would you not just want to speak to a real person instead? Yeoman and McMahon-Beattie (2006) in the paper *'Tomorrow's tourist and the information society'*, had drawn two different scenarios on the future of information provision in tourism. The 'Free Information Society' is one which highlights that information is freely available and future consumers no longer need to purchase information. On the other hand, the 'Real Information Society' uses technology to support personal information, rather than replace it entirely. The development of information technology with changing consumer attitudes and behaviours towards information search is revolutionising the way information is presented and collected within the tourism experience.

Without doubt, the advances of technologies as earlier discussed will shape the way information is provided and gathered in a manner that is quite different from how it is done today. Interactive media platforms incorporated with designs such as mobility and VR/AR will create a different experiential platform for tourists at a destination. In fact, potential developments such as telepresence may reduce the need for people to travel, since they are able to appear robotically as 'avatars' at another location. It can be argued however, that although having gone through significant advances of technology, real and personal information in tourism still plays a crucial role in the tourist's experience.

Tourism is an industry where people and culture are essential components of the tourism product, particularly in the provision of information in tourism. Unlike other commodities, tourists need to travel to the destination in order for consumption of various tourism products; it is intangible and cannot be seen or felt prior to purchase. This means the type of information collected prior to purchase is particularly influential. Although increasingly, more people are turning towards online user-generated content for information as it is perceived as being the neutral opinions about experiences, this does not increase the information's reliability. On the contrary, locals who are knowledgeable about their own destinations will be able to provide personalised information more accurately to visitors. This is also one key reasons why word-of-mouth is a particularly effective distribution channel in the tourism industry, where information provided by locals and people who have experienced the product are highly regarded. Technology in this case should enhance the visitor's search for information, allowing it to become easily accessible and convenient, rather than replacing it as a whole.

Many tourists seeking authentic experiences regard interaction with local people as a way of experiencing the local culture of a destination. Technology then becomes a large obstacle between tourists and authenticity. If in the free information scenario tourists are able to gather information entirely from various media platforms, the possibility of them engaging the use of a local visitor centre is minimal, thereby reducing the authentic aspect of the experience. However, personal recommendations from locals at the destination has been deemed as 'very important', and classified as 'tacit, episodic, difficult to code and to make explicit' (Yeoman & McMahon-Beattie, 2006), illustrating that personal information in the tourist experience plays a significant role in influencing the tourist's experience.

Consumer demographics are evolving, significantly reshaping attitudes and behaviours in their information search. The use of technologies for information searching will continue to rise as consumers become more comfortable with interacting with different media platforms. However, this will not be cause the demise of the use of local knowledge at visitor centres, as word-of-mouth recommendations and personal information continue to remain the most influential form of information for tourism destinations.

Concluding Remarks

From the internet to ...

Some would think that the world of the future has arrived today: the internet changed society. The mobile phone changed it again. In the future, the internet is everywhere; in wall screens, furniture, billboards and even in contact lenses. If you blink you will be online. Scientists at the University of Washington (Parviz, 2009) have perfected the virtual retinal display (VRD) in which red, green and blue laser light can be shone directly onto the retina. Contact lenses will have facial recognition capability so you will be able to recognise your friends via Facebook. In fact, you will have a world of information in the blink of eye. According to Kaku (2011) these pattern recognition systems have a 90% success rate. At a business meeting or social function, you will never be embarrassed because you forgot someone's name.

The goal of ubiquitous computing is to bring the computer into your domain by putting chips everywhere. The purpose of VR is to put us into the computer. Today, we can live in a virtual world, for example, www.secondlife.com. You can control your world and be part of someone else's world as an avatar. VR is already the staple of video games. In the future as computer power expands, tourists will visit unreal worlds that seem real. Does this mean the end of the holiday as we know it as real experiences are

no longer necessary? VR is already changing the shopping experience, for example, Westfield shopping centre in West London unveiled a 'tweet' mirror which allowed customers to see images of themselves and post the content straight to their chosen social networking site. Those who used the service were thus able to see how they looked in particular garments and then seek real-time advice from their online friends and family members. More, if a customer decided not to purchase an item, the image was nevertheless sent to their email address, together with a link to the website of the clothing brand in question, should they later change their mind. This is yet another example of increased interconnectivity in today's world, a retailer allowing consumers to connect with their social networks while in-store, as well as create digital images to make the process of shopping more fun and engaging.

Haptic technologies allow us to feel the presence of objects that are computer generated. The technology, first developed by scientists to handle highly radioactive materials with remote-controlled robotic arms, has moved on. By simulating the sensation of pressure you can feel shape and texture, that is, as you move your finger across a surface, haptic technologies will simulate the feeling of a wooden table. Haptic technologies combined with objects that are seen in VR goggles, complete the illusion of an alternative reality.

AR is already changing provision of information, as Hatton (2009) points out, '30% of hotel bookings in the cities of Tokyo and Seoul are on the day of arrival via the mobile phone'. Combining this trend with AR on mobile phones, tourists can find out anything about a hotel by simply pointing the phone at the building then making a decision about whether to book or not, and so forth. In the future, tourists will walk into museums and go to an exhibit and their contact lens will give a description of each object. A virtual guide will give you a cybertour as you pass. AR will allow you to see reconstructions of historical sites which are no longer there – along with an interactive recantation of battles of events from history. Hikers will never get lost in the future as they will know their exact position in a foreign land along with the names of all the plants. Tourists will be able to speak the local language via software translator. Imagine an American tourist ordering Peking Duck in a restaurant in Kunming using the right Mandarin dialect. Researchers at Carnegie Mellon University in Pittsburgh have pioneered computer-assisted translation (CAT) which attaches electrodes to the neck and face of the speaker, these pick up the contraction of the muscles and decipher the words being spoken. This approach does not require audio equipment, since the words can be mounted silently. Then a computer translates these words and a voice synthesiser speaks them out loud. In the future, language barriers will no longer be a barrier (Kaku, 2011). Finally, like the Greek gods, we think certain commands and our wishes will be obeyed. Today, the brain can control a computer; in the far future tourists will be able

to dream about a destination and then play that creation on their computer, and create an itinerary and test experiences. Scientists at the Advanced Telecommunications Research Computational Neuroscience Laboratory (http://www.cns.atr.jp/en/) in Kyoto use fMRI scans to record where the brain stores images and reproduce those images as jpeg files. The tourism industry will be radically changed by future technologies. We can only imagine exactly what these changes might be.

What does all this mean?

Rapid technological advancement means machines and humans will be indistinguishable by 2050, as the point of singularity arrives. What does this mean? Some might say that in 2050 the robots will be going on holiday and the humans will be captive in the zoo. This may be the case, but the importance of soft singularity, or the component parts of it, is that rapid change is occurring driven by gains in artificial technology. Technology is one of the key drivers of the future, where flying cars, internet capable contact lenses, resurrection of extinct life, the end of death, space tourism and everything else Star Trekky is possible. This is where AI will be dispersed across a world in which information sources will be connected, where tourists tracked by GPS could not get lost.

National Tourism Organization's (NTO) have fundamentally switched marketing expenditures from print to digital and more recently towards mobile applications. As Tapscott (2009: 40) points out, generations of consumers live life through the screen in which they 'inquire, discuss, argue, play, shop, critique, investigate, ridicule, fantasize, seek and inform … a noticeable movement from passive to interaction'. The South Korea tourism organisation marketing campaign (www.haru2010.com), is an example of this interaction towards new marketing applications in which change drives individualisation and personalised experience for tourists. Information, once linear and based on words, now has multiple dimensions, whether video or audio. In the not-too-distant future, haptic technologies will provide real 3D holographic feel as if you were talking to a real person. This rapid pace of change is happening now, ubiquitous computing is allowing technologies to join together, shape information and provide a seamless environment. Today, as Hatton (2009) points out, AR applications through mobile phones allow new dimensions in the distribution channel, where information and bookings are immediate and transparent. The MIT Media Lab project 'SixthSense' brings to life information with pictures in which a newspaper can have video and audio or a tourist could take photographs without a camera. Technology companies are talking about movement from the personal computer to the mobile phone, but the likely future is even more fantastic with connectivity achieved via smart contact lenses or even mind-reading telepathy.

This chapter recognises that technology has already changed how tourists engage with tourism and it will continue to do so. In the future we, like Maria, may use an artificially intelligent agent to seek authentic information, as if the robot was a real person; it is also likely that we will see increased use of biometric keys expediting and ensuring the safety of our trips.

6 Singapore 2050: Medicine, Science and the Meetings Industry

Learning points

- As the pace of discovery in science and medicine rapidly increases, new paradigms of complexity form. As a result, medical practitioners need to update their skills and knowledge more often at smaller and more frequent educational meetings.
- Science, medicine and technology represent 46% of all worldwide meetings.
- Singapore's science and research strategy is in sync with countries meetings, incentives and events industry.
- This chapter explains structural change in the meetings industry including the emergence of new meetings technologies and the importance of knowledge clusters.

Introduction

In most cultures God possesses the ultimate power; the power of life over death, the ability to heal the sick and prolong life. Is the future of medicine without death? Maybe! Use of the term 'complexity' has grown exponentially in the scientific literature. As society develops and grows, it finds new solutions; discovery is the heart of medicine, technological revolution seems endless and therefore humankind seems to be facing a world in which the pace of discovery is infinite. As a result, complexity and the pace of discovery are changing the world of science, technology and medicine, to the extent that simple human mortals cannot keep pace with this change. The meetings industry is benefiting from the increased complexity and rate of change. For example, medical doctors, instead of meeting every five years to keep abreast of change, now have to meet every two years (HCEA, 2009). Improvements in cancer treatments are a good example of how and why change is occurring.

Table 6.1 Five-year relative survival (%) during three time periods by cancer type

Type	*1975–1977*	*1984–1986*	*1996–2002*
All	50	53	66
Breast (female)	51	59	65
Colon	51	59	65
Leukaemia	35	42	49
Lung and bronchus	13	13	16
Melanoma	82	86	92
Non-Hodgkin lymphoma	48	53	63
Ovary	37	40	45
Pancreas	2	3	5
Prostate	69	76	100
Rectum	49	57	66
Urinary bladder	73	78	82

Source: European Federation of Pharmaceutical Industries and Associations

Table 6.1 shows that medical treatments for cancer have radically improved survival rates. The frequency of survival after five years has increased from 50% in 1975 to 66% in 2002. In other fields of medicine, new and better treatments are emerging. Over the last decade we have seen life expectancy massively increase for patients diagnosed with HIV due to new treatments and drug therapy combinations. One in five people in advanced economies by 2030 will probably celebrate their 100th birthday (Shoemaker & Shoemaker, 2009). A typical 50-year-old woman living in the United States in 1990 could look forward to an average of 31 additional years of life, bringing life expectancy to 81 (Shoemaker & Shoemaker, 2009). If we assume a cure for cancer, her average life expectancy increases to 84 years; adding a cure for heart disease she can look forward to 89 years of life. After we conquer strokes and diabetes, the increment rises to 47, yielding a full life expectancy of 97 years of age. No one knows for sure how far the boundary of death can be pushed, but optimistic scientists consider 130 years to be feasible by 2050.

It would seem logical that the complexity of change occurring in the field of science and technology can only be of benefit to the future of the meetings industry. However, the way the world changes is never simple. With reference to Singapore's public policy drive to champion scientific innovation this chapter explores how the future of the meetings industry will be shaped by science, medicine and discovery (Figure 6.1).

The Meetings Industry

Medical science has been the largest sector of the meetings industry for the last decade according to statistics from the International Congress

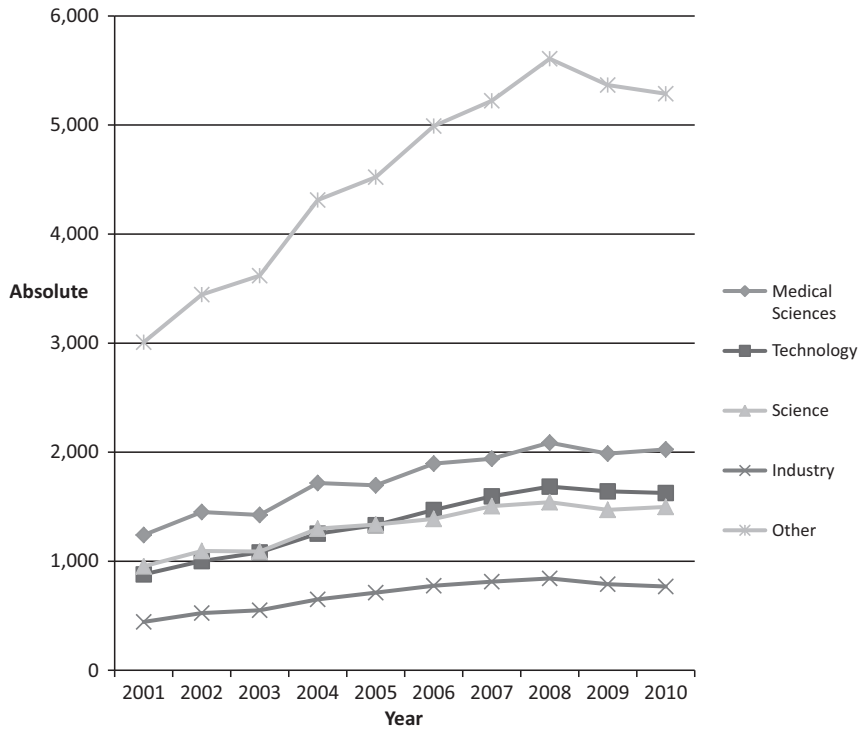

Figure 6.1 Meetings by sector
(*Source:* ICCA)

and Convention Association (ICCA, 2011). In 2010, medical science represented 18.1% of all meetings; combined with technology and science these sectors accounted for 46% of all meetings. According to the ICCA the following statistics provide a glimpse of the meetings industry worldwide:

- Over the last 10 years the number of meetings has risen from 5262 in 2001 to 9120 in 2010.
- The number of international association meetings that rotate the world has been decreasing over the last 15 years.
- Europe is still the most popular destination with the majority (54%) of the meetings hosted there in 2010. However, Europe's market share has been decreasing over the past 10 years and so has the relative popularity of North America, due to an increase in the attractiveness of Asia/Middle East mostly and Latin America.
- The United States and Germany are the number one and number two countries in terms of meetings per country, while Singapore is ranked 24th.

- Vienna has been the most popular city to host meetings for the last six years to 2010. European cities dominate the top 10 with Barcelona, Paris, Berlin, Madrid, Istanbul, Lisbon and Amsterdam constant performers for the last 10 years. The only non-European cities to make the top 10 are Singapore (5th) and Sydney (10th). However, Taipei (11th), Beijing (12th), Buenos Aires (12th), Seoul (16th) and Hong Kong (20th) are pushing hard.
- The average number of participants per meeting reached its lowest point in 2010 with 571 participants per international meeting compared to 696 in 2001.
- Over the last 10 years there has been a big expansion of the market share of the smallest meetings (50–149 and 150–249 participants) at the cost of all meetings attracting over 500 participants.

Healthcare

In the United States, according to the Healthcare Convention and Exhibitors Association (HCEA, 2011) the average total attendance for the top 50 healthcare meetings was 19,512 (Table 6.2). Notably, six of the top 15 healthcare meetings are dental, with the Greater New York Dental Meeting retaining its top position for the second year in a row. Attendance changes can vary greatly from year to year for most healthcare associations, depending on the economy, education draw, event location and the number

Table 6.2 Top 10 Associations Meetings in the United States

Rank	*Association name*	*Total attendance*	*Professional attendance*
1	Greater New York Dental Meeting	58,135	34,637
2	Radiological Society of North America	58,044	27,190
3	FIME	47,125	36,626
4	American Society of Clinical Oncology – Annual Meeting	32,700	26,600
5	Society for Neuroscience	31,975	26,393
6	Chicago Dental Society	31,373	22,054
7	American Academy of Orthopaedic Surgeons	29,164	14,716
8	Healthcare Information & Management Systems Society	27,855	13,846
9	Massachusetts Dental Society – Yankee Dental Congress	26,792	22,674
10	California Dental Association – Anaheim	26,166	18,737

Source: HCEA (2011)

of attendees who participate from outside the United States. The top 20 healthcare meeting destinations in the United States hosted 43% of all reported healthcare meetings in 2010. While location selection may be a result of cyclical decisions or the required resources that a limited number of cities may offer due to the needs of large events, these locations provide a benchmark for where medical meetings were held in 2010 according to the HCEA (2011). The top five cities in 2010 were Orlando, Washington DC, San Diego, Las Vegas and Chicago.

How the Meetings Industry is Changing

A report by futurist Rohit Talwar (2010a) highlights how the meetings industry is changing. The study identified six critical global drivers shaping the world in which the meetings industry operates. The drivers are: political power shifts, environmental drivers, economic drivers, commercial drivers, social drivers and science and technology. The drivers are summarised below as:

(1) *Political power shifts*: The uneven distribution of hope for a more prosperous future means that business optimism is higher in developing nations where commerce has been less hard hit by the global economic downturn. Developing nations such as China and India are exerting increasing influence on global organisations. The opportunity to better understand and partner with such nations exists. In terms of country risk and international security, political unrest, terrorism and cyber crime emerge as three key issues in the report.
(2) In terms of *environmental drivers*, the main question for the meetings industry is, is there a commercial advantage to be gained from understanding and taking a leadership role in driving sustainable business practice? We can anticipate sustainability issues over basic items such as fresh water and food. Severe water issues are likely in some geographical locations. As climate change becomes an increasing focus of attention, greater emphasis will need to be placed on assessing the climate risk of a location. By 2020, the peak oil period is likely to be over and on the basis of current consumption patterns it is unlikely that well thought out alternatives will be available.
(3) *Commercial drivers*: In the current economic climate we see strategic development driven by research and development utilising innovative and collaborative practices. New models of interaction are emerging with a movement towards marketing strategies targeted at the individual consumer. There is a trend towards free or fantastic and 'freemium' products, including free products with premium purchases and paid for upgrades to a free service.

(4) Power shifts, uncertainty, and infrastructure investment are the main *economic drivers* of future change. The global prominence of emergent markets in developing countries means that established destinations and venues need strategies to compete with the 'thrill of the new'. On a 'purchasing power parity' basis Asia will contribute a larger share of the global economy by 2014 than Europe and America collectively, providing 50% of sales for some Western multi-nationals, compared to 25% in 2010. Demographics are also a factor. By 2050, one-third of the world's population will be over 60 with an estimated pension bill 10 times larger than the cost of the recent financial crisis. Economic uncertainty is a key driver in a world where many markets are fragile due to the scale of the recent bailouts. The prospect of prolonged economic downturn is another factor shaping future scenarios for the meetings industry. With high public deficits in developed countries and lack of funds in developing countries the global infrastructure investment landscape is uncertain. Infrastructure investment decisions over the next few years will affect the meetings industry in both developed and developing countries.

(5) A number of *social drivers* will impact on the future of the meetings industry. In 2050, event formats will need to cater for up to five different generations in one room. Cities will be the primary drivers of economic growth over the next decade and the primary focus of convention activity.

> For the next three decades, the world will be demographically split: in the global north, old cities full of old people; in the global south, new cities full of young people. (Brand, 2010: 58)

According to Stewart Brand (2010), by 2020 more that 50% of the global middle class could be from Asia. With increasing GDP and the rise of the Asian middle class by 2025, 24 of the top cities will be Asian and the remaining six from Africa; these are the up-and-coming global city magnets.

Learning is integral to the meetings industry. New understandings of how we learn and the opportunities afforded by technological advancement are likely to have a huge impact on the way events are run. We are living longer and staying healthier as we become more accustomed to manipulating our health. As new technologies such as pharmacogenomics and nanotechnology progress, cognition enhancing food and drugs may become an aspect of event management.

(6) Science and technology, specifically global technology, the mobile economy and the growth in data traffic will be mega drivers of change in the meetings industry. 'The internet of things' (Kirkpatrick, 2010) or the 'internet of objects' is a term used to describe the networked

> interconnection of everyday objects, a growing set of technologies from which things that we would not recognise as computers, like cars and clothes, have computational power. This is an aspect of ubiquitous computing, one person, many computer interfaces. Videos will account for 91% percent of global traffic by 2013. This opens up a range of possibilities to track, capture and use information about the delegate experience, as well as offering new opportunities for generating revenue. Scientific innovation, the deliberate merging of disciplines and championing of hubs of scientific activity by national governments, such as in Singapore, may change the way technological innovation is undertaken and accelerate the pace of change in the decade ahead. Scientific output in Asia last year surpassed North America.

We are in a period of accelerating change, with revolutionary advances taking place in previously separate fields of science, technology and social science. As these come together, new understandings are reached. Normalisation of the interface between humanity and technology has occurred in most sectors of the Global North. We are in the ubiquitous computing era, the era of the cyborg, part human part machine. As technology continues to advance at an ever-increasing rate and the 'internet of things' develops we will see boundaries between the physical world and the virtual world begin to erode. This poses opportunities and threats for the meetings industry. Nonetheless, regardless of technological advance, there remains a need for non-interfaced, flesh-to-flesh communication. Basically, complexity becomes more complex. Medical science is changing as a consequence of new boundaries of science and technology emerging. So, what does this all mean for the meeting industry?

The Medical Meetings Industry in Singapore

The Singapore Meetings, Incentives, Conventions and Events (MICE) industry has grown tremendously over the past decade. In 2008, the Singapore MICE industry accounted for a quarter of all business events held in Asia and generated around S$6 billion in revenue. Following the economic recession, business/MICE travellers and receipts dipped to 2.7 million and S$4.2 billion in revenue, respectively, in 2009 (Statistics Singapore, 2012). The sector's importance to Singapore's tourism industry is reflected in *Singapore Tourism Board's (STB) 2015* plan, which aims to strengthen Singapore's position as a leading convention and exhibition city in Asia with a strong dynamic business environment, projected to contribute 35% of tourism receipts by then (Statistics Singapore, 2012; STB, 2010). STB also hopes

to increase its MICE sector market share in the Asia-Pacific region to 13% in 2015 from 8% in 2007 (Statistics Singapore, 2012).

The biomedical sector in Singapore is one key area focused on by the Singapore government. It aims to develop the country into a Biomedical Hub; a push to make Singapore a globally competitive and trusted centre for scientific and related commercial activities. This move attracted big players such as Japanese drug maker Takeda and GlaxoSmithKline from the industry to set up their regional headquarters and offices in Singapore (Singapore, Business Times, 2009). Aligned with the government's move to develop the nation into a Biomedical Hub, Singapore Tourism Board (STB) is also targeting these big players in the medical trade to bring conferences into the country. With regional offices based in Singapore, these companies will be more inclined to organise MICE activities locally. By targeting non-MICE professionals (such as the medical sector), STB launched a 'Corporate Outreach Programme' in late 2006 to draw in the international corporate community in Singapore. This approach hopes to attract, anchor and grow events that add value to Singapore's key economic clusters – such as biomedical sciences – a move aligned with the government's long-term plan. This strategy is brought through STB working closely with private sector partners and related government agencies to create and develop several flagship events.

STB and Singapore Exhibition and Convention Bureau (SECB) put forth bids and secured a number of major events within the biomedical sciences and medical cluster from 2010 to 2015, including:

- The 3rd World Congress of the International Academy of Oral Oncology (IAOO) (2011).
- The 15th World Conference on Tobacco or Health (WCTOH) (2012).
- The World Congress on Cardiac Pacing and Electrophysiology (2015). (*Source:* Singapore Tourist Board, 2009)

Scenario: Conveying Complexity

Professor Michael Daniels is the world's leading authority in multiple sclerosis, having completed a PhD on using nanotechnology machines to repair the myelin sheath at Harvard University's Singapore campus in 2030. The world's biannual neurology conference is being held at Singapore's new state-of-the-art convention centre which can hold up to 5000 delegates, but with video conferencing it is expected that 35,000 doctors worldwide will listen to Professor Daniels' keynote address, as some delegates from Western countries are not allowed to attend medical conferences due to the perception of the authorities that meetings are an indulgence and are 'seen as a freebie'. However, the conference has

been sold out 12 months in advance, as delegates are keen to update their skills and knowledge since medical science has developed so fast in the last decade. Medicine taught in medical schools seems like the 'dark ages' to many practising doctors today. For those that cannot attend the meeting or missed the video conference, the organisers have created an avatar presentation in a 3D hologram that can be emailed to any location in the world.

Key Issues

The key issues highlighted in the scenario about Professor Daniels are discussed in the next section of this chapter. The key issues are:

- The convergence of science and technologies.
- The cost of discovery and less discovery.
- Moving East.
- Science parks, elite universities and knowledge clusters.
- Assault on pleasure.
- The knowledge economy, complexity and pace of change.
- Virtual reality and meetings technologies.
- We will still want to talk to each other – face-to-face communications.

The convergence of science and technologies

The phrase 'convergent technologies' refers to the synergistic combination of four major 'NBIC' (nano-bio-info-cogno) provinces of science and technology, each of which are progressing at a rapid rate: (1) nanoscience and nanotechnology; (2) biotechnology and biomedicine, including genetic engineering; (3) information technology, including advanced computing and communication; and (4) cognitive science, including cognitive neuroscience. This is the foundation of Professor Daniels PhD in the scenario *Conveying Complexity.*

Convergence of diverse technologies is based on *material unity at the nanoscale and on technology integration from that scale.* The building blocks of matter that are fundamental to all sciences originate at the nanoscale. The same principles will allow us to understand and, when desirable, to control the behaviour both of complex microsystems, such as neurons and computer components, and of macrosystems, such as human metabolism and transportation systems. Revolutionary advances at the interfaces between previously separate fields of science and technology are ready to create key NBIC, including scientific instruments, analytical methodologies and radically new materials systems.

Roco and Bainbridge (2001) suggest numerous examples of what the convergence of science and technology outside of traditional disciplinary

boundaries will entail. Fast broadband interfaces directly between the human brain and machines. Comfortable, wearable sensors and computers will enhance every person's awareness of their own bodies and the world around them. Humanity will be more durable, healthier, more energetic, easier to repair and more resistant to many kinds of stress, biological threats and ageing processes. Machines and in fact structures of all kinds, from homes to aircraft, will be constructed of adaptable, efficient and environment-friendly materials. A combination of technologies and treatments will compensate for many physical and mental disabilities and will eradicate altogether some impairment that has plagued the lives of millions of disabled people. Instantaneous access to information. The ability to ethically control genetics. New organisational structures and management principles enabling enhanced effectiveness in business, education and government. Factories that are 'intelligent environments' organised around converging technologies and increased human–machine capabilities. Agriculture and the food industry with greatly increased yields and reduced spoilage. Bacterium-sized medical nano robots that according to Robert Freitas (2010) writing in the *Futurist*, would act like an artificial mechanical white cell seeking out and digesting unwanted pathogens like bacteria in the bloodstream.

The cost of discovery and less discovery

According to PricewaterhouseCoopers' (2007) study into the future of the pharmaceuticals industry, it has a core problem of innovation that is going to cripple product development in the future, and especially in meeting the medical needs of the elderly population. Even allowing for inflation, the industry is investing twice as much in research and development as it was in 1997 to produce two-fifths, 40% of the new medicines it then produced.

Specialist medicines hold huge clinical and commercial promise but they are used to treat conditions that affect only 3% of the general population (Consumer International, 2007). Prevention, on the other hand, is a much more stable market. As global populations grow and age, and demand for better healthcare management increases, the emphasis on treatment rather than prevention will become increasingly unsustainable. For example, in the US Merck's breakthrough vaccine for cervical cancer sells for US$360 compared to around US$20,000 for a course of interferon used in the treatment of multiple sclerosis. Older people consume more healthcare than young people everywhere. PricewaterhouseCoopers (2007) estimates that by 2020, the OECD countries will be spending 16% of their GDP on healthcare, while the United States will spend a huge 21%.

This innovation deficit in the pharmaceuticals industry has enormous implications for the meetings industry. It will either mean companies will reduce the need for research, therefore resulting in less meetings, or it

will drive further innovation in order to build a new model, which means more meetings.

Moving East

Asia is coming to the fore as a hub of NBIC innovation. The number of PhDs awarded in the natural sciences and engineering has levelled off or declined in the United States, United Kingdom and Germany since the late 1990s. Conversely, it has been rising steadily in Asia and in addition Asian students continue to travel overseas for their doctoral studies. Many of these foreign students returned to their countries of origin, once they graduated. The scientific literature published outside the established scientific centres of the United States, EU and Japan is likewise growing rapidly. China's output rose by a huge 530% and that of the Asia-8 (South Korea, India, Indonesia, Malaysia, the Philippines, Singapore, Taiwan and Thailand) by 235%, boosting their combined share of the world total from less than 4% in 1988 to 10% in 2003 (PricewaterhouseCoopers, 2007). Additionally, much of the scientific research performed in the West is becoming prohibitively expensive. Many of the leading pharmaceutical companies are establishing partnerships in Asia; for example, Wyeth has opened an early development centre with Peking Union Medical College Hospital in Beijing and Roche has set up a research base at Zhangjiang Hi-Tech Park in Shanghai. Although the research base for many of these pharmaceutical companies is still going to be in Europe and the United States, a long-term shift in knowledge will flow eastwards along with medical meetings by 2050.

Science parks, elite universities and knowledge clusters

In the scenario *Conveying Complexity*, Professor Daniels studied at Harvard University's Singapore campus. The government of Singapore is helping the pharmaceutical and biotech industry through the Biomedical Sciences Initiate, started in 2000, which brings universities, manufacturing and industry together in a knowledge cluster. The economic value of the cluster increased manufacturing output in Singapore in the biomedical sciences from US$5 billion to US$20 billion in 2008, a fourfold increase (Shoemaker & Shoemaker, 2009). Singapore's ability to quickly put together various resources and infrastructure needed to attract foreign investors and grow; the industry has proved to be the key. The crown of this achievement is Biopolis, a still evolving and growing research and development complex that houses the country's leading major public biomedical research institutes and private laboratories. This knowledge cluster enables the entities to share research facilities equipment and amenities, which helps to overcome a major challenge that both start-ups and established companies face: the need to manage research and development costs and shorten time-to-market. At Biopolis,

tenants can take advantage of its 'plug-and-play' infrastructure and access shared facilities and state-of-the-art equipment. One of the successes of the cluster has been the ability to attract an impressive number of top scientists from the United States and the rest of Asia, and it is becoming a hub for the biosciences meetings industry. Singapore has adopted a 'Queen Bee' approach to building its research base by enticing key international players and it assumes that others will follow.

The Singapore government has set out to make the country the hub of science in Asia, as a consequence The Singapore Tourist Board has developed a meeting industry strategy working with universities to attract medical and science conferences. For example, an aspect of the strategy is a meeting ambassador programme used to leverage leading medical experts such as Professor Neal Copeland who heads the Singapore Institute of Molecular and Cell Biology or Professor Edward Lui of the Genome Institute of Singapore to act as ambassadors for the tourism industry thus connecting science with tourism through the meeting industry (Talwar, 2009).

Assault on pleasure

There is hardly any aspect of the modern world that does not attract some form of moral or political debate; today the meetings industry is at the forefront of that debate. In the scenario, some delegates could not attend the congress because there were restrictions on hospitality spending and the perception of meetings by political leaders. In a free society where the individual should have choices, the range of options is declining. Authorities are increasingly intervening to restrict options and to prohibit activities, including smoking, gambling and anything perceived to be connected with indulgence and fun. From a consumer's perspective political correctness has reached the point at which they have to worry about what they do and how they behave. Since the fall of the Berlin Wall and subsequent demise of communism, capitalism has existed in a vacuum; there is nothing to counterbalance its excessive side. Therefore, politicians have focused on individual issues and the individual's lifestyle rather than the wider world. Telling someone how to live their life has become the order of the day (Yeoman, 2008) in which a new puritan order is born. From a tourism perspective, it is about taking the fun out of society as it is perceived as excessiveness. Yeoman (2008) coins this trend as an *Assault on Pleasure*, the ultimate outcome of which is a global environment in which tourism is banned.

An article in the *US Today* highlights the *Assault on Pleasure* trend:

> What do Reno, Orlando and Las Vegas have in common? To some pockets of the federal government, they just seem like too much fun. Instead, employees at some big agencies, like the U.S. Department of Agriculture,

> are being encouraged to host meetings in more buttoned-down places such as St. Louis, Milwaukee or Denver. When a conference planner for MGM Mirage's New York-New York Hotel & Casino in Las Vegas tried to book a conference with the Federal Bureau of Investigation, she received a polite refusal. The Department of Justice 'decided conference[s] are not to be held in cities that are vacation destinations/spa/resort/gambling,' according to a May email from an FBI employee obtained by the U.S. Travel Association and viewed by The Wall Street Journal. 'Las Vegas and Orlando are the first 2 on the chopping block.' According to an Agriculture Department employee familiar with the guidelines, the agency issued internal travel guidelines in the spring that encourage employees to hold meetings in cities that display three key attributes: a travel hub; low in cost; and 'a non-resort location.' … Resort locations aren't banned, 'but you have to provide robust justification' to supervisors for approval to hold an event there, the employee said. (Audi, 2009)

Furthermore, many countries and professional medical organisations have responded to this driver by creating regulations to curb perceived excessivenesses. In March 2009 (Hosansky, 2009), the state of Massachusetts finalised its Pharmaceutical and Medical Device Manufacturer Code of Conduct, which regulates interactions between drug and device companies and healthcare practitioners, placing restrictions on meeting venues, gifts, meals and entertainment. It also requires companies to disclose any gifts or payments to healthcare practitioners worth $50 or more. This practice is replicated across the world whether it is European Federations of Pharmaceutical Industries and Associations (EFPIA) code of practice or similar codes in Australia, New Zealand, Japan or Canada. The meetings industry is certainly influenced by the *Assault on Pleasure* driver.

The knowledge economy, complexity and pace of change

The foundation and creation of the knowledge economy lies with Moore's Law. Moore's Law describes a long-term trend in the history of computing hardware, in which the number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years (Brock, 2006). From a medical science perspective, Moore's Law can be applied to the fields of cardiovascular science and cardiovascular medicine, both of which are advancing at a similar breakneck pace. New drugs and therapies appear, only to be superseded or refined within a matter of a year or two. These advances have had a wide-ranging impact on the practice of both anaesthesia and critical care medicine (Howell *et al.*, 2004). As a consequence, over the last decade there has been a rapid expansion of continuous professional development for medical doctors as horizons of medical science

and technology expand as doctors try and keep skills and knowledge at the forefront (Bapat, 2009).

Virtual reality and meetings technologies

Virtual reality, one of the promises of the information revolution, is a term that applies to computer-simulated environments that can simulate places in the real world, as well as in imaginary worlds, the ability to immerse oneself in an artificial environment that simulates the sensory experiences. Virtual reality rooms have been around since the early 1990s, often as simple desktop systems. Today, organisations from governments to the military, and the commercial sector are investing in virtual application making. Second Life, Google Earth and a host of other 3D virtual worlds are creating an even more ubiquitous virtual environment called the 'metaverse'. According to Techcast (2010) the virtual reality market is valued at US$30 billion. 3D movies are becoming the first choice of many theatre goers, with the 3D version of *Avatar* grossing US$77 million in its opening weekend in 2009. As more cinemas install 3D technologies, revenues from 3D movies as a proportion of total sales range between 25% and 37%.

Human beings are fascinated with the virtual world. The success of 3D movies such as *Avatar,* holographic images like Marina Macaus's fire eating mermaid and the advent of pop star Hatsune Miku, the world's first virtual diva, are testament to this. While the virtual world may pose a threat to the meetings industry as increasingly attractive virtual reality options surface, it also offers opportunities. The creations of the metaverse, a virtual space made up of virtual worlds, augmented reality and the internet, are becoming increasingly seductive. In a technologically advanced postmodern world we are at home with the hyper real as our consciousness becomes increasingly comfortable with the melding of reality and fantasy. Virtual avatars can be manipulated to elicit particular responses, for example, red to increase competition, white to increase harmonious interactions (Merola & Peña, 2010). On the one hand Hatsune Miku is merely anime, on the other, a pop star with a host of fans who will travel to see her perform live and respond to her in the same way they would to a flesh and blood star. A virtual reality world takes us beyond our physical senses to the world of feeling.

One of the common applications of virtual application technology in the meetings industry is telepresence. Telepresence refers to a higher-level set of video-telephony technologies which allow a person to feel as if they are present, to give the appearance that they are present, or to have an effect, via telerobotics, at a place other than their true location. Telepresence requires that the user's senses be provided with such stimuli as to give the feeling of being in that other location. Additionally, users may be given the ability to affect the remote location. In this case, the user's position, movements, actions, voice, and so forth may be sensed, transmitted and duplicated in the

remote location to bring about this effect. Therefore, information may be travelling in both directions between the user and the remote location.

Kersey described some benefits of telepresence:

> There were four drivers for our decision to do more business over video and telepresence. We wanted to reduce our travel spend, reduce our carbon footprint and environmental impact, improve our employees' work/life balance, and improve employee productivity. (Kersey, 2008)

Rather than travelling for face-to-face meetings, it is now commonplace instead to use a telepresence system, which uses a multiple codec video system (which is what the word 'telepresence' most currently represents). Each member/party of the meeting uses a telepresence room to 'dial in' and can see/talk to every other member on a screen/screens as if they were in the same room. This brings enormous time and cost benefits. It is also superior to phone conferencing (except in cost), as the visual aspect greatly enhances communications, allowing for perceptions of facial expressions and other body language. These cues include life-size participants, fluid motion, accurate flesh tones and the appearance of true eye contact (Human Productivity Lab, 2010). This is already a well-established technology, used by many businesses today. The chief executive officer of Cisco Systems, John Chambers (Saunders, 2009) at the Networkers Conference compared telepresence to teleporting from Star Trek, and said that he saw the technology as a potential billion dollar market for Cisco.

Looking further into the future, virtual reality will move from a 2D telepresence to 3D imagery. For example, research by the Institute for Creative Technologies (ICT) at the University of Southern California have already developed a 3D teleconferencing telepresence device at the Army Science Conference in Florida. Dubbed 'Live 3D Teleconferencing' (http://gl.ict.usc.edu/Research/3DTeleconferencing), ICT's set-up captures a single participant in 3D and then transmits that image to a viewer. All of this is happening within microseconds. The video card and processor are rendering so quickly that they are creating 72 different facial views per second, enough different images so that each pass of the mirror shows one of the viewer's eyes in a slightly different image. It is this optical illusion that creates the 3D effect you see in the video. What does all this mean for the meetings industry? The projection of speakers to conferences in a 3D image or even the creation of celebrity conference avatars like Hatsune Miku as the ultimate virtual reality experience.

We will still want to talk to each other: Face-to-face communications

As Larsen *et al.* (2006) point out, the last decade has seen a striking increase in the use of technology and social media as a means of communications.

Even in this era of technologies the social context of personal relationships is still an important driver for the meetings industry. Sociological research on personal networks pays increasing attention to people's meeting opportunities (Mollenhorst *et al.*, 2008) and in particular, to the importance of social networks and informality in order to build trustful relationships. Bjorkman and Kock (1995) emphasise the importance of social bonds in buyer–seller relationships in China, focusing on personal relationships and recommendations as the most important influencers in purchasing decisions. This importance is underpinned by Anderson and Kumars' (2006) study of buyer–seller relationships in business executive's found relationships. They found that such relationships are formed through physical presence in which competence and trust are seen as the key variables. Mair and Thompson's (2009) review of the UK association conference attendance decision-making process highly emphasises networking and the quality of the speakers at events. In particular, asking the question what is 'the likelihood of attending the conference again in the future' is highly correlated to networking as a motivating factor. Mair and Thompson's (2009) review of reasons for conference attendance suggests personal interaction, with other like-minded people, keeping up with changes in their field and learning new skills are all part of networking.

Concluding Remarks

To sum up, the future of death ...

God may hold the ultimate power; the power of life over death, the ability to heal the sick and prolong life. But, for the mere mortal, life is full of disease and illness. Will death be a thing of the past by the year 2050? Change is happening within the fields of medicine. One of the major drivers of change is quantum theory and the computer revolution (Kaku, 2011). Quantum theory has given us amazingly detailed models of how atoms are arranged in each protein and DNA molecule. Atom for atom, we now know how to build the molecules of life structures. Gene sequencing, once a long, tedious and expensive process, is now fully automated and robotic. In the past it cost millions to sequence all the genes in the human body; now it costs a fraction of the price. The future is genomic medicine and personal treatments. We will know in advance what diseases to expect and life expectancy. Tissue engineering is another hot topic in medicine, making possible the human body spare parts shop in which scientists could grow skin, blood, heart values, bone and ears in the lab from your own cells. So far, the medical field has grown a couple of types of tissues and a few simple structures, but by 2050, livers, pancreas and hearts will be the norm. Another field of rapid change is stem cell technology, where cells have the

ability to change into any type of cell in the body. According to Kaku (2011) although a skin cell may have the genes to turn into blood, these genes are turned off when an embryonic cell becomes an adult skin cell. Each cell in our body has the complete genetic code necessary to create our entire body. As our cells mature they specialise and specific genes are inactivated. However, embryonic stem cells retain the ability to regrow any type of cell throughout their life. Stem cells have the potential to cure a host of diseases such as diabetes, Alzheimer's or the common cold, making mere mortals lives disease free. If we could grow various organs of the human body, then we could regrow a human being, creating an exact copy or a clone, a future without death.

What does this all mean?

As this chapter and the scenario *Conveying Complexity* highlights, spurred by the conscious convergence of previously separate technological and scientific disciplines the pace of change is increasing rapidly. The tourism industry is responding to changes in tourist needs through tailored services. In the meetings industry new global destinations and a raft of new players are shifting the competitive dimensions. Boundaries will shift with venues increasingly competing with professional conference organisers to offer event management and new alliances. As demonstrated in this chapter, the range of choice and range of meeting technologies are expanding rapidly with hybrid events of physical and virtual sessions, exhibits and other experiences becoming commonplace. This hybrid event means a new experience for the delegate. However, cost will be a significant factor in the future.

Change is particularly evident in the medical sciences where, for example, preventative medicines are vaccinating us against previously incurable diseases such as cancer. The pace and complexity of change in the medical arena, the largest sector of the meetings industry for the last decade, means that meetings are occurring more frequently in an effort to try to keep abreast with the complexity of change.

Increasingly, innovation is shifting eastwards as government and industry investment in the NBIC provinces of science and technology increases in these countries. For example, Singapore's creation of a knowledge cluster in the pharmaceutical and biotech industry increased manufacturing output in Singapore in the biomedical sciences fourfold. Capitalising on this investment the Singapore Tourist Board has created a meetings strategy to attract medical and science conferencing. While innovations in connective technology, the assault on pleasure in the modern world, increasing costs and a concern for the environment may adversely affect the meetings industry, it is likely that increasing technological complexities will necessitate the continuance of face-to-face meetings.

The end of the meetings industry . . .

What if the world ran out of oil and at the same time technological advancement changed the future of humanity? A number of changes would have to occur. One of these is haptic technologies. Haptic technologies provide the illusion of real objects through tactile feedback that takes advantage of the user's sense of touch by applying force, vibration or motion. This mechanical stimulation makes virtual objects become real. In the medical industry, doctors are already using haptic to undertake remote surgery using teleoperators. A particular advantage of this type of work is that the surgeon can perform many operations of a similar type, and with less fatigue. In the future, keynote speakers may be holographic projections and delegates may be avatars interacting remotely in real time with one another.