THE NEXT FAMILIAR

A collaborative project by Karen Maxwell and Shannah Segal
OCAD University 2014

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Submitted to OCAD University in partial fulfillment of the requirements for the degree of
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THE NEXT FAMILIAR

Using a speculative design foresight approach, this study explores the rapidly developing area of wearable, implantable and ingestible technologies, and how they might influence us over the next several decades. The authors have combined traditional research methods such as literature review and expert interviews; foresight methods, such as environmental scanning, trends analysis and scenario creation; and narrative, imagery and conjecture to produce an evocative account of future possibilities in the realm of the tools we keep and use close to and inside our bodies.

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DEDICATION

We dedicate this project to the Kvin.

ABOUT US

Karen Maxwell

Karen Maxwell is a versatile and strategic design-thinker with expertise in managing creative teams and defining user experiences, social strategies and visions for leading global companies and organizations. Karen uses strong communication, organizational and problem-solving skills to collaborate closely with clients and leads teams in creating innovative, original, and usable solutions to business challenges. Her proven success includes developing user experience visions and blueprints, while ensuring client goals and success criteria are met by understanding gaps and exposing opportunities to build rich experiences. Karen continually explores future possibilities and pushes the boundaries of innovation, while working within the parameters of an effective and implementable vision. Karen is a member of the Association of Professional Futurists.

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Shannah Segal

Shannah's mission, privilege and great pleasure is to continue to grow one of Canada's most highly regarded and best beloved user experience design firms. As one of the principals at Usability Matters, Shannah works directly with clients and designers to create experiences that resonate, motivate and compel. She has worked across many types of industries including media, education, travel, retail, loyalty, not-for-profit, and financial. For Shannah, the single most rewarding part of user experience is the opportunity to work with a wide variety of people and organizations. Usability Matters is an accomplished consultancy with a track record for results. It has been delivering exceptional user experiences for over a decade, leading the industry through a unique combination of rigorous research and smart, thoughtful design. Shannah is an expert at putting users at the centre of digital development and design – because she believes technology should work for people. Shannah is a member of the Association of Professional Futurists.

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AUGUST 2014

> *I don't feel that I'm using technology, I don't feel that I'm wearing technology, I feel that I am technology.*
>
> Neil Harbisson

It's a balmy summer evening in downtown Toronto, and around 400 people have gathered at the MaRS Discovery District to attend a meeting hosted by We Are Wearables. This group didn't exist a year ago. But wearables are becoming increasingly common, spotted on the wrists, necks and faces of more people every day. On the agenda for August's gathering is a Google Glass reunion – a panel discussion between seven 'Explorers' – intrepid souls who have worn Google Glass out and about for just over a year and are ready to talk about it…

Most consumer-focused wearables available in late 2014 are activity trackers or companions to a smartphone. Now we are also starting to see devices with functionality beyond tracking, like Nymi that converts the wearer's heart rate into an authentication protocol (Etherington, 2014) or Myo that lets the wearer use electrical activity in their muscles to control other systems. (Thalmic Labs, 2013) And of course there is Google Glass, designed to be a self-contained, ubiquitous, constantly connected computer worn on the face and controlled mostly by a combination of natural language and physical actions.

Our observation of how the electronic and digital tools we use are getting closer and closer to our bodies, and our curiosity around what the future may hold for wearable technologies, is the basis for this exploration. Will the proximity of our tech to our bodies increase until crossing the skin barrier is of no consequence? Will we one day be swallowing tiny machines with the nonchalance of brushing our teeth? Will our very definition of what it means to be 'human' change because of the machines to come? Using a speculative design foresight approach, we seek to investigate the following question:

How might wearable, implantable or ingestible technologies affect us in the next 30 years?

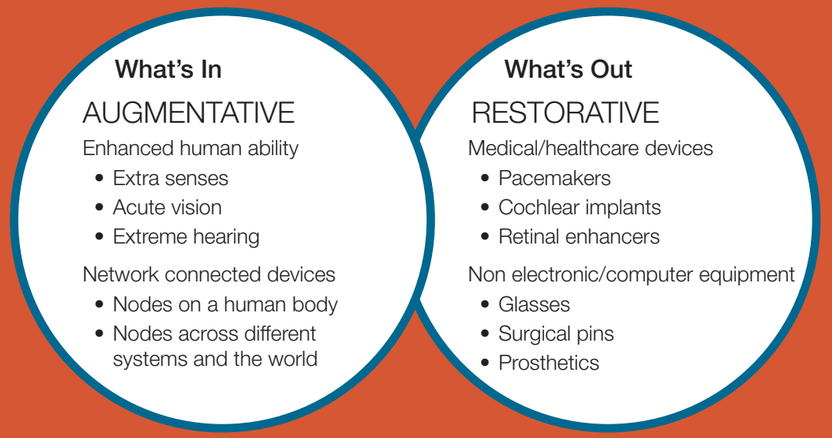
When we started socializing this question in our collective circles, people wondered first, what we were talking about, and then, why we were interested in the topic. We are both experience designers, meaning we work to make (mostly) digital products useful, usable and hopefully memorable. As design practitioners we are sometimes asked by our clients and peers to help prepare for the future. We see a dizzying array of devices being produced and want to understand what we should pay attention to. But it goes deeper than that. We want to practice thinking about what technologies or concepts or archetypes might become prevailing forces in the event that we will someday design for them. We feel it is reasonable to contemplate the emergence of digital interactions that are drastically different from the screen-based interfaces we know now, and that working from a wearable, implantable or ingestible perspective could emerge as a new frontier of design. The effects of these new technologies promise to be broad and systemic, and will impact many facets of our lives, necessitating a new paradigm for ideation and design.

Our project title, *The Next Familiar*, speaks to two meanings of the world 'familiar'. As an adjective, familiar is something that is handy, or known through frequent use. Today many of us consider our smartphones familiar because they are just part of our daily lives, unremarkable, used for the most part without particular thought as the means to an end goal of completing a task, communicating with someone, or getting some type of information. Our project contemplates what we'll consider familiar in the years ahead. In fairy tales and myths, a familiar is a helpmate; often with the power to shift and change form. Wearable, implantable or ingestible technologies could conceivably be considered familiars of the modern age — helpers; with capabilities we don't possess ourselves, beholden to us but sometimes devilish and unpredictable as well.

In the pages that follow, we will explain what we mean by wearable, implantable and ingestible technologies. We'll outline recurring concepts that emerged in literature and provide a rationale for our time horizon of 30 years. Subsequently, we will describe the methodology and techniques we employed to identify trends, drivers and implications in this space. We will introduce you to the thoughts and practices of over a dozen experts in several areas that this topic encompasses. Finally, we'll present five possible scenarios inspired by our research, in order to immerse you in a series of speculative situations from the future.

This research project may be a first step in understanding the wearable, implantable and ingestible technology domain. It's important to note that this project is not a roadmap or set of tactical guidelines. We did not have any specific stakeholders in mind while we undertook the project activities, but hope that a wide spectrum of companies, interest groups and people will find our exploration useful and thought provoking. To that end, we conclude with an outline of how several types of industry sectors might bring our findings to bear in their own organizations.

WEARABLE, IMPLANTABLE, INGESTIBLE



The scope of our investigation includes wearable, implantable and ingestible technologies. In this section, we explain how we have defined these three terms based on interviews with experts, literature review, and an environmental scan. From an overarching perspective, we created some parameters in order to narrow down the span of the type of technologies we looked at.

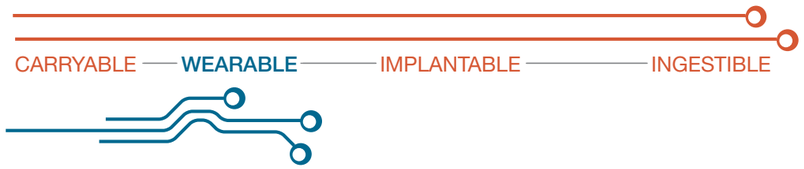
In terms of proximity to the body, the bulk of our data is about wearable and implantable objects. Material about wearables is abundant, implantables a little less so. Some of the experts we consulted also discussed 'carryables' such as smartphones. Ingestibles are definitely at the forefront of our device spectrum – material was scant and experts could really only speculate about the role they would play in the years ahead. We see this continuum in the following way:

Additionally, we focused on devices that either do not have, or go beyond what we are calling a 'restorative' capacity in a healthcare or medical context. In other words, while many devices are incredibly important as precursor technologies, we're excluding examination of medical implements such as pacemakers, cochlear implants, and retinal enhancers. The sheer number and variations of medical implements are beyond the scope of this project. Additionally, we wanted to explore a dimension beyond the restorative. What might the future hold for devices that could grant us abilities we don't have now — extra senses like the capacity to sense magnetic fields, or see from the backs of our heads, or process parts of the light or sound spectrum we can't today? We're interested in the technology that might let us do things we couldn't reasonably expect to do by virtue of simply being human.

We have also excluded equipment that has no electronic or computerized components. Therefore items like glasses, surgical pins, 'inactive' prosthetics, or pharmaceuticals that assemble chemically inside the body, are out of our scope (though they are technologies and are certainly wearable, implantable or ingestible). Further to the electronic component, we wanted to incorporate the notion of connectivity in the devices we look at. Much of the computational power of the technologies that are emerging today has to do with their ability to connect via some sort of network, with other systems or devices. This might be on a small scale, such as different nodes on one person's body, or on a large scale, such as different nodes across different systems across the whole world.

In sum, the technologies we are mostly concerned with go beyond the restorative to the augmentative or sense bridging; have an electronic/computerized/digital component and embody some type of network connectivity. They are mostly wearable and implantable, though we have considered items carried and looked forward to items ingested.

WEARABLE



Perhaps the most recognizable of the three technologies are the wearables. ‘Wearables’ as a term has only recently made its way into the common parlance as a short form for ‘wearable computer’. Oxford defines wearable as “denoting or relating to a computer or other electronic device that is small or light enough to be worn or carried on one’s body.” (Oxford, n.d.) Wearables that many people are familiar with include fitness or activity trackers. There are dozens on the market; several well-established versions are Fitbit (launched 2008), Jawbone Up (launched 2011) and Nike Fuelband (launched 2012). These examples are devices typically worn on the wrist, like a bracelet, though some companies have designed versions that can be attached to various other places on the body. Early activity trackers, such as pedometers and heart rate monitors, were self-contained units that would communicate the information they tracked on a small display. The advent of the smartphone instigated a huge change in trackers by essentially adding a computer to manage, analyze and display the data collected by the device. Some might consider smartphones themselves to be wearable technology, but in this study, we differentiate between items that are mostly carried and wearables that are specifically designed to be attached to the body. We’ve defined wearables as devices with a form factor meant to be attached to the body, that can perform computational tasks either inherently or by connection to a companion system or network.

In addition to health trackers, smartwatches are a form of wearable that — while far from ubiquitous — are readily available commercially. As the name connotes, these are devices worn on the wrist, they look like watches, and amongst myriad other functions they tell time. Currently, many tech companies are scrambling to launch their smartwatch offering to the public. While watches with some computational power, like the ability to handle user-programmable data or perform mathematical calculations, existed in the early 1980s, Steve Mann, “the father of wearable computing”, is credited with being the creator of the first watch to incorporate an actual operating system. In 1998 he developed a videophone wristwatch that used GNU/Linux paired with his body-worn computer system WearComp to capture images which could be transmitted over the Internet. (Mann, 2000)

Smartwatches may or may not have built-in sensors that allow them to perform the same functions as activity trackers. Many (but not all) smartwatches sync to another device, commonly a smartphone

Figure 1 - Jawbone

Frances Berriman www.flickr.com

Figure 2 - FitBit and Sony Smartwatch

Becky Stern: www.flickr.com

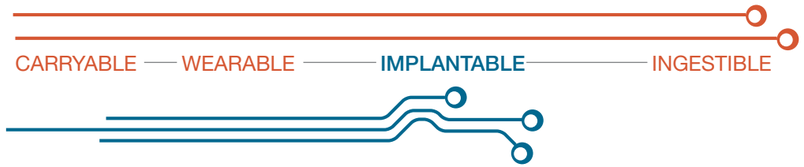
running an operating system such as Android, and therefore rely on the greater capability of the partner device for processing power and storage. Some tech industry watchers have expressed skepticism around the longevity of the smartwatch based on the fact that (at least currently) they are mostly a front end to another device, necessitating the user to carry two items rather than one. (Emrich, 2014; Graafstra, 2014) Nevertheless, smartwatches are pertinent to this exploration because they currently represent the convergence of sophisticated computational ability with a generally accessible form factor in wearables.

The wearables landscape changed significantly when Google Glass appeared in 2012. Google Glass has a number of key differentiators over other wearables. It can function as a self-contained device that isn’t necessarily paired with a smartphone or tablet or other computer after initial set up. It can be operated mostly hands-free using voice commands and eye and head movements, though some functions necessitate tapping the side of the device with a finger. It could be argued that Glass is more suited to natural language input than any other wearable invented to date because it’s worn on the face, in proximity to the user’s mouth. Of interest to us from a social and cultural perspective is that unlike activity trackers and smartwatches, Glass is literally ‘in your face’ and on your face. The wearer is obviously sporting a technological device and those around the wearer are cognizant of it. It is the most overt of the commercially available wearables manufactured to date, yet what it’s actually doing is clear only to the wearer. Google Glass uses Google applications such as Gmail, Google Maps and Google Now (an intelligent personal assistant) and applications designed and built by a wide range of third parties such as media outlets, corporations and private developers. It can of course take pictures and video. Besides being one of the first face-mounted heads-up display devices available on the consumer market, Glass also exhibits the possibility of a constant state of augmented reality.

Google Glass is not the only face-mounted wearable, there are many, many entrants in the field but they are not as well known. We would be remiss, however, if we didn’t mention Oculus Rift, the largest player in virtual reality wearables. Virtual reality (Oculus Rift) differs from augmented reality (Google Glass). A virtual reality apparatus eclipses all perception of the real world for the wearer, whereas an augmented reality apparatus presents additional layers of information superimposed on (and often related to) the real world. Oculus Rift is firmly rooted in the world of gaming. The software wasn’t a pleasant experience when it first came on the market, and the hardware is still awkward. The ‘clunkiness’ of Oculus Rift and the experiences of Google Glass Explorers highlight the importance of designing devices that are seamless in everyday life. In our interviews, especially with Dr. Isabel Pedersen, Tom Emrich and Karl Martin, there was a distinct emphasis on the need to understand users and use cases, and design technology that fits into their daily lives. There must be usability and a value proposition for wearables to be adopted — a wearable must not just be another device that makes for extra work.

Wearables as a category of devices encompasses many different types of objects, but they all share a form factor that allows for easy removal from the body. Some lesser known and experimental wearables start to cross the line from ‘wearable’ to ‘implantable’. For example, Motorola (owned by Google) has patented an electronic skin tattoo which is adhered to the throat and has an embedded microphone, transceiver and power supply. (U.S. Patent No. 20130297301, 2013) As another example, Steve Mann’s EyeTap requires special tools to remove; it can’t simply be ‘taken off’. (Daubs, 2012) Our second technological sphere addresses items not so easily donned and shed — implantable devices.

IMPLANTABLE



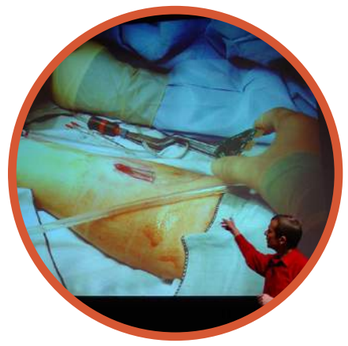
From our interviews, literature review, and environmental scanning, we learned that the line between wearables and implantables is indistinct. For example, a company called MC10 has created 'Biostamp' — a paper-thin electronic membrane that can be affixed to the body like a plaster, that is 'closer' than a wearable but not quite implanted. (Bhanoo, 2014) We have decided to use crossing the skin barrier as our dividing line between wearable and implantable. Hence, a device that necessitates piercing or cutting into the body, such as a biohacker's RFID or NFC chips, is an implantable, whereas a 'smart' contact lens worn on the eye or an etattoo applied to the skin is a wearable. Implantables are not easily removed and have a greater level of permanence and incorporation into the body. They may also be directly affected by or work in tandem with biological systems, such as bone structure or the circulatory system. By our definition then, the eyeborg implant and antenna that is part of one of our interviewees (Neil Harbisson) is an implantable, while the eyeborg camera encased in the prosthetic eye of another of our interviewees (Rob Spence) is a wearable. Kevin Warwick (who we were not able to interview), Neil Harbisson and Stelarc have some of the most extreme implants we came across in data gathering. These three are referred to frequently in literature and media, especially with regard to the practice of biohacking.

https://www.facebook.com/photo.php?fbid=331409795119038set=a.331408739163910902218518295038type=3&theater

Figure 4: Neil Harbisson and Stelarc

PhOtOnQuAnTiQuE: www.flickr.com

Figure 3: Rob Spence TEDx Brussels



Erwin Boogert: www.flickr.com

Figure 5: Kevin Warwick's augmentation surgery

In healthcare, implantables have been around for many years. There is a subset of medical tools called Active Implantable Medical Devices (AIMDs) that can be defined as "any active medical device which is intended to be totally or partially introduced, surgically or medically, into the human body or by medical intervention into a natural orifice, and which is intended to remain after the procedure." (British Standards Institution, 2014) The 'active' part of the definition refers to the devices capacity to perform an action. Examples of AIMDs include implantable pacemakers and defibrillators; nerve, bladder, sphincter and diaphragm stimulators; and cochlear implants. AIMDs perform a restorative or therapeutic function — they are designed to 'fix' a medical issue that prevents a human from functioning to a reasonable level of ability. While we have examined AIMDs lightly as precursor technologies, our interests for *The Next Familiar* diverge from the restorative and embrace the augmentative. In other words, we are defining implantables in this project as devices that imbue the implantee with senses or capabilities that would not fall within the reasonable expectation of human ability. Thus, RFID chips that enable a person to unlock doors, or start a motorcycle, NFC chips that store data, magnetized devices that allow for the sensing of magnetic fields, or other items that instil enhanced sensory perception (night vision, greater auditory range, etc.) would fall within our scope. While some of these technologies exist today, others are speculative.

One of the earliest experimenters in implantables is University of Reading professor Kevin Warwick, who claims to be the world's first cyborg and documents his early work in a book titled *I, Cyborg*. The first chapter opens with the following:

> *I was born human.*
>
> *This was merely due to the hand of fate acting at a particular place and time. But while fate made me human, it also gave me the power to do something about it. The ability to change myself, to upgrade my human form with the aid of technology. To link my body directly with silicon. To become a cyborg – part human, part machine. This is the extraordinary story of my adventure as the first human entering into a Cyber World; a world which will, most likely, become the next evolutionary step for humankind.* (Warwick, 2004)

Kevin Warwick underwent two procedures. In 1998 he had a silicon chip transponder surgically implanted in his forearm, which allowed him to be monitored by computers as he went about his workday, and via a unique identifying signal granted him the ability to "operate doors, lights, heaters and other computers without lifting a finger." (Kevin Warwick, n.d.) In 2002 he had a 100-electrode array implanted in his arm, which interfaced directly with his nervous system. In a series of experiments he was able to control a robotic arm in a remote location, as well as interact directly with his wife who had a less complex array implanted in her own arm. Professor Warwick's work is significant in that he was one of the first (and we understand still one of the only) academic researchers to formally undertake cybernetic enhancement primarily for the sake of augmentation. He has received some criticism in academic and scientific circles in response to his casual presentation style, popularity with the media and perceived lack of scientific method. Journalist David Green, writing for BBC News has maintained his work is difficult to assess objectively because write-ups about it lack descriptions of hypothesis, apparatus, method, results and conclusions. (Green, 2002). After Kevin Warwick visited and lectured at the University of Pittsburgh, neurobiology professor Andrew Schwartz stated, "I think it's important that we distinguish entertainment from academics, and Kevin is the entertainment part. I don't want people to be confused about that." (Hamill, 2010)

It is true that Warwick's name appears in some fairly provocative contexts. His 2002 book *I, Cyborg* claims that humans will experience an evolution through technology and those that choose to join with machines will in fact become akin to another species. These views have led Warwick to be linked to a movement known as transhumanism – a school of thought based on an ideology of human enhancement through technology.

In the domain of the arts, performance artist Stelarc has incorporated wearable, implantable and ingestible artifacts into his work throughout his entire career. In our interview with Stelarc he stated that "...the body was inadequate, very vulnerable, susceptible to micro-organisms, easily damaged, easily cut. Our bodies are easily traumatized, we have limited longevity… We malfunction often, our memory retrieval is very unreliable...." (Stelarc, personal communication, August 12, 2014) And although Stelarc feels that "our bodies are wonderful complex evolutionary architectures" he also feels that the body is not "necessarily well designed to function in a technological terrain." Thus, his work focuses on augmenting, attaching and inserting technology on and into the body. Two projects we have found particularly salient to *The Next Familiar* are EAR ON ARM and Stomach Sculpture (discussed in our section on Ingestibles).

EAR ON ARM is an event started in 2006, but conceived 10 years earlier. Stelarc's aim was to actualize a permanent alternation of the human form. EAR ON ARM is a "partly surgically constructed, partly cell-grown" organ. (Dayal, 2012) In its original conception, the ear, situated on the inner left forearm, contained a microphone and wireless transmitter enabling audible sound and transmission of that sound across the Internet. Another receiver and transmitter could be placed in the mouth.

> *If you telephone me on your mobile phone I could speak to you through my ear, but I would hear your voice 'inside' my head. If I keep my mouth closed only I will be able to hear your voice. If someone is close to me and I open my mouth, that person will hear the voice of the other coming from this body, as an acoustical presence of another body from somewhere else. This additional and enabled EAR ON ARM effectively becomes an Internet organ for the body.*
>
> (Stelarc, n.d.)

Andy Miah: www.flickr.com

Figure 6: Stelarc, EAR ON ARM

Unfortunately, infection necessitated the removal of the microphone shortly after it was implanted. Currently, *EAR ON ARM* is on hold while Stelarc marshals the considerable expenses associated with continuing the project. In our interview with him, he stated his strong desire to continue to actualize the work, and also discussed the opportunities that delays present. As every year passes, advances in medical and material technology make new potential for the actualization of *EAR ON ARM* possible. Stelarc's milieu of the arts is quite different from Kevin Warwick's of engineering and computer science, but central to the work of both men is the transhumanist notion of transcending the human form through technology.

Neil Harbisson has incorporated a cybernetic appendage into his life since 2004. He does not think of the antennae integrated into his skull as a device, but simply as a part of his body. Neil, a musician and artist, was born with a form of colour blindness called achromatopsia. In 2003, he met Adam Montandon, then a student of the University of Plymouth's MediaLab Arts program. Together they built the first iteration of the eyeborg. The eyeborg was subsequently osseointegrated — permanently attached to the skull. Over the past 10 years, Harbisson has fully integrated the extra senses he has acquired through his antennae into his work and life. It translates visual colours into sound waves, allowing him to 'hear' the world around him. It can also sense hues not visible to the eye, such as ultraviolet and infrared – thereby extending his capabilities beyond that of regular vision. He has been granted a UK passport featuring the antennae in its official photograph, significant in that it legitimizes the antennae as a body part as opposed to a device. Neil spoke with us about the nature of becoming a cyborg. He sees cyborgism as three types of possible union — a union between cybernetics and the brain, which is invisible; a union between cybernetics and the body, which is visible; and a union between the cyborg and society, which is the slowest type of union because it is about societal acceptance. (N. Harbisson, personal communication, September 1, 2014) Neil Harbisson and his associate Moon Ribas founded the Cyborg Foundation, an organization that promotes sense bridging and extension of human capabilities by applying technology to the body.

In our conversations with experts, we interviewed two others with devices implanted in their bodies: Adi Roberston, who has a magnet and a NFC chip implanted in her finger and hand, and Amal Graafstra who has two RFID chips in his hands. Amal runs the website Dangerous Things, which sells implantable kits online. He also works on outreach and education around implantables and on making implantable devices and processes physically safer.

Christopher Jones/Telegraph Media Group Jan 2005

Figure 7: Neil Harbisson and Adam Montandon

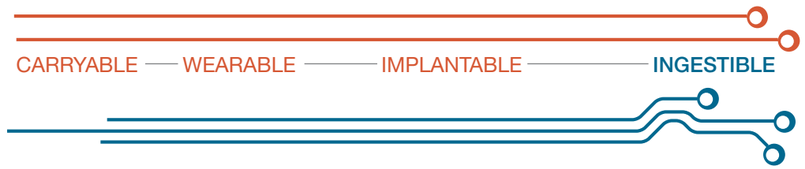
re:publica: www.flickr.com

Figure 8: Cyborg Foundation's Neil Harbisson and Moon Ribas

Courtesy Vox Media, Inc. and www.TheVerge.com

Figure 9: Adi Robertson, implanted magnet

INGESTIBLE



The ingestible sphere is the most nascent in terms of technological development, especially with regard to applications outside the medical realm. Not surprisingly, we did not come across any examples of people ingesting technology for purely augmentative purposes. We will however discuss an artistic ingestible event later in this section. Keeping in mind that we are not medical researchers and that this is a vast and complex field, we determined there are two predominant types of ingestibles that 'fit' within the electronic/networked part of our scope. The first are pill cameras that capture images and transmit them as they travel through the body, the second are pill sensors that measure biometric data and transmit that data for analysis.

An example of a pill camera (there are several) is the PillCam developed by Israeli company Given Imaging Ltd., approved by the FDA in the United States in the early part of 2014 and commercially available in Canada as well. (CBC News Health, 2014) It's a capsule that contains two colour video cameras, a light and a battery. As the pill travels through a person, images are transmitted to a recorder worn on a belt, outside the body. There are versions of PillCam for use with different parts of the human gastrointestinal tract. The PillCam is active for about 10 hours and passes with excretion. Doctors can download and analyse the recorded images.

An example of an ingestible sensor was developed by Proteus Digital health. It received European clearance in 2010 and FDA approval in 2012, though it's unclear if it is presently in use anywhere in the world. The sensor itself is one part of a 'Digital Health Feedback System', consisting of the ingestible sensor, a wearable patch, and a device like a tablet or smartphone. The sensor is powered organically by using stomach fluids to complete a power circuit with two conductive materials (magnesium and copper). The sensor is inserted into a capsule, when the capsule is swallowed, the patch picks up a unique identifying number to signal it has been taken. Additionally, the patch monitors other biometric information like heart rate, temperature, activity and rest. (Proteus, n.d.) Theoretically, applications on a smartphone or other device would then analyze and use the data.

No actual applications for this technology could be found during the course of our data gathering, but the expected use cases as listed on the Proteus corporate website could include patient monitoring, medication adherence, consumer wellness, fitness tools, clinical trials, and home/device automation.

David Yeo T. B.: www.flickr.com

Figure 10: PillCam capsule camera

We discovered only one well-documented, non-medical example of an ingestible, the performance art event 'Stomach Sculpture' completed in 1993 by Stelarc. Stelarc briefly mentioned Stomach Sculpture in our interview with him, where he described the installation as an event of machine choreography inside the human body (Stelarc, personal communication, August 2014) Stelarc described 'Stomach Sculpture' more fully in an interview in the journal *CTheory* in 1995:

> **CTHEORY:** *Stelarc, your latest work centers around a sculpture you built for your stomach. What was the impetus for creating a sculpture to display inside your body?*
>
> *Stelarc: I've moved beyond the skin as a barrier. Skin no longer signifies closure. I wanted to rupture the surface of the body, penetrate the skin. With the stomach sculpture, I position an artwork inside the body. The body becomes hollow with no meaningful distinction between public, private and physiological spaces. The hollow body becomes a host, not for a self or a soul, but simply for a sculpture. [...]*
>
> **CTHEORY:** *Can you describe the stomach sculpture?*
>
> **Stelarc:** *It's built of implant quality metals such as titanium, steel, silver, and gold. It is constructed as a domed capsule shell about the size of a fist. The shell contains a worm-screw and link mechanism and has a flexidrive cable connected to a servo motor controlled by a logic circuit. The capsule extends and retracts opening and closing in three sections. An embedded instrument array, light and piezo buzzer make the sculpture self-illuminating and sound-emitting.*
>
> **CTHEORY:** *How did you insert it?*
>
> **Stelarc:** *Very slowly. The stomach sculpture is actually the most dangerous performance I've done. We had to be within 5 minutes of a hospital in case we ruptured any internal organs. To insert the sculpture, the stomach was first emptied by withholding food for about 8 hours. Then the closed capsule, with beeping sound and flashing light activated, was swallowed and guided down tethered to it's flexidrive cable attached to the control box outside the body. Once inserted into the stomach, we used an endoscope to inflate the stomach and suck out the excess body fluids. The sculpture was then arrayed with switches on the control box. We documented the whole performance using video endoscopy equipment. Even with a stomach pump, we still had a problem with excess saliva. We had to hastily remove all the probes on several occasions.* (Atzori & Woolford, 1995)

In addition to the artistic (which we think will remain a rare use case) and the health care use cases, we've seen weak signals for another possible use case for ingestibles — temporary authentication. At the D11 conference in 2013, Motorola senior VP Regina Dugan discussed the frequency of having to authenticate over the course of an average day, and the fact that authentication is clunky and awkward and hasn't changed fundamentally in years. "'Electronics are boxy and rigid, and humans are curvy and soft', Dugan said. So how can a password be more accessible by becoming more like a human body? Perhaps you attach it to the skin as a tattoo, or you swallow it as a pill. And this is less science fiction than reality, at least in Motorola's lab and on the D11 stage, where Dugan showed off both products." (Gannes, 2013) The tattoo and pill mentioned by Dugan are speculative and not in production.

IN SUMMARY

Overall, our context for wearable, implantable and ingestible devices emphasized objects that are augmentative rather than restorative — articles that are not a therapy but an enhancement to human capability. We have also chosen to focus almost exclusively on devices that have computational capacity and are connected to some form of network, though we have looked at a very few ‘dumb’ devices like implanted magnets, in light of their role as a precursor technology, or for the psychological or emotional impact they may have on their users. The context we’ve outlined hints at some of the drivers of change that will be referred to in subsequent parts of this study — that computational capability will increase; components will become more materially varied, smaller and less expensive; and that the western zeitgeist will tend towards incorporating larger and larger data sets and connected information into our social and cultural fabric. Intimate technology has the effect of extending our capabilities in many ways. From the middle of our continuum — the implantable — the notion of actually transcending the human form by integrating technology with the body, or cyborgism, emerged. The possibility offered by cyborgism to mitigate physical deterioration and extend longevity is one of the central principles of the school of thought known as transhumanism.

WHY 2044

We’ve chosen to explore our question against a 30-year time horizon, placing our scenarios in 2044.

30 years in a technology-centered domain is quite far out. Several of our expert interviewees, when asked to speculate about the state of wearable, implantable and ingestible devices 30 years into the future, amusedly stated they had trouble thinking even a few weeks ahead. We felt that 2044 is far enough away that we could be speculative and creative; it allowed us to stretch imaginatively but still maintain plausibility. It is highly unlikely everything will change so much in the next 3 decades that our lives will be unrecognizable.

According to famous transhumanist and Google Director of Engineering, Ray Kurzweil, 2044 is the year before the speculated advent of the technological singularity in 2045. The Singularity is a hypothetical construct, but as Om Malik said, “We imagine what the future looks like and then we try and build it.” (Malik, 2014)

SPECULATIVE DESIGN FORESIGHT METHODOLOGY

> *At the intersection of the disciplines of design and futures, a set of practices are currently emerging whose key feature is the creation of material representations of speculative future worlds.*
>
> Jonathan Resnick

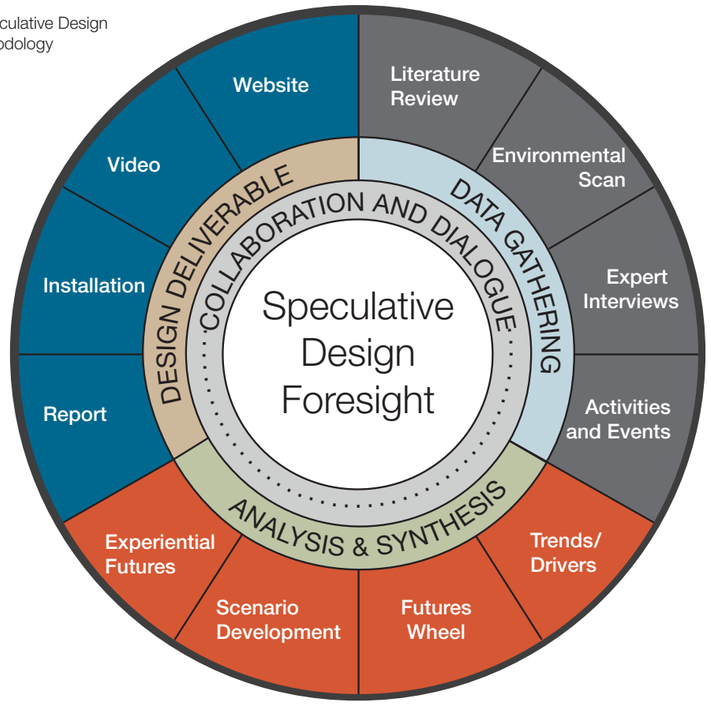
Strategic foresight, experiential futures, design fiction, design futures, speculative design, alternative futures… OCAD University's Strategic Foresight and Innovation program employs concepts and methods from a number of known practitioners and theorists in the foresight, futures and design domains. In terms of process, our adjudication of this field is that it exists in a state which affords flexibility and fluidity in methods, but is also hard to define. For the purposes of this project, we selected a combination of techniques that would allow us to approach the topic area in a way that is based on evidence, but is also immersive and/or provocative. We think of this approach as ***speculative design foresight***. Speculative design foresight is grounded in research as well as hypothetical and creative. It combines themes that are imaginary, plausible and concrete. According to internationally known futurist Richard A. Slaughter:

> *Strategic foresight is the ability to create and maintain a high-quality, coherent and functional forward view and to use the insights arising in organizationally useful ways; for example: to detect adverse conditions, guide policy, shape strategy; to explore new markets, products and services. It represents a fusion of futures methods with those of strategic management.* (Slaughter, 1997)

Strategic foresight as outlined by Slaughter is organizationally useful, but to our minds, not entirely engaging. Enter design futures! We are user experience designers with a combined 30+ years of acquired expertise in applying design principles to (mostly) digital environments. Our toolkit includes primary research through observation, contextual inquiry and stakeholder interaction; visioning and discovery activities; persona and user journey development; usability testing and visual design – activities that infuse any strategic endeavour with a holistic view of the people and systems in play, as well as conveying insight in an appealing and understandable way that people remember. Our background in the design world draws us towards the experiential and fictional embodiment of a foresight process. To that point, for our scenario creation and our experiential futures we looked to two dynamic partnerships in the foresight and design worlds – Coates & Jarratt and Dunne & Raby. How we employed their methods is described in the Analysis and Synthesis section beginning on page 44.

'Speculative' is the other term in our approach. We embrace the concept of the speculative to mean notional, hypothetical, or conjectured; it can also mean projected, unpredictable and abstract. By including speculation in our approach, we acknowledge the value of imagination and creativity in addition to facts and figures. Speculation is especially important to foresight and to this project about the future of technology. As futurist Jim Dator puts it, "Any useful idea about the future should appear to be ridiculous." (Dator, 2007) And as author, inventor and futurist Arthur C. Clarke surmised, "Any sufficiently advanced technology is indistinguishable from magic." (Clarke,1977)

Figure 11 - Speculative Design Foresight methodology



We tackled our project in three phases: data gathering, analysis and synthesis, and design deliverable. Importantly, we collaborated as a team of two throughout the entire process. We feel that collaboration and dialogue is essential to speculative design foresight. This is a methodology practiced best with others!

DATA GATHERING

In the data-gathering phase we undertook a literature review, an environmental scan, and interviewed experts in various fields related to our topic. This phase was not linear, but iterative – we revisited literature and scanned for signals as new understanding or opinions emerged from the expert interviews, and even from steps in the subsequent phases.

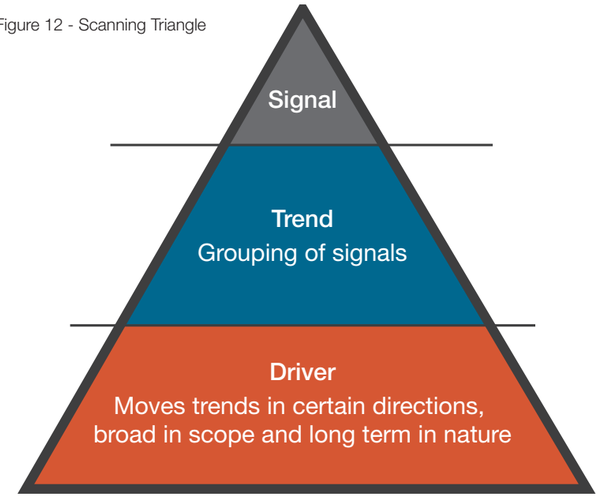
LITERATURE REVIEW

We began with a literature review. This helped to shape our understanding of the overlapping fields our topic encompassed and helped mold our research question. It also helped us identify gaps and expose opportunities for further investigation. As discussed in the previous Context section, gaps we identified included very little information about ingestibles, ambiguity around the meaning of transhumanism, and the question of dubious use cases for many devices that proliferate the market.

ENVIRONMENTAL SCAN

Foresight strategists have varied ways of conducting horizon and environmental scans. Some foresighters don't make a distinction between horizon and environmental scanning, but our interpretation of the difference is in terms of scale. Horizon scans take into account very macro movements, like climate change or population growth. An environmental scan is much smaller and more attentive to a particular domain. We bound our scan first by using the terms in our research question, and second by creating a visualization of what was 'in' and 'out' of scope. Then, taking Peter Schwartz's and Maree Conway's approach as a basis, we began "systematically exploring and interpreting the external environment to better understand the nature of trends and drivers of change and their likely future impact on your organisation." (Conway, 2009). While we did not undertake our scan from the perspective of a particular organization, we followed Conway's basic 'scanning triangle'.

Figure 12 - Scanning Triangle



(Conway 2009)

The apex of the triangle is searching for signals. A signal is a 'hit of information' that pinpoints a specific example of a possible trend. We cast a wide net and reviewed hundreds of sources, including academic journals, reports, books, websites, wikis, forums, conferences, TEDtalks, podcasts, films, television series, and short stories. Of course, simply finding signals does not advance an investigation without some form of framework for analysis. A common framework used in foresight is STEEPV, where signals are sorted into the following categories: Social, Technological, Economic, Ecology (or Environment), Politics and Values. We did a first cut of categorization of signals using STEEPV, and included the large number of 'biological' hits we found in the ecology category. Our use of STEEPV as a brainstorming tool was not unique, though this is not the original purpose of the framework. (Loveridge, 2002). We found the STEEPV classification was initially useful as an organizational structure, but it didn't lend great insight about the human implications of our research question when used at such an early stage of data gathering and analysis. Loveridge asserts a formal STEEPV process is "best used by a close knit group meeting very frequently to work with a complex set of 'mini-scenarios' each of which describes a particular direction of change or an end state or both." (Loveridge, 2002) If this was a project conducted on behalf of or within an organization, STEEPV could be employed by the working team in conjunction with our scenarios or experiential futures to create strategies.

EXPERT INTERVIEWS

Through our literature review and environmental scan we identified experts in the field of wearable and implantable technology. We found very limited resources in ingestible technology and none who would speak with us. We created a sampling frame for experts based on matching our areas of interest against their expertise. The sampling frame is comprised of ten categories. Some experts spanned many of the categories, while others were more focused in one or two fields. The interviews were semi-structured; they followed the same general questionnaire, but discussion sometimes gravitated to respondents' specific areas of interest. Each interview was between 45 and 60 minutes, and conducted via Skype. Most interviewees consented to being recorded, are featured in the video accompanying this project and available at http://youtu.be/oYhJteLt4yQ.

The recurring concepts that arose from the interviews, fed into our trends and scenarios.

Table 1 - Expert Sampling

WEARABLES	Art/Performance	Innovation/Experimental	Academic	Transhumanism	Biometrics	Inventors	Lead Users	Privacy/Security	Bridging Senses	Makers/Hackers
Adam Montandon		✓	✓	✓		✓	✓			
Dr. Isabel Pedersen		✓	✓						✓	
Tom Emrich		✓					✓			
Eric Boyd		✓				✓	✓		✓	✓
Noah Feehan	✓	✓				✓	✓			✓
Dr. Cosmin Munteanu		✓	✓							
Amal Graafstra		✓		✓		✓	✓		✓	✓
Adi Robertson		✓					✓		✓	✓
Ariel Garten		✓			✓	✓				
Karl Martin		✓	✓		✓	✓		✓		
Chris Dancy		✓		✓	✓	✓				
IMPLANTABLES										
Stelarc	✓	✓	✓	✓		✓	✓		✓	✓
Rob Spence	✓	✓				✓	✓			
Neil Harbisson	✓	✓		✓		✓	✓		✓	
PHILOSOPHY / PSYCHOLOGY / SOCIOLOGY										
Dr. Anders Sandberg			✓	✓						

ACTIVITIES AND EVENTS

To our minds, speculative design foresight is an active practice. While a vast amount of data and knowledge can be gained through desk research, getting out into the environments where signals are found and trends are playing out is extremely valuable. To that end, we participated in a variety of events focused on wearables, and also on foresight. This helped us make connections with some of the experts we later interviewed and gave us insight into the issues and recurring concepts at play in the communities involved in our topic area.

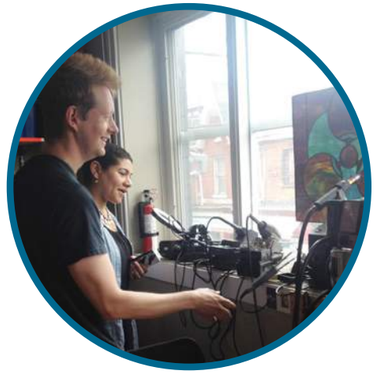


Figure 13: Hacklab Toronto visit

Figure 14: Google Glass day

Figure 15: We are Wearables event at MaRs

Figure 16: Karen testing Google Glass

Figure 17: Shannah testing Google Glass

All photos: Maxwell and Segal

DESIGN DELIVERABLES

The design deliverables are the final pieces to our process. These are the items that encapsulate all activities in a speculative design foresight exercise and preserve them for the access and enjoyment of others. Our design deliverables for *The Next Familiar* are this report, a video of our expert interviews, a website and an installation featuring our experiential futures.

REPORT

WEBSITE

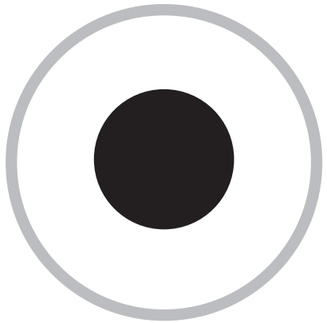
http://thenextfamiliar.com

VIDEO

http://youtu.be/oYhJteLt4yQ

EXPERIENTIAL INSTALLATION - 5 EXHIBITS

Dark Circle (page 94)



- A draped plinth
- On it sits a transparent jewel box, connoting great value
- The Dark Circle is nestled in the box
- A textual explanation of the Dark Circle app is displayed

Other Self (page 96)

- On the wall, a large full colour print of the cover and inside spreads of a tabloid magazine from the future
- Magazine is also displayed in several copies nearby for easier reading

I Make People (page 102)

- On a table or plinth, several flat-pack cartons are displayed
- Bubble wrap peeks out from the boxes
- A textual explanation of what the boxes contain is displayed

Feels Good Like A Memory Should (page 104)

- On the wall, photojournalist images of a crowd of protesters
- A listening station offers an audio snippet of the protest
- A textual explanation of the protest is displayed

Salon Modifica (page 106)

- A life-size diorama of a partial view of an augmentation salon
- On the wall, a permit, a service list and other imagery
- In the diorama, salon furniture and accoutrements

OUR COLLABORATION

Our team of two consisting of Karen and Shannah, advised by Suzanne Stein with Adam Montandon as our second advisor, worked collaboratively throughout – from the proposal stages to the design and installation of our exhibit at the OCAD University Graduate Gallery. We conceptualized, workshopped, wrote, critiqued, designed and revised every part of the project as a team.

The tools we used were vital to our real-time collaboration. We used SMS for quick conversations and ideas throughout the day. We set up a Google drive and created documents for sharing and review. We used Google-talk to communicate in real-time when working separately. Our tool for collaborative environmental scanning was an Evernote notebook, where we collected the signals pertinent to our topic area. We used Skype and Call Recorder to interview and record our experts. We used this consistent form factor for all of our expert interviews regardless of their geographical location, in order to be able to collate the interviews into a documentary style video. When inviting the experts to be interviewed, we used Survey Monkey to gain consent for both using their insights and for the recording of the interview.

Our in-person meetings were held every Wednesday and Sunday from June to October, 2014. We began each meeting with an agenda of what we wanted to accomplish for that day, and a review and critique of what we each had completed for that day. We concluded each meeting with what each of us would accomplish prior to the next meeting. In the last four weeks leading up to the defense we also met on Saturdays and in the evenings when necessary.

As part of our proposal we created an initial project plan. Throughout the project we continued to hone and shape the project plan as it was the document that guided us to the end date of October 9th, 2014.

Our Speculative Design Foresight methodology consisted of data gathering, analysis and synthesis and the creation of design deliverables.

Data Gathering
In our literature review we both gathered and shared literature that was wider and more varied than our topic area. As we shared, discussed and reviewed our literature in the form of academic journals, books, web articles, and TedTalks we began to narrow down and focus in our what we would include in our scope and what we wouldn't focus on. This helped us contain our project and further refine our research question. We both collected hundreds of signals throughout our environmental scan. This was not a linear process as we continually found literature and collected signals throughout our project. We created a sampling grid of where we wanted to focus our efforts in regards to the experts we sought out. We invited over 25 experts to participate in our research, and 15 agreed to be interviewed. We attended activities and events together and separately that spanned the area of our intended research.

Analysis and Synthesis
When brainstorming and bringing all of our data together we used whiteboards and stickies where we diverged and then converged. In a Google spreadsheet, we formulated a coding system for our expert interviews, and while reviewing the interviews, we captured words, phrases, patterns and concepts that were repeated along with anything that might be surprising or counter to what we saw in the literature and environmental scan. We brought all of the data gathering activities together and began to see recurring concepts emerge, as well as trends and their drivers, which are the factors that contribute to the trends. We developed futures wheels for each of the trends and considered many first and second order implications for each of the trends. Together through workshops, we then moved into our scenario development and experiential futures creation.

Design Deliverables
We have four deliverables, the MRP report, an installation, a video, and a website. Karen was responsible for the creation and execution of the MRP report using InDesign, and Shannah was responsible for the creation and execution of the expert video using iMovie. However, for both the video and report, the brainstorming, decision-making and art direction was a collaborative process. The website www.thenextfamilair.com houses the report, a link to the expert video and pictures of the installation. The installation in the graduate gallery was again a collaborative process that took 3 days to build including the printing of the artwork, purchasing items, and set designing for the experiential futures.

EXPERTS

> *I sometimes find that in interviews you learn more about yourself than the person learned about you.*
>
> William Shatner

We are indebted to our experts for graciously participating in and allowing us to audio and video record the interviews. Please refer to our video for our experts' thoughts and insights in the domain of wearable, implantable and ingestible technology. Our sampling frame consisted of the intersection of our areas of interest, and the experts areas of expertise in the following ten areas:

- Art/Performance
- Innovation/Experimental
- Academic
- Transhumanism
- Biometrics
- Inventors
- Lead Users
- Privacy/Security
- Bridging Senses
- Makers/Hackers

OUR EXPERTS

Adam Montandon
Associate Professor of Innovation, Erhvervs Akademiet Lillebælt, Odense

Adi Robertson
Writer for the Verge, New York

Amal Graafstra
Technologist, Author and Speaker, Seattle

Dr. Anders Sandberg
James Martin Research Fellow, Future of Humanity Institute, Oxford University, UK

Ariel Garten
CEO, InteraXon Inc., Toronto

Chris Dancy
The Most Connected Human on Earth, Chief Digital Officer, Healthways, Franklin, Tennessee

Dr. Cosmin Munteanu
Associate Director, Technologies for Aging Gracefully Lab (TAGLab), Assistant Professor, Institute for Communication, Culture, Information, and Technology, University of Toronto, Toronto

Eric Boyd
President, Hacklab.to, Founder, Sensebridge, Toronto

Dr. Isabel Pedersen
Canada Research Chair in Digital Life, Media, and Culture and Author, Professor at University of Ontario Institute of Technology, Oshawa

Karl Martin
CEO, Bionym Inc., Toronto

Neil Harbisson
Founder, Cyborg Foundation, Barcelona

Noah Feehan
Maker, Artist, Developer, New York

Rob Spence
Filmmaker, Toronto

Stelarc
Performance Artist, Director of Alternate Anatomies Lab, Curtin University, Perth

Tom Emrich
Emerging Technology Consultant, Founder, We Are Wearables, Toronto

Watch our video of experts at: http://youtu.be/oYhJteLt4yQ

“The cyborg stuff… it was more about accidental experimentism... just looking at the potential of technology, readily available, cheap technology, and seeing how you can push human potential with a bit of imagination.”

©Adam Montandon

ADAM MONTANDON

Associate Professor of Innovation, Erhvervs Akademiet Lillebælt, Odense

©Fred Tablado

zeitelhack: www.flickr.com

Adam Montandon is an expert in digital futures, a consultant, author and educator. He has a cross-discipline arts and science bachelor degree from Plymouth University’s MediaLab Arts, a multimedia program known for its experimental nature. He then received a Master of Science degree from the Institute of Digital Arts and Technology in the UK. In 2005, Adam founded the HMC MediaLab Organization, a digital arts community which won the Best of British award within 2 years of its inception. Upon HMC’s acquisition by Twofour Group, a large UK media company, Adam headed up research and development for numerous innovation and future-focused projects. He has lectured and been a keynote speaker in Europe and around the world. Adam’s work has been featured in documentaries, magazines, newspapers and TV programs. Together with colour-blind artist and musician Neil Harbisson, Adam created the ‘Eyeborg’ project, a device that allows Neil to “see” colour through sound. Adam’s work with cyborgs has been featured in several documentaries. He is currently Associate Professor of Innovation at Erhvervsakademiet Lillebælt (E.A.L), Denmark, where his focus is transformation through education and changing mindsets.

“I love the magnet... its a sixth sense in that its not a very big sixth sense but its really interesting. I genuinely feel things that I wouldn’t have before and... changes how I interact with the world.”

https://plus.google.com/+AdiRobertson

ADI ROBERTSON

Writer for the Verge, New York

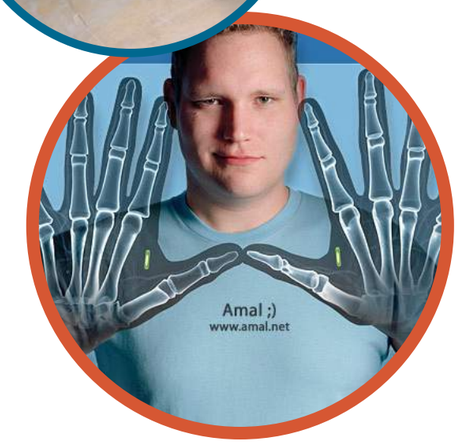
Bottom photos, Courtesy Vox Media, Inc. and www.TheVerge.com

Adi Robertson is a reporter with TheVerge.com, an online news source that focuses on the intersection of technology, science, art, and culture. Adi’s writing focuses on nerd culture, tech policy and gaming, and she is also interested in biohacking. For The Verge, she has written about virtual reality including Oculus Rift, 3D printing, and cyborg implants amongst many other topics. We found Adi through her article “Cyborg conversion incomplete: my life with finger implants”, where she discusses the mundane pleasure she derives from her magnetic and NFC implants.

“We’re in this mode of taking the excitement over the idea that we can enhance and modify ourselves and channeling it through established professional channels with tested, verified, safe materials and gear. That’s our mission at this point…”

AMAL GRAAFSTRA

Technologist, Author and Speaker, Seattle



All photos, ©Amal Graafstra http://amal.net

Amal Graafstra began implanting RFID technology in 2005. It was something that started very simply — he looked at his keys and felt they were archaic compared to the technological advancements of the time, and decided to explore taking advantage of biometric technology to open his front door. Through research and investigation, he found a safe supplier of implantable RFID chips, and had a doctor insert one in his hand. A friend saw him use his hand to open his door, posted about it online, and the Internet picked it up. This started Amal down the path to founding Dangerous Things. In the biohacking and maker communities there is a lot of discussion around safety, some people acquire questionable technology from dubious sources. Individuals have been known to implant toxic glass, get infections, experience rejections and breakage, and put poison into their bodies. The Dangerous Things website sells implantables that are safe, tested and sterile. Amal created an implantation procedure guide, and is currently building a partner network consisting of professional piercers and body modification artists to implant chips in their clients. Amal Graafstra is an author and spokesperson for safe implantation at hacker spaces, universities and TEDx talks.

“The total amount of questions and problems you can face in real life is way bigger than what any particular device can do… On the other hand when we link up to the rest of the world, suddenly we have literally billions of minds available to solve problems. It’s way more powerful.”

David Orban: www.flickr.com

DR. ANDERS SANDBERG

James Martin Research Fellow, Future of Humanity Institute,
Oxford University, UK

Anders Sandberg: www.flickr.com

Tasha Dhanraj: www.flickr.com

Dr. Sandberg holds a doctorate in computational neuroscience from Stockholm University. His background is in computer science, neuroscience and medical engineering and his areas of interest include cognition, neuroethics, collective intelligence and public policy. Currently attached to the philosophy department at Oxford University, his work is around the ethics and societal impacts of human enhancement and emerging technology. Specifically, he is working on a collaboration examining the systemic risk of risk modeling – or how to think about conditions that are deeply uncertain but highly impactful to the human condition. Dr. Sandberg’s sprawling set of interests also has him working on simulations about the far future of the universe and sustainable practices for the next trillion years. A devoted transhumanist, Dr. Sandberg was instrumental in crafting “The Transhumanist Declaration” with Nick Bostrom and other founding members of the organization now known as Humanity+. He writes extensively on ethics, transhumanism, love, the meaning of life, artificial intelligence, whole brain emulation and systemic risk.

“Wearables certainly are not going away. Wearables really just mean that we are getting smarter about marrying technology with natural human forms and behaviours.”

LeWeb: www.flickr.com

ARIEL GARTEN

CEO, InteraXon Inc., Toronto

TEDx SanDiego: www.flickr.com

Ariel Garten has a background in psychotherapy, neuroscience, art and fashion, and is the CEO and cofounder of InteraXon. InteraXon focuses on brain-controlled interfaces (BCI) and creates both software and hardware in this space. Their flagship product is the Muse headband, a consumer facing brain sensing technology that helps people better understand their stress through technology. The headband tracks brain activity in real-time and sends data to a smartphone or tablet app called Use Calm. The app then gives the wearer feedback in the form of exercises to improve attention and working memory and to decrease stress.

Bottom photos: Sean Dreilinger: www.flickr.com

“I have had rapid meaningful transformation in my own life, whether it’s the weight loss or the smoking or other things that I don’t do or do do now. In a relatively short amount of time – less than 2 years... and oddly enough I can’t stop it, I keep getting thinner, I keep getting more articulate, I keep getting faster...”

CHRIS DANCY

The Most Connected Human on Earth
Chief Digital Officer, Healthways, Franklin, Tennessee

All photos, Christopher M Dancy: www.flickr.com

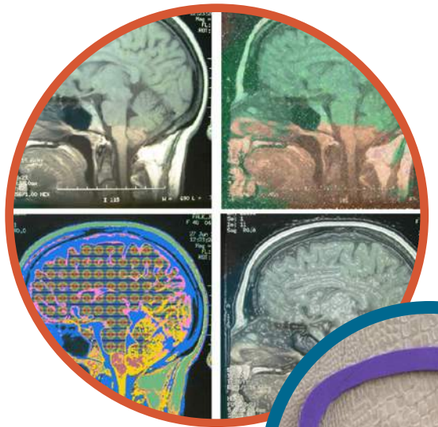
Chris Dancy personifies the quantified self. A former IT operations professional, he oversaw complex enterprise networks, then moved into Internet and cloud computing. Around 2010, while still working in IT, he began a personal project to map his own human behaviour. He looked at simple things like eating habits, how long he was stationary, and movement patterns, essentially anything he could measure using a digital touch point. He was interested in understanding his own behaviour in his environment, which led him to speak and consult in the area of self-quantification. In 2014, Chris Dancy left IT operations to take a position with Healthways Inc., a company that provides technology based health and wellness solutions. Chris is passionate about designing for habit and behaviour, not simply making tools. He wants to understand how to influence the delivery of wellness and use non-traditional tools to provoke real changes in health issue prevention and treatment.

“Things change in terms of social perception, in terms of what we find comfortable... we might not be interested in going in one direction, because right now we are rejecting it from a social convention perspective. But things that would pop up in the future in terms of technological capabilities maybe will change the way we interact...”

http://www.cs.toronto.edu/~mcosmin/

DR. COSMIN MUNTEANU

Associate Director, Technologies for Aging Gracefully Lab (TAGLab)
Assistant Professor, Institute for Communication, Culture, Information, and Technology,
University of Toronto, Toronto



Julie Falk: www.flickr.com

Marc Wathieu: www.flickr.com

Dr. Cosmin Munteanu focuses on speech and natural language interactions that transcend media and format, allowing people to interact more naturally with both information and technology. He is a University of Toronto, Institute for Communication, Culture, Information, and Technology Assistant Professor, and also holds positions with the National Research Council as a Research Officer and is a Research Associate with the University of New Brunswick.

“Anyone who’s done stuff in the real world knows that almost every idea you have is a terrible idea. You need to experiment, you need to test, you need to refine, you need to discard old ideas and have new ones, you need to interact with other people and real things...”

Rain Rabbit: www.flickr.com

ERIC BOYD

President, Hacklab.to
Founder, Sensebridge, Toronto

Both photos, Planetart: www.flickr.com

Eric Boyd wears many hats. He is founder of Sensebridge, a company that makes electronic jewelry that responds to the wearer. Sensebridge’s flagship products are Heart Spark, which illuminates in time to the wearer’s heartbeat, and Sound Spark, which illuminates in time to the wearer’s voice. A devotee to technologies that grant additional senses, Eric also created North Paw, an anklet that gives wearers the ability to sense north — not simply access information about which way is north, the way a smartphone or a regular compass does, but to actually feel north as a sense of absolute direction. Eric Boyd is also the President of Hacklab.to, a tech community space in Toronto, where makers, artists, coders, designers and others experiment and work together. Additionally, he speaks and gives workshops on various technologies like 3D printing and Arduino. In August 2014, Eric and three collaborators created an add-on for 3D printers called the Retro Populator, which places electronic components in the right places on circuit boards, an invention that is, in essence, one step on the road towards a future when hobbyists or very small manufacturers can 3D print electronic devices.

“Wearables have been designed and imagined for more than 20 years… there were many researchers across the world believing and working towards the future that we’re going to wear technology on the body, but we didn’t necessarily go through the phases of asking all the questions of how will they affect not only business and industry and the future of the technology itself, but how will they affect identity and personhood and relationships and memory or imagination...”

http://technologyandsociety.org/members/2013/8/12/dr-isabel-pedersen

DR. ISABEL PEDERSEN

Canada Research Chair in Digital Life, Media, and Culture
Author, Professor at University of Ontario Institute of Technology, Oshawa

Bottom images: courtesy of Isabel Pedersen

Dr. Pedersen began her work in the digital arena with a design focus. In the late 1990s, when it started to become evident we were going to wear our computers, she found much of the discourse and experimentation with wearables was in the domain of a technical elite — those with the means and ability to design and build their own computers, and with a certain idea of what a wearable computer would look like and do. The area was somewhat out of the grasp of researchers in the social sciences, humanities and arts. Isabel Pedersen embarked on a process of understanding wearable technology from a critical cultural studies standpoint, examining how wearables and other forms of digital media humanize and dehumanize us as individuals and as a society. She is the author of *Ready to Wear: A Rhetoric of Wearable Computers and Reality-Shifting Media*, a book that investigates how we presuppose our technology — emerging devices and their attending use cases, enter the public discourse, and demand attention or even adoption before we have a chance to comprehend or question their effect.

“One of the ways I’ve looked at it is, if you were to essentially reengineer the human body for the modern world, what would you do? Well one of the things you would do is give an easy way of securely communicating your identity to other things because it’s a gap right now. Using passwords to communicate to your devices that you’re you is kind of ridiculous considering how we’ve moved forward on other technological fronts.”

http://www.getnymi.com/company/

KARL MARTIN

CEO, Bionym Inc., Toronto

http://www.getnymi.com

http://www.getnymi.com

Karl Martin heads up Bionym, a start-up in the wearable space. Bionym is the creator of Nymi, a device that uses heartbeat as a unique identifier for authentication. Every person’s heartbeat is unique. Placing Nymi on the wrist and touching its sensor with a finger completes an electrical circuit, allowing the device to recognize the wearer’s cardiac rhythm. Other devices can then recognize the wearer, providing secure authentication. The value proposition for Nymi lies in persistent authentication. Nymi has the potential to make the constant transactional authentication we engage in via passwords, codes, fobs, keys, secret questions and mother’s maiden name obsolete – a captivating idea. Bionym has a strong ethos around user-driven design and privacy concerns. Their entire product is based on the notion of the wearer being in control of their own identity. Karl Martin is enthusiastic for the potential of wearables. To him, the key to moving wearables forward is in creating actionable value for people in their everyday lives. There must be apparent value to compensate for the cognitive load of managing another device. The challenge many wearable entrepreneurs face is determining and then demonstrating that after the initial moment of cool, there is long-term value in their device or platform.

“What I have is not a wearable technology, but a body part. So body parts are permanent and they also create a sense and in my case the sense is also permanent.”

Neil Harbisson: www.flickr.com

NEIL HARBISSON

Founder, Cyborg Foundation, Barcelona

http://munsell.com/color-blog/neil-harbisson-cyborg-interview/

Neil-harbisson: www.flickr.com

Neil Harbisson embraces the term cyborg. He and collaborator Moon Ribas are the founders of The Cyborg Foundation, dedicated to education and promotion of cybernetic transformation. Neil has augmented his senses and body through the acquisition of an alternate body part. It resembles an antenna, and is osseointegrated into his skull – meaning surgically attached to the occipital bone. Born with a form of colour-blindness called achromatopsia, Neil has only ever seen in grayscale. The antenna allows him to perceive hues as sound, through bone conduction, not through his ears. Thus it is truly a sixth sense. Neil Harbisson holds a UK passport that is unique in that it ratifies the antenna as a legitimate body part and not a tool or device. The cyborg state is comfortable and exciting to Neil, he feels a greater connection with the natural world due to his ability to perceive more parts of it. He is actually mildly surprised that the acceptance and embrace of cyborg extension has not progressed more swiftly, and encourages others to experiment with sense bridging or augmentation in whatever small ways they can.

“I’m interested in the way that wearables are perceived by others and the interactions they engender by dint of their visibility… the work that I’m doing is trying to make devices that really need to be seen by others in order to work, in order to deserve to be on the body…”

Linkedin profile image: Noah Feehan

NOAH FEEHAN

Maker, Artist, Developer, New York

Jean-Baptiste LABRUNE: www.flickr.com

Courtesy of Noah Feehan, akamediasystem

Noah Feehan is a creator of many things, including objects, videos, and code. He was a student of video and new media art at Harvard, and did graduate studies at the MIT Media Lab, where he worked in the Hyperinstruments group on locative media art, performance robotics, rapid prototyping, and interface design. As a maker at the New York Times Research and Development Lab, Noah worked on a project called Blush, a social wearable. Blush is an object that occupies a space between the wearer’s online and offline behaviours. Designed to be visible and an active part of interaction between humans, Blush listens to words around it and lights up when it ‘hears’ certain cues. Thus, Blush adds a layer of contextuality to human exchanges. Noah’s work on Blush probes the difference between wearables that hide – like many activity trackers that are designed to vanish into a pocket or strap, and those that reveal. He is also interested in understated haptic interactions like that offered by Ringly – a ring, attractive in it’s own right, that notifies the wearer when an important update or call is sent to their smartphone.

“Be nice to cyborgs because they are the ones who will be leading the fight against the robots... when they come for the humans.”

http://www.gizmodo.com.au/2009/04/filmmaker_gets_his_cyborglike_led_prosthetic_eye-2/

ROB SPENCE

Filmmaker, Toronto

Campus Party Brasil: www.flickr.com

TEDx Brussels: www.flickr.com

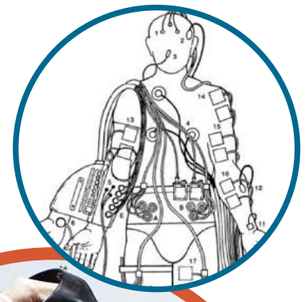
Rob Spence is a documentary filmmaker who counts amongst his tools of the trade a tiny camera housed in a prosthetic eye. A little wryly, Rob acknowledges he’s considered a cyborg, a state he’s come to in part by happenstance, in part by design. As a young adult, a gun accident claimed the vision in his right eye. Several years later, as a one-eyed filmmaker, he initiated a project to construct a camera eye and worked with an ocularist and several engineers to create ‘eyeborg’. The device is by our definition a wearable, as it can be put in or removed at will. The eyeborg is not connected to Rob’s brain or biological systems in any way. In 2011, to mark the launch of the video game *Deus Ex: Human Revolution*, Rob was approached to make a documentary exploring prosthetics, body augmentation and cybernetics. Becoming a cyborg has been professionally beneficial – but Rob points out that some people make the assumption he has taken elaborate steps specifically to transform into a cyborg, when in reality, the physical affordance for the camera eye was already in place. The eyeborg will possibly evolve; a 3D version is being planned.

“The body is a wonderful complex evolutionary architecture, but on the other hand that complexity, that sort of analogue organization of the organs... means that the body isn’t necessarily well designed to function in a technological terrain...”

©Stelarc, photography Nina Sellars http://stelarc.org

STELARC

Performance Artist
Director of Alternate Anatomies Lab, Curtin University, Perth



©Stelarc, drawing by Stelarc http://stelarc.org

©Stelarc http://stelarc.org

Stelarc is a world-renowned performance artist who uses his body extensively to explore themes of connectivity and extension of the human body. For over 40 years, he has created art and events that incorporate machinery, digital data and organic material. His most well known pieces, such as Third Hand, Exoskeleton, Stomach Sculpture, *EAR ON ARM*, and Ping Body feature intimate connections between his body and technological objects. Actualizing these projects required the use of surgeries, biotechnology, robotics and prosthetics. Stelarc thinks of his work as interrogating rather than enhancing the human body. He is intrigued by the notion of the chimera — the fusing of two or more different species in one being. While Stelarc is interested in some elements of transhumanism, such as the benefits of a more robust body and extended longevity, he does not consider himself connected to the transhumanist movement. In the near future, Stelarc hopes to move towards actualizing the next phase of *EAR ON ARM*. He is the current director of the Alternate Anatomies Lab at Curtin University in Perth, Australia, investigating body extension and the possibilities of biomimicry as a strategy for interesting robots or human augmentations.

“With wearable technology it will come down to the applications and use cases that make it a sticky and valuable tool in your life… I definitely see wearable technology breaking down our smartphones and our computers and recreating them in different points in the body and creating the body as a computer itself. I would see in 10 years us not necessarily relying so heavily on our screens that we’ve been relying on for the past decades…”

@tomemrich: Twitter

TOM EMRICH

Emerging Technology Consultant
Founder, We Are Wearables, Toronto

@tomemrich: Twitter

@tomemrich: Instagram

Tom Emrich is a writer, consultant and evangelist for emerging technology. He is the founder of We Are Wearables, an association dedicated to education around wearable technology. Tom’s passion is to help individuals and organizations navigate the world of wearables by organizing regular community events that enable developers, thought leaders, entrepreneurs and many other interested individuals to come together in dialogue around this emerging space. He also writes extensively on wearable and other types of tech for several digital publications including Tech Vibes, Mobile Syrup and BetaKit. As one of the first (and few) Canadian Google Glass Explorers, Tom has been at the forefront of the introduction of a novel device into society. In conversation with us, Tom discussed the momentum that is starting to gather around wearables in the business community. As we approach 2015, businesses are starting to allocate budgets to wearable projects, though there is much uncertainty around the wearable value proposition for many organizations. Tom has seen most corporate interest centered on health care and advertising use cases. In terms of health care, companies are just starting to explore how health tracking and other aspects of self-quantification could be beneficial in an insurance or employee benefits context.

ANALYSIS & SYNTHESIS

> *Predicting the future is not possible because our world is a complex adaptive system. It is characterized by non-linear, complex, highly dynamic, set of interlocking issues that change in unexpected ways and at varying rates.*
>
> Michael Jackson, Shaping Tomorrow

TRENDS

In foresight, a trend is "… a change that affects a wide range of people and that has, or will eventually have, broad social, economic, or political implications." (Gordon, 2009) Assessing where patterns start to emerge in environmental scanning can be used to identify trends. Trends often have some notion of movement or directionality. For our purposes we have classified trends along three vectors: emerging, rising and flourishing. ***Emerging trends*** are those that have fewer signals, maybe are a little obscure, and that we saw more in particular subcultures or pockets. ***Rising trends*** are more prevalent; signals are plentiful and easier to find. And ***flourishing trends*** are on their way to becoming mainstream. Not all emerging trends progress through to mainstream status. However, a trend is something that design foresighters imagine will have some longevity and effect. Trends should not be confused with fads – which are popular but short-lived movements that may or may not be associated with a trend. For example, 'flash mobbing' might be considered a fad, while organizing large numbers of people for ad hoc, improvised events via social media could be considered a trend.

For *The Next Familiar,* we identified a number of trends that are salient to wearable, implantable and ingestible devices, and that, if emerging or rising, may flourish or become mainstream by 2044.

Each trend is described more fully later in this document, along with their accompanying signals and drivers.

Constant Connectivity
The idea of being attached to a digital network at all times. *(Flourishing)*

Internet of Things
A vast networked system of everyday objects. *(Rising)*

Maker Movement
The practice of do-it-yourself technological crafting. *(Flourishing)*

Biohacking
Modifying the human body for the purpose of increased capabilities. *(Emerging)*

Quantified Self
Intricate tracking of personal biometric data. *(Rising)*

Cyborgism
Becoming a being that is part organic and part cybernetic. *(Emerging)*

Lifelogging
Capturing daily memories and moments and preserving them for the future. *(Rising)*

Technological Singularity
A fundamental transformation in everything we know about humanity, brought about by accelerating technological change. The idea of the singularity is gaining momentum as a totalizing yet indefinable event. *(Emerging)*

DRIVERS AND FRICTION POINTS

“Drivers are underlying causal forces at work within systems, which lead to more visible manifestations of change, such as Trends and Signals. Strategic Foresight looks for Drivers by asking what factors contribute to trends.” (2020 Media Futures, 2011) There can sometimes be an indistinct line between drivers and trends. We looked at the signals collected from data gathering activities, as well as our trends, and extracted a series of targeted forces that are specifically moving our trends forward. These we have categorized as drivers. Our drivers are:

- Exponentially increasing computational capacity
- Advances in artificial intelligence
- Miniaturization
- Innovation in material design and manufacturing
- Nanotechnology
- Pervasive access to networks
- Social media
- Machine to machine communication
- Crowdfunding
- Corporate determination
- Changing attitudes towards privacy
- Impulse for preservation of memories/personal history
- Desire for virtual social connection
- Fear of illness, aging and death

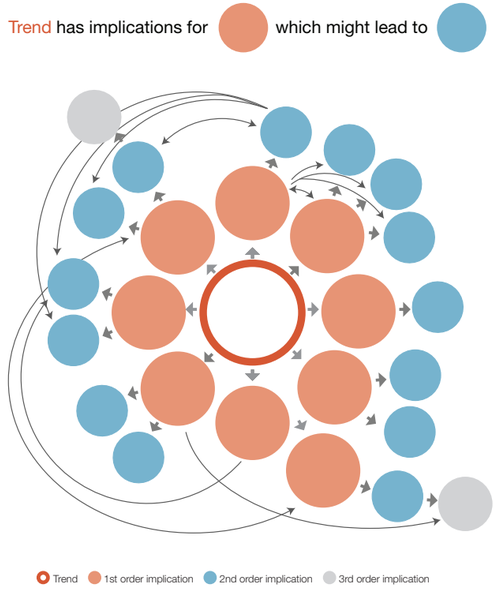
Friction points are forces that oppose or threaten a trend. Friction may be due to a number of reasons such as financial, technological, ideological or social resistance to change. (Gordon, 2010) Any given trend could encompass hundreds of potential friction points. Based on our data gathering, we identified examples of friction points for each trend. These are included in the trend summaries.

FUTURES WHEELS

The futures wheel, as described by Jerome C. Glenn in 1971, “is a way of organizing thinking and questioning about the future – a kind of structured brainstorming.” (Glenn, 2003) Futurists have used the futures wheel since the 1970s as a tool to think through a trend in a systematic way. There are many ways to use it and many variations on the basic format, which is essentially simply a series of concentric circles spreading out from the central starting point, usually the name of the trend.

We created a futures wheel for each trend, which we used to visualize some of the possible implications of the trend. These implications fed into our scenario planning and the creation of our experiential futures.

To read the futures wheel: start with the trend name in the centre circle, and then follow the thick arrows outward to understand the implications. The thin arrows indicate implications that are linked to each other. To a certain degree all implications are intertwined, but the arrows highlight particularly synergistic connections.



RECURRING CONCEPTS

From our interviews with experts, literature review and environmental scan, we saw several concepts emerge that we could not comfortably classify as drivers or trends. These were concepts that appeared again and again across our literature review, environmental scan and our discussions with experts.

The difference between a recurring concept and a driver is that recurring concepts are broad and affected by many drivers as well as many friction points. Likewise, these recurring concepts are different from trends in that they are influencing factors in all of the trends and don’t have the same kind of movement and directionality that we see in trends.

Our recurring concepts are:

- Transcending the human form
- Ethics/legality
- Identity/sense of self
- Surveillance
- Human-centered design
- Adding/bridging senses
- Power/Energy
- Privacy

These concepts were a key part of scenario development and creating our experiential futures.

SCENARIO DEVELOPMENT AND EXPERIENTIAL FUTURES

Developing scenarios and creating experiential futures is a rewarding part of the design foresight process. Scenarios help conceptualize our world in various future states. In business, scenarios can help organizations consider possible futures and how these different futures may affect their operations. A strategy can then be developed to help move the organization in a positive direction. *The Next Familiar* scenarios are not designed with a particular organization in mind, rather they are meant to provoke dialogue and contemplation around humans and technology in the next 30 years.

In the article "The Current State of Scenario Development: An Overview of Techniques", Peter Bishop, Andy Hines and Terry Collins maintain that we need to think creatively about the future and about multiple plausible futures. (Bishop, Hines & Collins, 2007) Since the future is an arena of infinite possibilities, it is helpful to have some way to focus scenario construction. Scenarios are born of both planning and development, where scenario planning is the output of a comprehensive foresight study and scenario development is about crafting stories of the future. (Bishop et al., 2007) The output of scenario development could take the form of 'experiential futures', or snippets and slices of life from possible future worlds, which we chose to create for this project. To make scenario construction a little easier to understand in our own eyes, we likened the process to baking a cake: where planning is everything that goes into understanding the concept of 'cake'; scenario development is composing a recipe for cake; and the experiential future is the cake. Design foresighters may look to several categories of techniques for scenario development. The Appendix, Comparison of Scenario Development Techniques, pages 135 and 136 includes three tables from "The Current State of Scenario Development" describing and comparing scenario development techniques. We have chosen to use a judgmental technique called Coates and Jarratt (Coates, 2000) to develop scenarios and experiential futures.

Judgmental techniques rely on the reasoning of the futurist. These techniques may be conducted without any other information than the futurist's inherent knowledge, but in our case we have built the scenarios on the scaffolding of our data gathering and analysis and synthesis. Coates and Jarratt does not involve specialized equipment or software, and can be conducted by a small team (such as our team of two). The Coates and Jarratt technique draws its name from the foresight consultancy led by Joseph Coates and Jennifer Jarratt from the mid-1980s to 2002. Their scenario construction process, (Coates, 2000) and how we have followed it, can be described as follows:

1. **Identify the universe of concern**

    - We are dealing with wearable, implantable and ingestible technologies and a timeline of 30 years – taking us to 2044.

Photos by Maxwell and Segal

Figure 18: Scenario development workshop

2. Define the important variables in shaping this future

- Our variables were the recurring concepts, drivers and trends drawn from expert interviews, literature review and environmental scanning.

3. Identify scenario themes

- Scenario themes were formed by collecting the 'what if' questions we had as we worked through the data gathering and analysis and synthesis process. 'What if' questions were our way of interrogating our research from an experiential futures perspective.

What if…

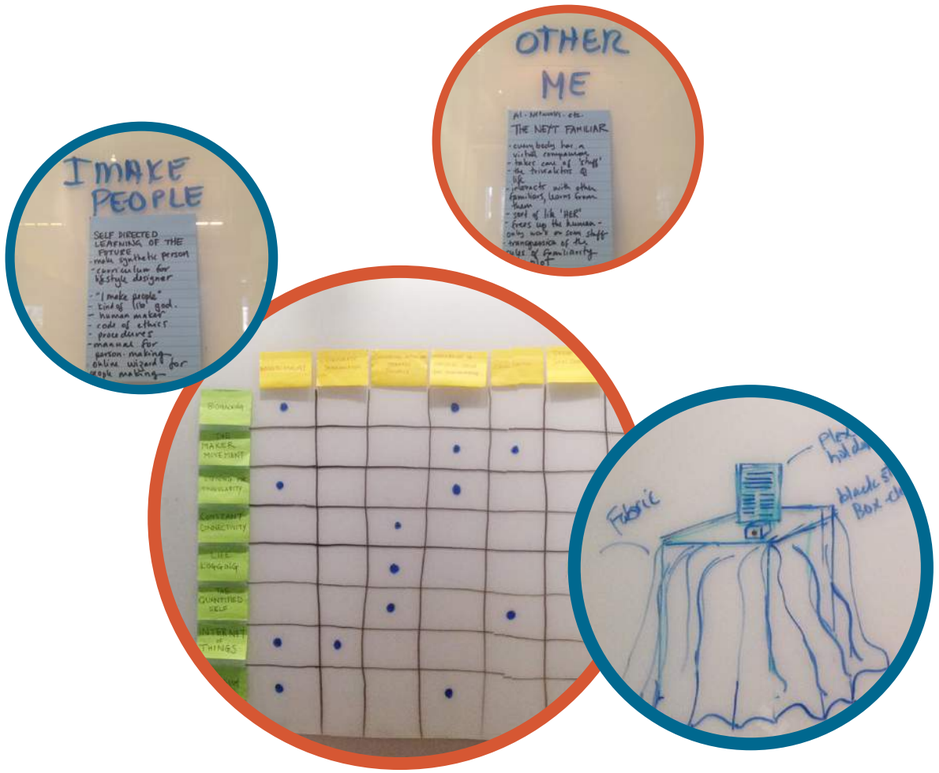
- Getting an RFID implant was as common as getting a manicure/pedicure?
- Augmentation salons are as ubiquitous as nail salons are today?
- Everybody has minor or major cyborg bits?
- There was policy around facilities and personnel working in the augmentation field?
- You could download/upload memories?
- You could flip through a memory catalogue like you do an Ikea catalogue?
- There were memory addicts?
- You could download so many memories from other people that you don't know who you are?
- Emergency rooms of the future need doctors and engineers to work together?
- There's no such thing as privacy and everything is documented digitally?
- You have to pay for your right to privacy?
- Nanotechnology allows for invisibility?
- The Internet of Things really does provide an all-encompassing connected intimate environment?
- Mundane daily tasks can be handled by computers and machines?
- Everyone has a virtual companion?
- The assembler happens?
- Humans become God-like through technology?
- There's no discernible difference between a 'real' human and an 'unreal' human?
- A different species of homo sapiens comes into existence?
- We live on other planets?
- You could upload your mind – who would own your IP after you physically die?
- It was difficult to live off the technology grid?
- The singularity happens?

4. Create the scenarios

- We posted each scenario theme on a sticky note, then posted each variable (recurring concepts, drivers and trends) against the scenario theme and gave each variable a 'score' between 1 and 5 for relevance to the theme.
- This process was captured in photos and is included in the Appendix, Scenario Development Process Images, pages 137-141.

5. Write the scenarios/create the experiential futures

- We brainstormed different form factors for the outputs of the scenarios, which are the experiential futures. Our intention around using different tones, voices, artifacts and display methods was to illustrate that in design foresight, we need not be limited in how we embody slices of the future.
- Our installation (exhibited in the OCAD University Graduate Gallery in October 2014) provided a three dimensional way to experience the futures that are described textually in this document.



Photos by Maxwell and Segal

Figure 19: Whiteboard brainstorm, scenario development

To find inspiration for writing the scenarios and creating artifacts, we followed the direction of Dunne & Raby, speculative designers, professors and authors who focus on designing ideas that consider and speculate possible futures. They advocate looking to film, fiction and art for inspiration, and to embrace tools from these realms to craft ideas, tools such as made-up worlds, what-if questions, absurd scenarios and so on. According to them:

> *This form of design thrives on imagination and aims to open up new perspectives on what are sometimes called wicked problems, to create spaces for discussion and debate about alternative ways of being, and to inspire and encourage people's imaginations to flow freely. Design speculations can act as a catalyst for collectively redefining our relationship to reality.* (Dunne & Raby, 2013)

In OCAD University's foresight studio, part of the Strategic Foresight and Innovation Master of Design degree, Professors Stein and Candy discussed the value of an immersive approach versus a text only manifestation of experiential future. They encourage design foresighters to make use of the art of the double-take, make people think twice, put us in the future world and keep us there, and make it fun. (S. Stein and S. Candy, personal communication, November 14, 2013) *The Next Familiar* invites the reader or viewer to consider how we have explored our questions about wearable, implantable and ingestible technology through experiential futures, and then use this exploration as a platform from which to ask their own questions.

TREND SUMMARIES

In foresight a trend is…

“a change that affects a wide range of people and that has, or will eventually have, broad social, economic, or political implications.”

(Gordon, 2009)

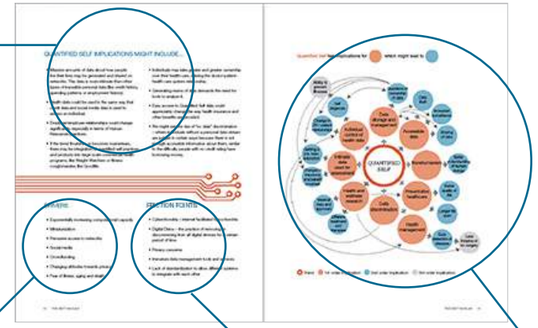
HOW TO READ THE TREND SUMMARIES

After the trend title is an indication of movement or directionality. ***Emerging*** trends are those that have fewer signals, maybe are a little obscure, and that we saw more in particular subcultures or pockets. ***Rising*** trends are more prevalent; signals are plentiful and easier to find. ***Flourishing*** trends are on the cusp of ceasing to be trends and on their way to becoming mainstream.

The trend summary is a brief overview of the trend – trends are not necessarily commonplace and could even be completely unfamiliar to some readers if they are emerging. The summary may also indicate origins of the trend, key people involved in the trend and hubs of trend activity.

Signals are concrete examples that point to the existence of a trend. An emerging trend may have only a few signals and they may be quite weak, while a flourishing trend will have many strong signals.

Implications are short descriptions of what the trend might mean. Some trends will have implications that are deeply complex, scientific, political or technical. The examples listed in each trend summary are indicative, but not comprehensive – a trend could have hundreds of possible implications.



Drivers are forces that push a trend forward. Drivers often influence many trends, and may actually be trends in and of themselves. (Gordon, 2010)

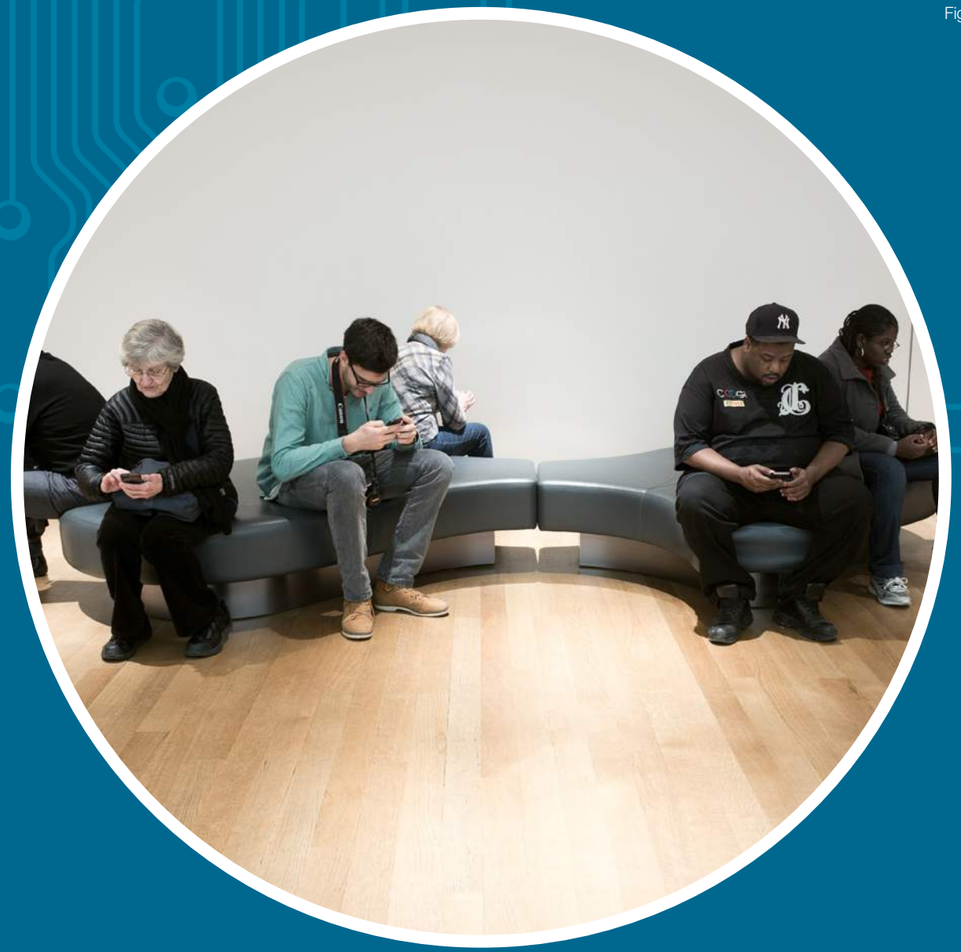
Friction points are forces that oppose or threaten a trend. Friction may be due to a number of reasons such as financial, technological, ideological or social resistance to change. (Gordon, 2010)

The futures wheels are visualizations of some of the implications of a trend.

When looking at the futures wheels it might be helpful to think of them as graphic representations of rough sentences using this formula:
(Trend name) has implications for **(first order implication)** which might lead to **(second order/third order implications)**.

For example:
Quantified self has implications for **preventative health care**, which might lead to **longer lifespans**.

Figure 20



Susan Sermoneta: www.flickr.com

CONSTANT CONNECTIVITY

FLOURISHING

> *Hypersigils… are basically what I call the networked human persona in digital form. So you are an individual when you are organically sitting there, but when you connect to a system or a networked group of beings, you become a hypersigil.*
>
> Chris Dancy

I AM WE AS YOU ARE WE

Being constantly connected might soon be considered the new normal. Sitting in a waiting room, riding public transit, standing in a line — these activities are now often paired with reading, working, conversing with a friend, shopping and gaming. We are always connected, but are we in fact more alone because of technology? Dr. Sherry Turkle, a director at MIT and a PHD in both sociology and personality psychology began to research and write about people and computers in the early 1980s, before the personal computer was a common household object. (Turkle, 2011) In her book *Alone Together*, Turkle discussed what was then emerging technology and its effects on people. Turkle, having interviewed hundreds of people of all ages and walks of life, felt that technology is changing who we are and how we live. Although we may be physically in the same location, we are often connected to someone or something else; a situation that she maintains is actually driving us towards a new state of solitude and destroying our capacity for self-reflection.

Interestingly, what Turkle observed as 'odd' behaviour just a few years ago, such as texting during meetings, classes and other formal events, is now quite commonplace (if not always acceptable). The trend of being constantly connected also encompasses networks of information and things. This trend is closely tied to the trends of Quantified Self, Lifelogging and the Internet of Things.

SIGNALS OF CHANGE

- Retailers are experimenting with beacons – low powered transmitters that send signals to smartphones, allowing targeted communication and marketing. [1]
- Startup DanTeb Enterprises is working on placing device-charging stations in public spaces in the city of Toronto. Soon to be rolled out in government buildings and the underground PATH system. [2]
- "Nomophobia" – the fear of being without one's mobile device is acknowledged as a clinical condition in psychology circles. [3]
- According to researchers, sleep texting is a sleep disorder and a growing phenomena, especially amongst adolescents. [4]
- Keeping Ontario's Roads Safe Act, introduced in March 2014, proposes steep fines for distracted drivers. [5]

[1] https://www.paypal.com/webapps/mpp/beacon

[2] http://www.blogto.com/tech/2013/04/toronto_to_get_more_phone_battery_charging_stations/

[3] http://news.nationalpost.com/2014/06/01/fear-of-not-having-a-working-cell-phone-should-be-added-to-psychiatrys-diagnostic-manual-researchers-say/

[4] http://www.theatlantic.com/health/archive/2013/10/sleeptexting-is-the-new-sleepwalking/280591/

[5] http://news.ontario.ca/mto/en/2014/03/improving-road-safety-in-ontario.html

CONSTANT CONNECTIVITY IMPLICATIONS MIGHT INCLUDE...

- Relationships: Distance has become less of a barrier in terms of many types of relationships – personal, social and business – this is likely to continue to be the case.
- Relationships: The way organizations deliver services will morph in relation to pervasive contact between service providers and recipients.
- Social Media: Our ability to 'be in the moment' or enjoy unmediated experiences may diminish.
- Distraction: Distraction as a social force may result in a wide range of changes to public behaviour and policy.
- Reputation: Reputation and social status is now and will likely continue to be judged on virtual as well as actual behaviour.
- Knowledge: Stories that were once managed with effort through journalist networks now pervade millions of social networks in record time, a phenomenon that can be both incredibly beneficial and hugely damaging.

DRIVERS

- Pervasive access to networks
- Social media
- Changing attitudes towards privacy
- Impulse for preservation of memories/personal history
- Desire for virtual social connection

FRICTION POINTS

- Lack of convenient ways to keep our devices charged
- Religious or spiritual or mindfulness groups activating against a highly digitized lifestyle
- Early abandonment of connected technologies when there is an unclear value proposition
- Ambivalence
- Health-related fear of being in such close proximity to electronic devices all the time

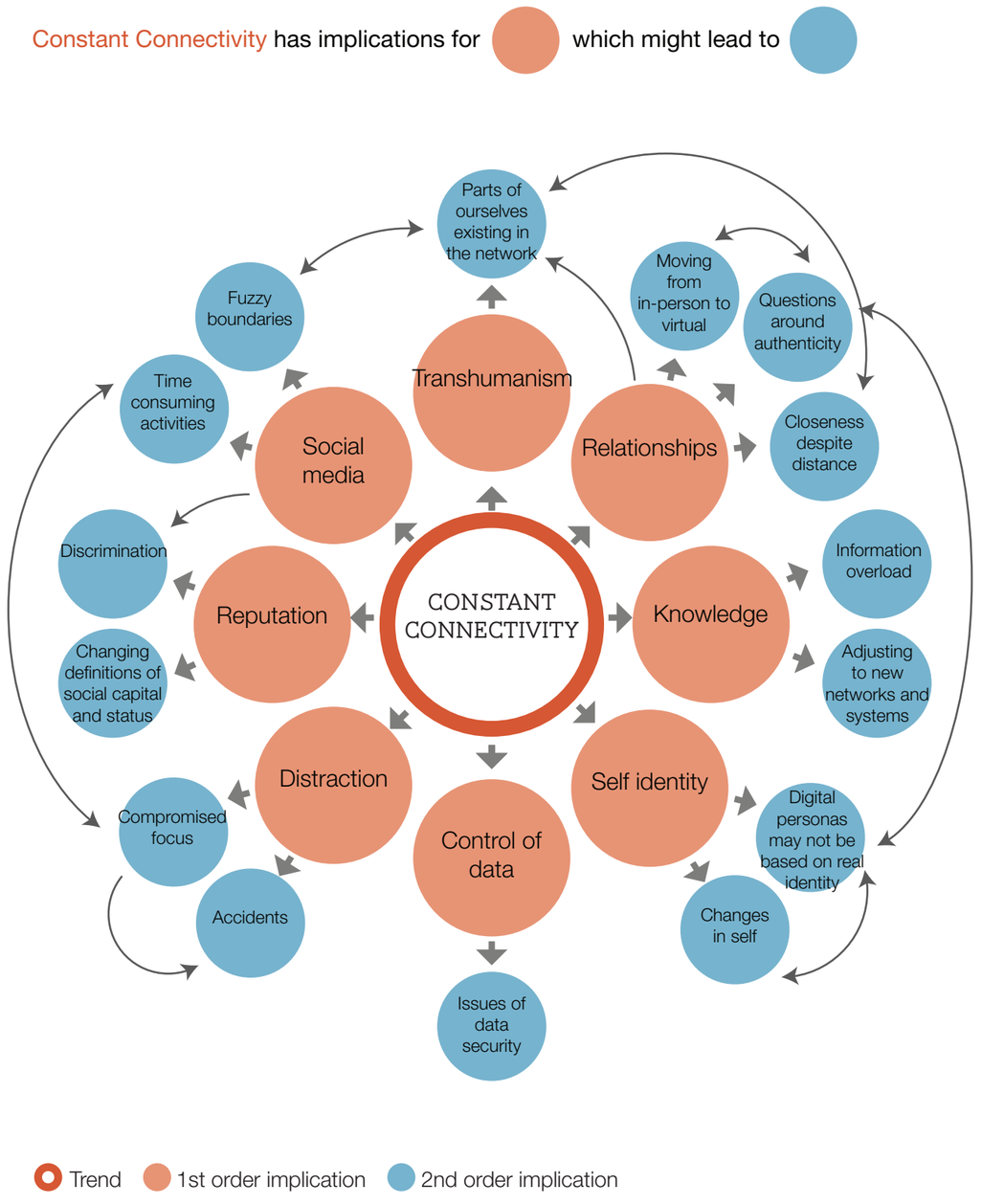


Figure 21

Planetart: www.flickr.com

MAKER MOVEMENT

FLOURISHING

“I’m president of HackLab which is a local community hacker space, basically it’s like a clubhouse for people who are really in love with technology… It’s like an anarchy of people doing their own things, almost all of it is hobbyists, it’s not commercially focused at all, people just making the stuff that they want to make…”

Eric Boyd

TINKERING 2.0

Makers are do-it-yourselfers who create technological things. The maker movement represents a subculture of home grown innovation and talent around fashioning objects with a wide variety of mechanical, engineering and electronic tools. In 2005, Dale Dougherty, a publisher and technologist, founded Make magazine, dedicated to the DIY mindset in technology. He also organized the first Maker Faire in 2006, “the Greatest Show (and Tell) on Earth” a festival featuring makers and their creations. (Dougherty, 2012) Making is a philosophy as well as a pastime, centred on curiosity, self-sufficiency, creativity, and sharing. It is has a non-commercial ethos, though this may be changing. The advent and increasing availability of tools such as 3D printers and Arduino (a tool and platform for developing applications that included physical as well as digital information) has propelled the maker movement into a flourishing trend.

SIGNALS OF CHANGE

- Maker Faires in Bay Area and New York in 2013 attended by about 195,000 people. That same year, 98 other Maker Faires took place around the world. [1]
- World Maker Faire to take place in New York in September 2014 has large corporate sponsorship – Disney, Intel, LG, Toyota, Radio Shack, indicating this trend may be about to mainstream. [2]
- Libraries like the Toronto Public Library offer free courses in 3D printing and Arduino. [3]
- Large software company Autodesk acquired makeresque website instructables.com in 2011. [4]
- Mark Hatch, author of The Maker Movement Manifesto, became CEO of DIY space TechShop in 2007. Eight TechShops are in operation in the USA, with plans to open more locations around the world. [5]

[1] http://makerfaire.com/makerfairehistory/

[2] http://makerfaire.com/

[3] http://www.torontopubliclibrary.ca/using-the-library/computer-services/innovation-spaces/3D-design-print.jsp

[4] http://techcrunch.com/2011/08/01/autodesk-acquires-diy-community-instructables/

[5] http://www.fastcoexist.com/1678519/techshops-mark-hatch-is-building-a-place-where-you-can-build-your-dreams

MAKER MOVEMENT IMPLICATIONS MIGHT INCLUDE...

- Commoditization of Electronics: Democratization of technology allows people to create fairly sophisticated devices or tools without needing large laboratories or corporate investment.
- Technological Accessibility: Innovation could happen on smaller stages and with greater frequency.
- Education: Educative spaces may be reconfigured or repurposed to accommodate shifts in learning.
- Technological Accessibility: The maker movement may result in lower barriers to entry for entrepreneurs looking to develop products.
- Sharing Knowledge: There might be an increase in open-source systems and code as more makers collaborate and produce projects together.

DRIVERS

- Exponentially increasing computational capacity
- Miniaturization
- Innovation in material design and manufacturing
- Crowdfunding
- Machine to machine communication

FRICTION POINTS

- Lack of time/money to devote to 'hobbyist' pursuits
- Corporate interests acquire or crush DIY initiatives
- Lack of representation of some segments of society in the maker community (women, lower earners)

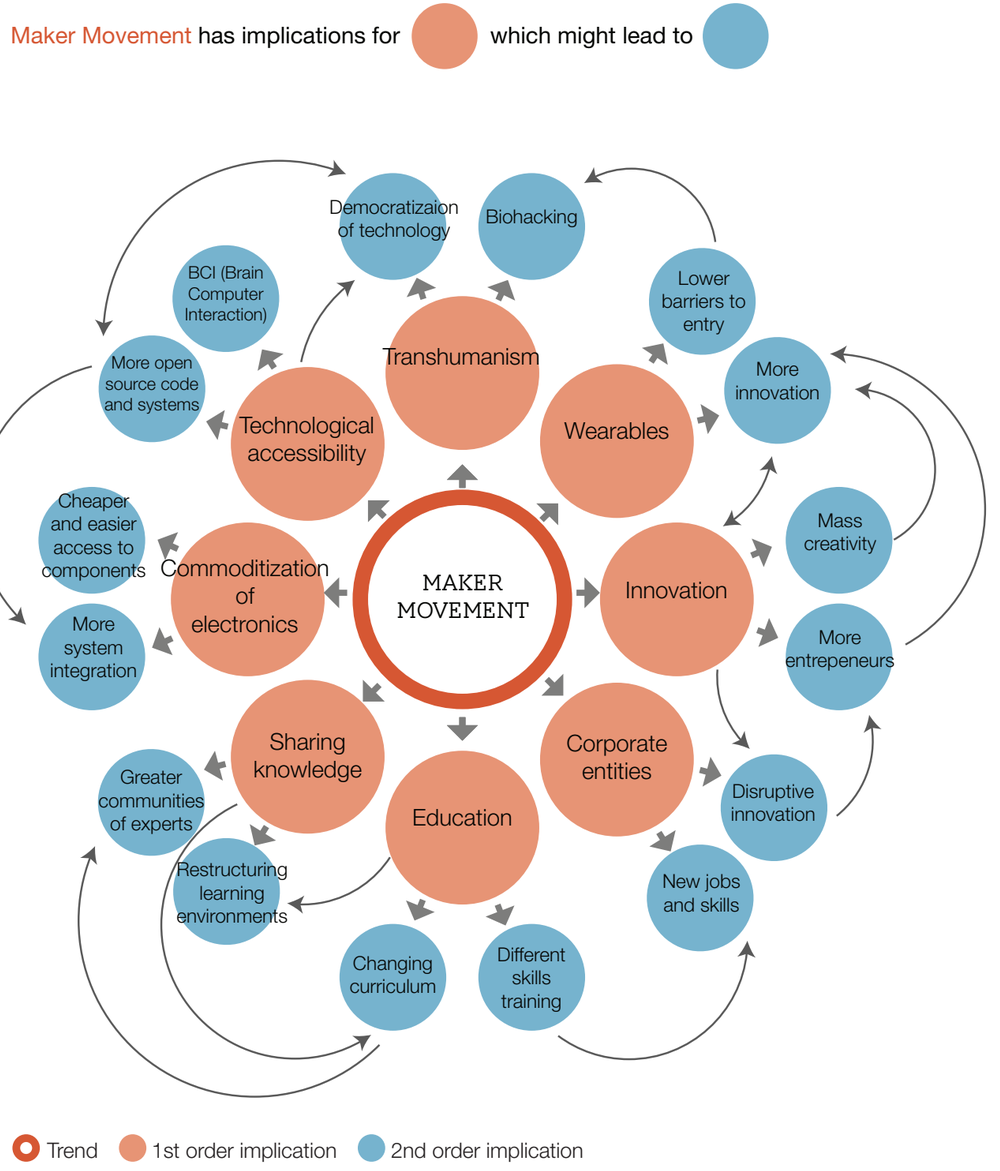


Figure 22

Christopher Michel: www.flickr.com

QUANTIFIED SELF

RISING

“There are three wearable types that are of interest and it depends on the client. A lot of interest is in the health wearables. That’s from insurance companies, from any data oriented business; even HR is looking to utilize the Quantified Self movement in order to better understand their employees, and also to provide them with benefits like bonus for fitness for example…”

Tom Emrich

SELF-KNOWLEDGE THROUGH NUMBERS

Self-quantification refers to the practice of recording and tracking various types of personal data, most often wellness or health-related. Examples include, but certainly aren’t limited to: activity levels, sleep information, posture, calorie intake, heart rate, breathing patterns. Self-quantifiers with illnesses often track much more specific data in relation to their conditions. *Wired* journalists Gary Wolf and Kevin Kelly coined the term “Quantified Self” in 2007 (Wolf, 2011) and their website tagline “self-knowledge through numbers” concisely summarizes the ethos of the trend. The QS movement has spawned groups in many cities around the world, including 5 in Canada, and there have been 6 global Quantified Self conferences since 2011. We’ve tagged this a rising trend. While there are many hard-core self-quantifiers who manipulate complex algorithms and large numbers of data, create code or make their own tracking tools, there are a growing number of people who track to a lesser extent with commercially available products. As technology gets smaller, more sophisticated and less expensive, it is easier to become a devotee to the Quantified Self.

SIGNALS OF CHANGE

- Chris Dancy “The Most Connected Man on Earth” claims he “is you, just a few years from now.” Demonstrates on YouTube his life and home, where he uses up to 700 tracking devices, some worn on the body, some placed around his house. [1]
- Quantified Self conference in Amsterdam in 2014 attracts about 350 attendees; in 2008 the first QS meeting was attended by 28 people in the home of Kevin Kelly. [2]
- BP America gave 14,000 employees free FitBit Zips as part of a corporate wellness program. Employee Karl Dalal was able to get a lower health care premium based on the amount he walked over the year. [3]
- The Quantified Self website Guide to Self Tracking Tools has 505 entries. [4]
- Quantified Self movement is discussed on large health sites such as curetogether.com and patientslikeme.com. [5]

[1] http://mashable.com/2014/03/13/most-connected-man-in-world-chris-dancy/

[2] http://technori.com/2013/05/4566-5-takeaways-quantified-self-conference/

[3] http://www.forbes.com/sites/parmyolson/2014/04/17/the-quantified-other-nest-and-fitbit-chase-a-lucrative-side-business/

[4] http://quantifiedself.com/guide/

[5] http://www.economist.com/node/21548493

QUANTIFIED SELF IMPLICATIONS MIGHT INCLUDE...

- Intimate Data used for Assessment: Massive amounts of data about how people live their lives may be generated and shared on networks. This data is more intimate than other types of traceable personal data (like credit history, spending patterns or employment history).
- Individual Control of Health Data: Health data could be used in the same way that credit data and social media data is used to assess an individual.
- Data Discrimination: Employer/employee relationships could change significantly, especially in terms of Human Resources practices.
- Health Management: Integration of quantified self practices and products into large-scale commercial health programs, like Weight Watchers or fitness conglomerates like Goodlife.
- Health Management: Individuals may take greater and greater ownership over their health care, altering the doctor-patient-health care system relationship.
- Data Storage and Management: Generating reams of data demands the need for tools to analyze it.
- Intimate Data used for Assessment: Easy access to Quantified Self data could appreciably change the way health insurance and other benefits are provided.
- Data Discrimination: We might see the rise of “no data” discrimination – where individuals without a personal data stream are judged in certain ways because there is not enough accessible information about them; similar to the difficulty people with no credit rating have borrowing money.

DRIVERS

- Exponentially increasing computational capacity
- Miniaturization
- Pervasive access to networks
- Social media
- Crowdfunding
- Changing attitudes towards privacy
- Fear of illness, aging and death

FRICTION POINTS

- Cyberchondria – internet facilitated hypochondria
- Digital Detox – the practice of removing or disconnecting from all digital devices for a certain period of time
- Privacy concerns
- Immature data management tools and services
- Lack of standardization to allow different systems to integrate with each other

Figure 23

Franklin Heijnen: www.flickr.com

LIFELOGGING

RISING

> *I'm wearing a lifelogging camera and I thought 15 years ago that would be 30 years from now. Now it's a consumer device. So one thing I've learned is a lot of the things we think will take long are actually much shorter.*
>
> Isabel Pedersen

THE FUTURE OF YOUR PAST

Lifelogging is the practice of capturing moments in life and preserving them for the future. For as long as we've been able to record things, humans have sought to keep records of daily and special events. Diaries, journals, scrapbooks and photo albums are all forms of lifelogs. Record keeping with the addition of data capture and sharing technology forms the core of this trend. There's a wide spectrum of activities that could be considered lifelogging, such as taking photos, recording video clips, and making entries on a social media site. But in order to differentiate lifelogging from occasional record making, there must be elements of effortless (Sellen, 2010), undiscriminating (Whittaker et al, 2012) and very frequent or perpetual capture. Lifelogging has obvious overlaps with our Quantified Self trend. Both sousveillance and surveillance are inherent parts of lifelogging. (Allen, 2008) Where self-quantification is more about numbers and analysis, we would say lifelogging tends towards narrative, sentiment and experience. However, many blogs and online articles equate lifelogging and self-quantification or consider one a subset of the other. There are tools specifically marketed as 'lifelogging' devices, such as Narrative Clip or Autographer, but this trend is more about behaviour than tools. For example, depending on usage, Facebook and Twitter could be rich lifelogs.

One of the most prominent bodies of knowledge around lifelogging is the MyLifeBits project, sponsored by Microsoft and led by Gordon Bell. Starting in 1999 Bell scanned or captured everything he possibly could about his life, such as memos, papers, photos, presentations, music, home movies, and videotaped lectures, phone calls, IM transcripts, emails, browsing history, and daily activities captured by a SenseCam device. (Bell and Gemmell, 2007) Bell and Gemmell's research was published as a notable book in this area, "Total Recall", later released in paperback as "Your Life, Uploaded".

SIGNALS OF CHANGE

- Memoto (now Narrative Clip) Kickstarter campaign goal of $50,000 raised over $550,000. [1]
- Lead users Tom Emrich, Chris Dancy and Isabel Pedersen wear lifelogging device Narrative Clip – a tiny camera that automatically takes a picture every 30 seconds, accompanied by an app to manage data. [2]
- British television show Black Mirror showcases lifelogging in two episodes, *The Entire History of You* and *Be Right Back*. [3]
- Facebook's move to the timeline reflects a lifelogging paradigm. [4]
- Facebook's Look Back video – where users could download a video of the most significant entries in their profiles was used by over 200 million people and shared by about 100 million. [5]

[1] https://www.kickstarter.com/projects/martinkallstrom/memoto-lifelogging-camera

[2] T. Emrich, C. Dancy, I. Pedersen, personal communication, August 2014

[3] http://www.imdb.com/title/tt2085059/?ref_=ttep_ep_tt

[4] https://www.facebook.com/notes/facebook/timeline-now-available-worldwide/10150408488962131

[5] thttp://www.forbes.com/sites/amitchowdhry/2014/02/11/facebooks-look-back-video-feature-was-used-by-200-million/

LIFELOGGING IMPLICATIONS MIGHT INCLUDE...

- Transhumanism: Lifelogging would appear to be a fundamental if clumsy precursor to the transhumanist notion of uploading a consciousness.
- Data Storage and Management: Data storage and management tools may undergo radical changes over the next few decades to deal with heavy data sets.
- Privacy: Who owns or has access to lifelogged data may become a societal and legal hot-button issue
- Professions that Demand Recall: Ramifications for industries where recall and interpretation are important – such as policing, litigation, journalism, politics, medicine and health.
- Privacy: Lifelogging cameras take hundreds of pictures of individuals without their consent and that dataset is controlled by the lifelogger and possibly stored in third-party vaults.
- Disillusionment with Life: People might place too much value on what would otherwise be miscellaneous details of life.
- Sousveillance: Might be a decrease in crime if the likelihood of getting caught is much greater
- Medical Diagnosis: Medical diagnosis, especially of mental or emotional issues could greatly benefit from lifelogged data.
- Disillusionment with Life: Recalling or revisiting an event doesn't necessarily mean remembering it – the desired value proposition of preservation of memories might fall short of expectation, leading to ambivalence rather than uptake of lifelogging.

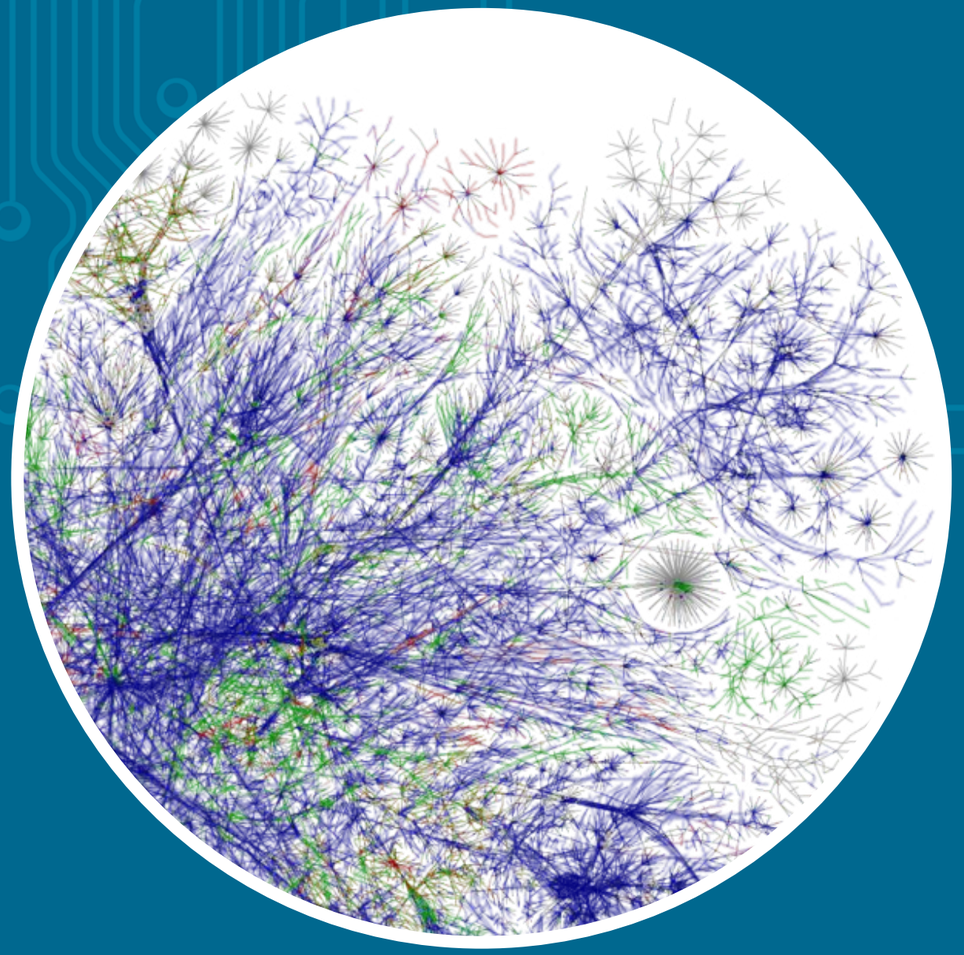
DRIVERS

- Exponentially increasing computational capacity
- Miniaturization
- Pervasive access to networks
- Social media
- Changing attitudes towards privacy
- Impulse for preservation of memories/ personal history
- Desire for virtual social connection

FRICTION POINTS

- Ambivalence – people might find lifelogging fun at first, then it becomes another thing to manage and they let it slide
- Privacy and security concerns
- Immature data management tools and services
- Storage costs

Figure 24



http://en.wikipedia.org/wiki/Internet_privacy#mediaviewer/File:Internet_map_1024_-_transparent.png

INTERNET OF THINGS

RISING

> *Contextual wearables integrating with the Internet of Things… is really the powerful duo that we are waiting for. I think that is when the smartwatch is really going to make sense.* Tom Emrich

PREPARE FOR THE PROGRAMMABLE WORLD

The Internet of Things (IoT) is the concept of a vast network of objects that are connected to each other and most likely to the Internet or other net by any number of information and communication protocols. It is the combination of sensors, actuating hardware and software, and networked intelligence. The term was coined by Kevin Ashton, cofounder of the Auto-ID center at MIT, and a prominent researcher in RFID technology. In a daily life scenario, the Internet of Things might manifest as a connected home, where different devices such as your smartwatch, thermostat, entertainment system and appliances work in tandem to ensure task are accomplished and the family's comfort is maintained. In a larger context we have already started to see the potential of the IoT as an enabler of global shipping and distribution systems, manufacturing, energy, retail and travel. IoT lets machines talk to each other without human intervention. The convenience and efficiency factor brought about by the removal of many types of transactions currently performed by humans might result in this trend flourishing rapidly.

SIGNALS OF CHANGE

- Beacons, like the PayPal beacon, allow for "transactionless" purchases. Using sensors and an app, a retailer could charge a consumer for a purchase through communication between the beacon and the consumer's device. [1]
- 'Works With Nest' is a series of objects designed to integrate with the Nest thermostat and smoke alarm system. Currently Nest-compatible partners include Jawbone Up fitness tracker, Whirlpool washer/dryers and Mercedes-Benz cars. [2]
- Smart tags like Tile let people keep track of various daily objects by linking them digitally. [3]
- City of Montreal parking meters let drivers pay for parking from anywhere using their smartphones. [4]
- Engauge makes technology to monitor critical life safety equipment such as fire extinguishers and defibrillators. Their system can tell when equipment is pulled from its mount, if access to it is blocked or if it is malfunctioning; and send alerts or reports to relevant parties. [5]

[1] https://www.paypal.com/webapps/mpp/beacon

[2] https://nest.com/ca/works-with-nest/

[3] https://www.thetileapp.com/

[4] https://pservicemobile.ca/pub/3/site/scsm/psp/scsm-www/page/login

[5t] http://www.engaugeinc.net/fire-extinguisher-monitoring

INTERNET OF THINGS IMPLICATIONS MIGHT INCLUDE...

- Leisure: Maybe the IoT will deliver on our as-yet-unattained dream of technology as the provider of free time for leisurely pursuits.
- Health: Ability to effortlessly monitor for health conditions could save lives in emergency situations.
- Know-how: The appreciation of knowing 'how things work' will be removed even farther from our understanding than it is today.
- Employment: Some of the tasks humans do today may be taken over by machines, changing employment for many.
- Systems: IoT will probably contribute to the continued globalization of economies as systems around the world will be linked by data and communications.
- Humans: Embarking down the path towards the Internet of Things without considering humans as core nodes in the system may be detrimental.

DRIVERS

- Exponentially increasing computational capacity
- Advances in artificial intelligence
- Miniaturization
- Pervasive access to networks
- Machine to machine communication
- Corporate determination
- Nanotechnology

FRICTION POINTS

- Lack of standardization to allow different systems to integrate with each other
- Privacy and security concerns
- Power sources for sensors and devices
- Sheer magnitude of the task of connecting objects, devices is mind boggling

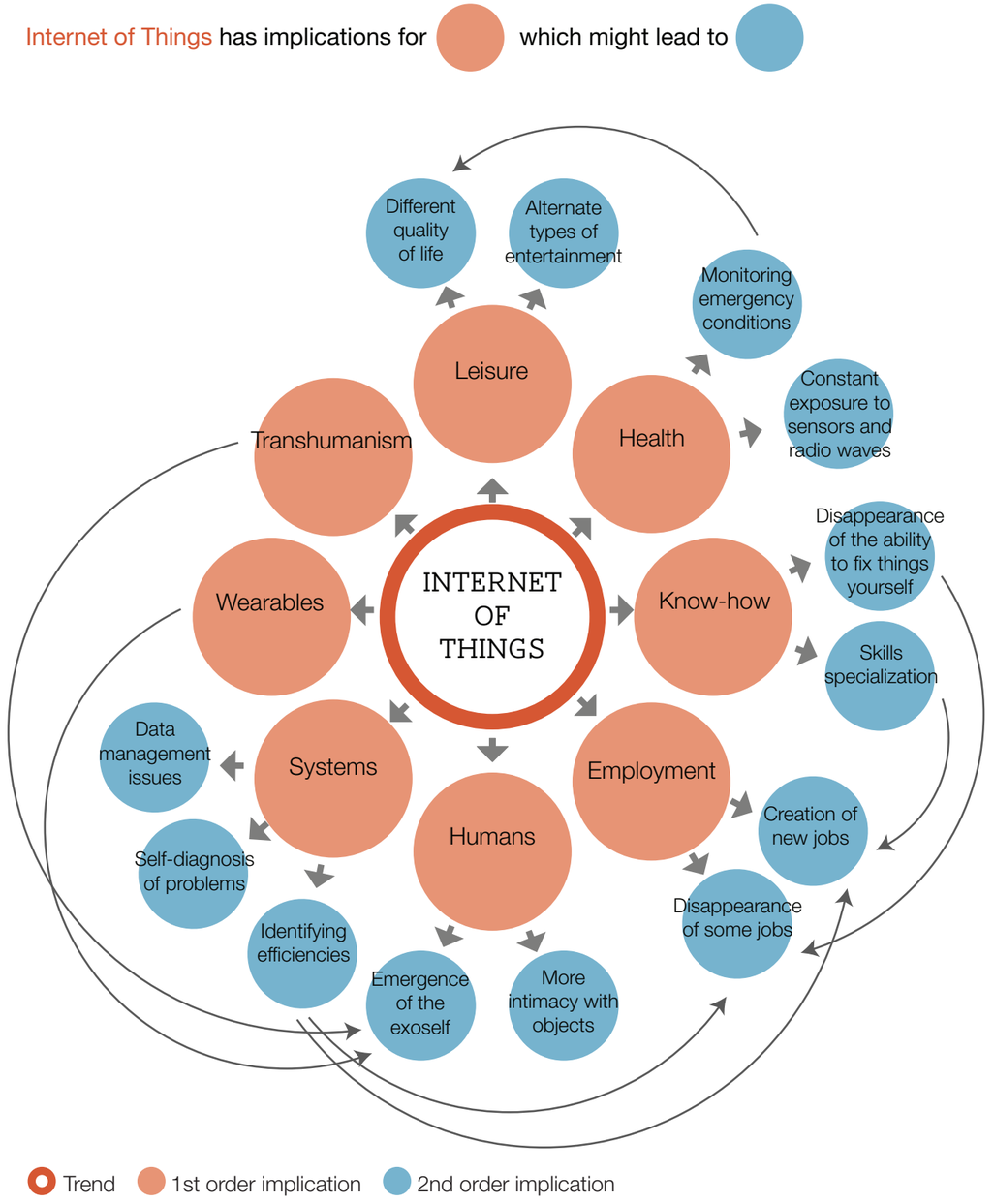


Figure 25

http://amal.net/?page_id=3034

BIOHACKING

EMERGING

My RFID tags are not necessary for any medical purpose or bodily function, yet they become so integrated with my life that I absolutely and completely take them for granted... for granted as much as my heart, my liver, or kidneys. This is the fundamental difference between an implantable technology and a tool that you use, where as the tool has to be managed... if you put it down it ceases to become part of your interaction with the world until you pick it up again...

Amal Graafstra

BODY MODIFICATION MEETS MAKER CULTURE

Biohacking is a wide term that encompasses a range of practices. Biohacking as it relates to the human body is the concept of surgically or genetically altering the body to incorporate extra capabilities. In *The Next Familiar*, we have concentrated on surgically implanting devices that incorporate some form of network connectivity or digital capacity, though the more common implantables are magnets. Biohacking is closely tied to the transhumanist movement, as transhumanists are keenly interested in augmenting the physical body for the purposes of transformation and longevity. The most well documented experiments in biohacking are those of University of Reading professor Kevin Warwick. Professor Warwick undertook a series of procedures to implant first a silicon chip transponder and then a 100-electrode array in his body. Using these devices he was able to communicate with other systems in his environment and also with his wife who was also implanted. Performance artist Stelarc is also involved in biohacking through his *EAR ON ARM* project. Warwick and Stelarc's work has the support of medical and university professionals. In the last several years a do-it-yourself biohacking community has emerged. Called 'Grinders' DIY biohackers embrace smaller implant projects that can be performed at home or more often at body modification or tattoo parlours.

SIGNALS OF CHANGE

- University of Reading professor Kevin Warwick experiments extensively with implanted devices on himself and his wife Irina. [1]
- In 2004 Barcelona bar Baja Beach Club (now defunct) offered VIP customers the option of an implanted RFID chip for ID and payment. [2]
- Extreme grinder Lepht Anonym influences the DIY biohacking movement by implanting various items and writing/blogging about it. [3]
- Active grinder community interacts online at discuss.biohack.me. [4]
- Grindhouse Wetware formed by members of biohack.me forums as an active team working towards human augmentation around the world. [5]
- Dangerous Things, a website run by Amal Graafstra, sells implantable devices and accessories online. [6]

[1] http://www.kevinwarwick.com/Cyborg2.htm
[2] http://news.bbc.co.uk/2/hi/technology/3697940.stm
[3] http://sapiensanonym.blogspot.ca/2010/03/faq.html
[4] http://discuss.biohack.me/
[5] http://www.grindhousewetware.com/index.html
[6] https://dangerousthings.com/

BIOHACKING IMPLICATIONS MIGHT INCLUDE...

- Physical Capabilities: Some daily tasks we do with tools like keys, cards or passcodes may become accomplishable via an implanted device.
- Physical Capabilities: Credit cards or money could be stored on an implanted device.
- Physical Capabilities: Pastimes or entertainments that depend on physicality, such as sports, could become much faster-paced or exciting. “Para” athletics might disappear if biohacking mainstreams in the sporting world.
- Health and Wellness: If biohacking mainstreams, some medical procedures might move out of hospitals and clinics and into more ‘retail’ environments.
- Additional Senses: Interface and industrial designers may start accounting for extra senses in the creation and manufacture of everyday products.
- Physical Capabilities: Healthy or functioning body parts may be removed for aesthetic reasons or to upgrade their capacity.

DRIVERS

- Exponentially increasing computational capacity
- Miniaturization
- Innovation in material design and manufacturing
- Pervasive access to networks
- Machine to machine communication
- Nanotechnology

FRICTION POINTS

- Power sources for implantable devices
- Ick factor
- Thoroughly tested and accepted medical guidelines and practices around surgery and patient safety
- Mark of the Beast – fringe religious movements claim implanted chips or sensors worn on the skin are the modern day Mark of the Beast

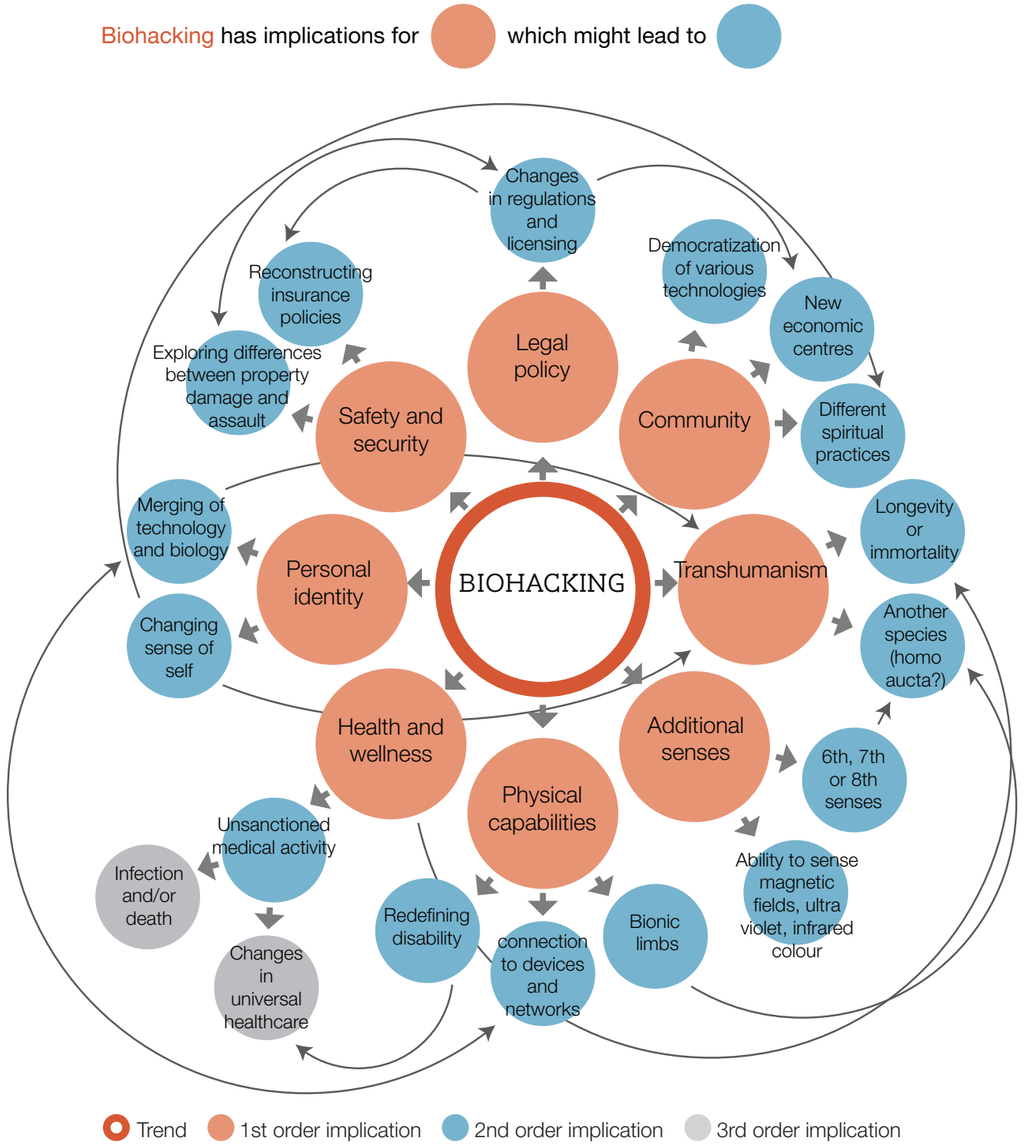


Figure 26

Mike Mozart: www.flickr.com

CYBORGISM

EMERGING

> *I think maybe wearable technology will actually be a transition into this state where we will want to become technology, not only wear or use it.*
>
> Neil Harbisson

THEY LOOK HUMAN

The concept of a human being that is not entirely organic, that is composed of materials in addition to flesh and blood, has captured our imagination in fiction, medicine and science for decades. In 1816 Mary Shelly created Frankenstein, the monstrous entity often credited as the first appearance of a human/machine hybrid in fiction. (Gray, 1995) In 1960 Manfred Clynes and his collaborator Nathan Kline combined cybernetics and organism together to form the term “cyborg”. Their definition of cyborg was a being that “deliberately incorporates exogenous components extending the self-regulatory control function of the organism in order to adapt it to new environments”. (Clynes, 1960) Roughly 25 years later, scholar Donna Haraway wrote *The Cyborg Manifesto*. While *The Cyborg Manifesto* was firmly positioned in a socialist feminist school of thought, its effect was that “the notion of cyborg was given serious attention to in academic and nonacademic intellectual circles… Haraway’s manifesto represents a milestone that opened up a new perspective in theoretical thought on how technologies impact and redefine the notion of human.” (Guga, 2011) For decades, cyborgs in fiction have captured the interest of the entertainment-loving public. In 2014, the notion of the human as both figuratively and physically connected to technology is more prevalent than ever.

SIGNALS OF CHANGE

- In 2010, Neil Harbisson and Moon Ribas founded the Cyborg Foundation to promote cyborg projects and advocate for cyborg rights. [1]
- Neil Harbisson is granted a UK passport with the eyeborg featured in the passport photo, thereby granting the antenna official status as a body part. [2]
- Dr. Steve Mann, University of Toronto Professor, is thrown out of a Paris McDonalds in what became feted on the Internet as the world’s first cybernetic hate crime. [3]
- Filmmaker Rob Spence integrates a camera into a prosthetic eye to become a “bionic documentary maker.” [4]
- Cyborgism makes it into United States case law in Riley v. California, where in 2014 justices rule smartphones are pervasive and personal enough to be analogous to a part of the human anatomy, and therefore may not be seized without a warrant. [5]

[1] http://eyeborg.wix.com/cyborg

[2] http://io9.com/the-first-person-in-the-world-to-become-a-government-re-1474975237

[3] http://www.theverge.com/2012/7/19/3169889/steve-mann-cyborg-assault-mcdonalds-eyetap-paris

[4] http://robspence.tv/

[5] http://www.brookings.edu/research/reports2/2014/09/cyborg-future-law-policy-implications

CYBORGISM IMPLICATIONS MIGHT INCLUDE...

- Government: Government, justice and law making bodies will start to see instances of cyborg-related policy need.
- Medicine: Public health policy and practices may start to change in response to self-augmentation.
- The Human Body: Fringe practitioners may go mainstream, leading to commonplace augmentation parlours and modification shops.
- Athletics: The notion of ‘para’ (Para sports, Paralympics, paraplegic) may take on different cultural meaning.
- Employment: Employment in some fields might start to require augmentations.
- Medicine: There might be more and more crossover between medicine, engineering, robotics and computer science.
- Transhumanism: An increase in replaceable body parts could lead to longer lifespans and more productivity.
- Law and Ethics: There could be an augmentation element added to the divide between technological ‘haves’ and ‘have nots’.
- Medicine: The physiological risks and side effects of augmentation will begin to be studied by medical researchers, as will the psychological and social impacts.

DRIVERS

- Exponentially increasing computational capacity
- Advances in artificial intelligence
- Miniaturization
- Innovation in material design and manufacturing
- Pervasive access to networks
- Fear of illness, aging and death
- Nanotechnology

FRICTION POINTS

- Desire to not harm the body
- Ick factor
- Lack of thoroughly tested and accepted medical guidelines and practices around surgery and patient safety
- No perceived need for the attributes cyborgism grants
- Cost and availability of cyborg augmentations

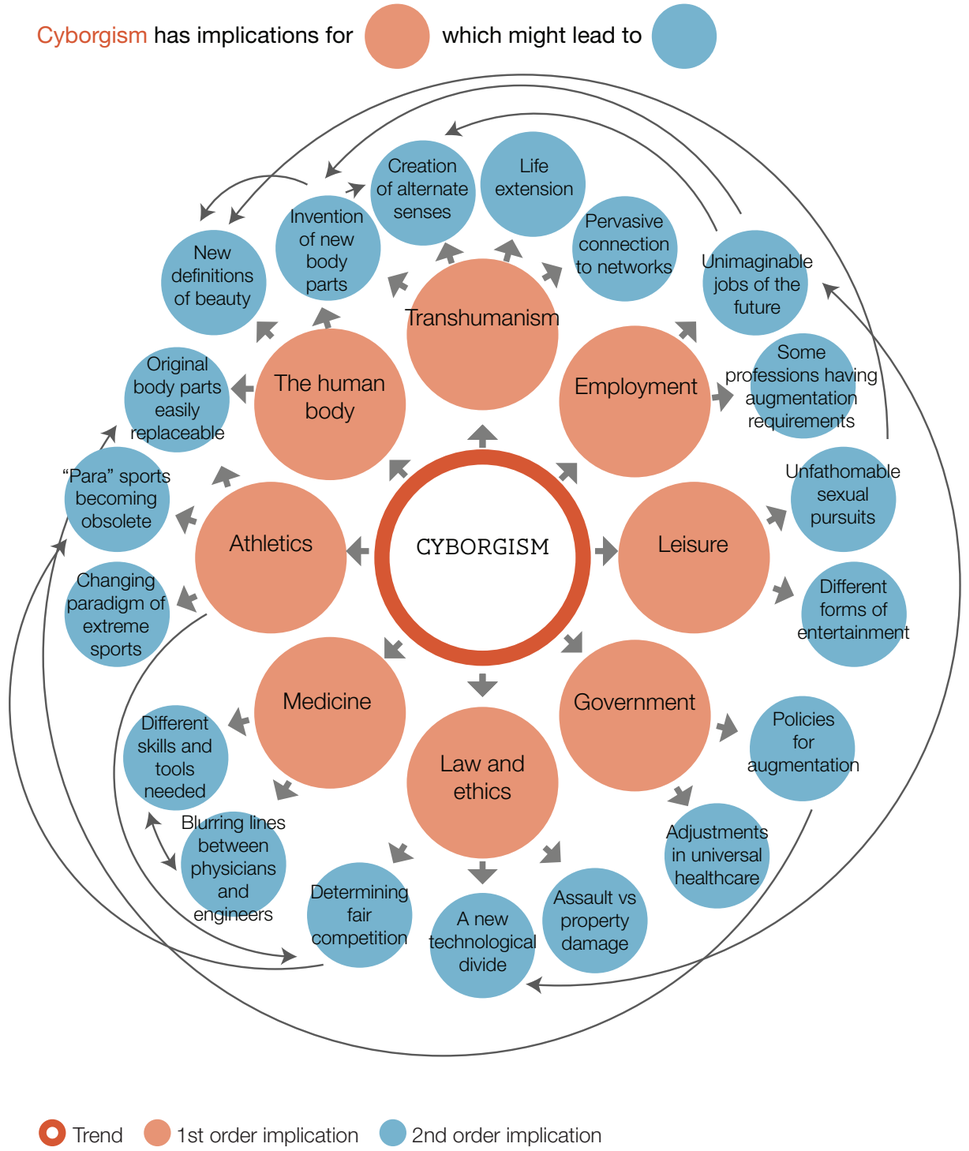


Figure 27

Courtesy of Palateth

STRIVING FOR SINGULARITY

EMERGING

> *A good way to understand the singularity is to imagine explaining the Internet to somebody living in the year 1200. Your frames of reference would be so different that it would be almost impossible to convey how the internet works, let alone what it means to our society… Talking about the singularity is a paradox, because it is an attempt to imagine something that is by definition unimaginable to people in the present day.*
>
> (Annalee Newitz. 2010)

SUPERINTELLIGENCE CHANGES EVERYTHING

The Technological Singularity (or just, 'the singularity') is part philosophy, part movement, and part event. Singularitarians believe that at some point in the future, as a result of the ever-increasing pace of technological change, humanity will achieve a point at which change is so fast that we will no longer be able to comprehend it (Kurzweil, 2005). The singularity is highly dependent on accelerating change, a concept popularized by Moore's Law and Kurzweil's Law of Accelerating Returns. Both laws describe exponential rather than linear or logarithmic increases in the pace of technological change. Where Moore's Law (as first conceived in 1965) was focused on the quite mechanical accelerating increase in processing power of computer hardware (Moore, 2006), the Law of Accelerating Returns encompasses all evolutionary practices including biology and technology. (Kurzweil, 2004) As a result of the singularity — according to Kurzweil — humanity will be transformed in ways we can't predict, but that might include altered biology, superintellingence and the merging of human and machine. (Kurzweil, 2005)

Perhaps the second most famous singularitarian is science fiction author and retired computer science professor Vernor Vinge, whose essays "The Coming Technological Singularity" and "Signs of the Singularity," outlined several ways the singularity might happen. These are: the creation (by humans) of superhumanly intelligent computers; the awakening of computers to a state of self-awareness; the merging of humans, computer interfaces and a system of sensors and databases to a point where they may be considered one massive symbiotic network; and the enhancement of human intellect through biological science. (Vinge, 2008)

The technological singularity is a notion celebrated in science fiction, where it often provides a catalyst for a utopic or dystopic narrative of the future. Both Vinge and Kurzweil have stated the singularity will occur in this century, possibly between 2030 and 2045. (Vinge, 2008; Kurzweil, 2005) Singularitarians, those who are actively engaged in working towards the singularity, include extropians and transhumanists, who await singularity's promise of increased intelligence through technology, the transformation of the human biological form, and longevity and/or immortality. (Bell, 2003)

SIGNALS OF CHANGE

- Google hires singularitarian Ray Kurzweil as Director of Engineering. [1]
- Google invests heavily in robotics and artificial intelligence firms, acquiring Boston Dynamics and Deep Mind. [2]
- IBM Watson wins at Jeopardy using its powerful natural language processing and data crunching capabilities. [3]
- The Internet of Things begins to approximate one of Vinge's scenarios of the singularity; that of a massive networked system connected enough to conceivably be considered a single superintelligent being. [4]
- Singularity Summit to be held in November 2014 expected to attract over 900 executives, entrepreneurs and policy makers. [5]

[1] http://www.wired.com/2013/04/kurzweil-google-ai/

[2] http://www.theguardian.com/technology/2014/jan/27/google-acquires-uk-artificial-intelligence-startup-deepmind; http://www.theguardian.com/technology/2013/dec/17/google-boston-dynamics-robots-atlas-bigdog-cheetah

[3] http://www.nytimes.com/2011/02/17/science/17jeopardy-watson.html?pagewanted=all&_r=0

[4] http://www.wired.com/2013/05/internet-of-things-2/all/

[5] http://global.singularityu.org/summits/amsterdam/

STRIVING FOR SINGULARITY IMPLICATIONS MIGHT INCLUDE...

- If it happens, everything will be different, but the differences are inconceivable.

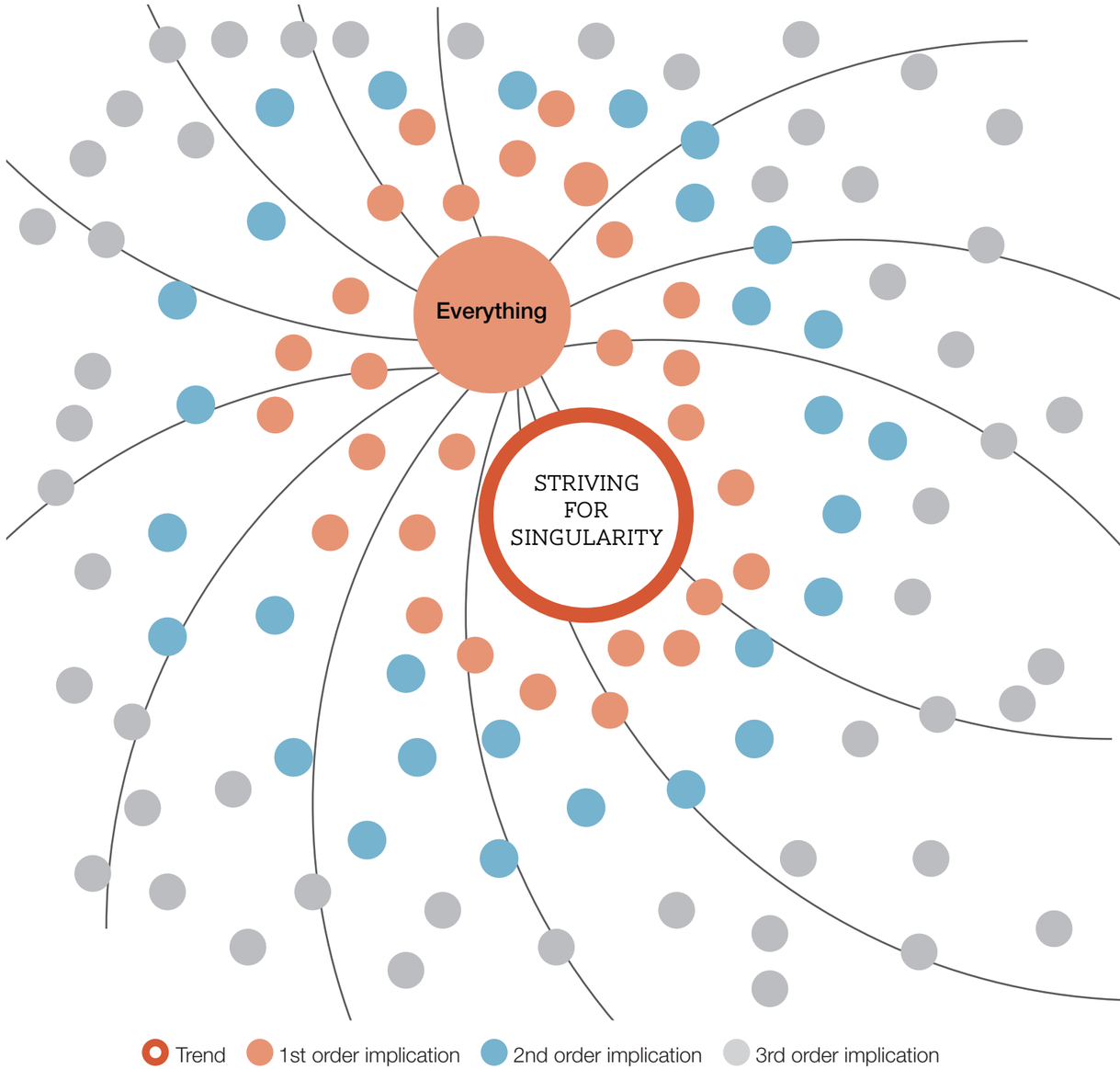
DRIVERS

- Exponentially increasing computational capacity
- Advances in artificial intelligence
- Innovation in material design and manufacturing
- Pervasive access to networks
- Machine to machine communication
- Nanotechnology

FRICTION POINTS

- Neo-Luddites – those opposed to the rapid advance of technology for both ethical and practical reasons
- Overestimation of the scientific and technological capabilities of humans
- Moore's Law and the Law of Accelerating Returns prove incorrect
- Elusiveness of the concept of the Singularity

The Singularity has implications for EVERYTHING.



TRANSHUMANISM

> *Death is a great tragedy… a profound loss… I don't accept it… I think people are kidding themselves when they say they are comfortable with death.*
>
> Ray Kurzweil

One pervasive thread that appeared very early and continued to reappear over the course of this investigation was the idea of how devices worn on and in the body incited curiosity around transcending the state we currently call 'human'. A topic that was discussed by several of our experts, and that came up in some of the material we examined for this project was transhumanism. We felt transhumanism was not consistent enough to be a theme, a little too fringe to be considered a trend, and didn't have the directionality or force of a driver. Rather, we propose that one of the many possible answers to the question of how wearable, implantable and ingestible devices might affect us in the coming decades is by helping to establishing a transhumanist culture.

According to Nick Bostrom, a prominent voice in the transhumanist movement, the term 'transhumanism' was first used in 1927 by biologist Julian Huxley (brother of Brave New World author Aldous Huxley). Huxley wrote:

> *The human species can, if it wishes, transcend itself – not just sporadically, an individual here in one way, an individual there in another way – but in its entirety, as humanity. We need a name for this new belief. Perhaps transhumanism will serve: man remaining man, but transcending himself, by realizing new possibilities of and for his human nature.* (Huxley, in Bostrom 2005)

Ars Electronica, Adam Brandejs: www.flickr.com

Figure 28: Genpets

Stephan Harlan: www.flickr.com

Figure 29: Future human?

Suzanne Gerber: www.flickr.com

Figure 30: Human

Transhumanism is an intellectual school of thought that has various overlapping definitions. One of the difficulties in situating an investigation within a transhumanist paradigm is that there is not an overarching understanding of what the term means, or agreement between notables in the field on what it encompasses.

> *Not merely are there idiosyncrasies of individual academics, but there does not seem to exist an absolutely agreed on definition of transhumanism. One can find not only substantial differences between key authors and the disparate disciplinary nuances of their exhortations, but also subtle variations of its chief representatives in the offerings of people.* (McNamee and Edwards, 2006)

That said, the bulk of transhumanist ideology from the 1980s to the present revolves around several principles and technologies. Most salient to *The Next Familiar* is the embrace of science and technology to expand the capabilities of humans at the individual level, through alterations to the body and mind. Our expert interviewees addressed this frequently. Transhumanists, or those engaged in transhumanist practices even if they do not identify with the movement, engage in exploration of information technology, biotechnology, artificial intelligence, virtual reality, cryonics, mind uploading and nanotechnology. As prominent transhumanist Anders Sandberg says:

> *"Transhumanists were early on thinking about the singularity, and generally most transhumanists were super enthusiastic and still are, and are really hoping that Ray Kurzweil is really right... because once we get super intelligent machines they're going to help us of course solve the problems of nanotechnology and then we get on the cryonics and fix aging and enhance ourselves and so on..."*
> (Sandberg, personal communication, September 3, 2014)

Mind uploading and nanotechnology may be the least recognizable concepts. Mind uploading refers to the notion of replicating a brain, or more accurately, a consciousness, either to a storage area such as 'the cloud' or to another biological or non-biological vessel. Several works of fiction describe mind uploading well. For example, in the novel Neuromancer, the character of Dixie Flatline is the consciousness of former human McCoy Pauly, stored as code. (Gibson, 1984) In the movie Avatar, the mind of main character Jake Sully is transferred from his imperiled body to the consciousness of the alien planet upon which the story is set, and then to a genetically manufactured alternate body that previously served as his representative (avatar) on the planet. We can't know if mind uploading will ever be possible — primarily because the idea of replicating an organ we really know so little about is problematic, but it is plausible that the combination of lifelogging, neural interfaces and computational capacity we see emerging today could approximate or even result in the ability to mind upload.

Nanotechnology is the "the engineering of functional systems at the molecular scale" (Center for Responsible Nanotechnology, n.d.). Nanotechnology is of massive interest to large organizations and governments at the moment. Theoretically, nanotechnology offers the possibility of fabrication at the atomic level, which could mean a fundamental change in the way every single material and substance on earth is created. The ability to create and configure biological material could conceivably result in the elimination of disease, aging or other damage to the human body.

As mentioned above, Nick Bostrom is perhaps the most prominent transhumanist academic alive today. Together with philosopher David Pearce, he started the World Transhumanist Association, an organization for the promotion and discussion of transhumanism, now known as Humanity+. Other significant contributors to the transhumanist movement include: futurist FM-2030 (born Fereidoun M. Esfandiary, he wrote the 1989 book Are You a Transhuman?: *Monitoring and Stimulating Your Personal Rate of Growth in a Rapidly Changing World*); Max More and his wife Natasha Vita-More (both writers and speakers, currently advising and managing Humanity+ and editors of the 2013 book *The Transhumanist Reader*); Bostrom's contemporary Anders Sandberg (who we were fortunate to interview for this project); and perhaps most famously, Google director of engineering Ray Kurzweil.

Bostrom's 2005 work *A History of Transhumanist Thought* included "A Transhumanist Declaration", a manifesto originally created in 1998 by a consortium of transhumanists. It has been updated over the years and is now posted on the Humanity+ website. What interests us about the declaration is the marriage of futuristic and technological concepts such as artificial intelligence and human modification with views that are strongly aligned to a human-centered and foresight design mindset. "The Transhumanist Declaration" is included in the Appendix of this document, page 134.

Transhumanism has critics. In 2004, Foreign Policy magazine asked eight intellectuals to contribute to their special report "The World's Most Dangerous Ideas". Seven contributions addressed fairly standard political/policy topics, but the composition by political scientist, political economist, and author Francis Fukuyama called out transhumanism, stating "…it is very possible that we will nibble at biotechnology's tempting offerings without realizing that they come at a frightful moral cost." (Fukuyama, 2004) He questioned the ability of transhumanism to accommodate certain values of equality that many hold sacrosanct, and asked if transhumanists "really comprehend ultimate human goods". McNamee and Edwards also focus on the biomedical in their article "Transhumanism, Medical Technology and Slippery Slopes". In that piece, "transhumanism is considered to be a quas-medical ideology that seeks to promote a variety of therapeutic and human-enhancing aims. Moderate conceptions are distinguished from strong conceptions of transhumanism and the strong conceptions were found to be more problematic than the moderate ones." (McNamee and Edwards, 2006) They explicitly discuss the issue of "…moral arbitrariness, which undermines both forms of transhumanism" and echo Fukuyama:

> *So just as humanism is founded on the idea that humans are the measure of all things and that their fulfillment is to be found in the powers of reason extolled and extended in culture and education, so too transhumanism has a vision of the good, albeit one loosely shared.[…] Against the more moderate transhumanists, who see transhumanism as an opportunity to enhance the general quality of life for humans, it is nevertheless true that their position presupposes some conception of the good. What kind of traits is best engineered into humans: disease resistance or parabolic hearing? And unsurprisingly, transhumanists disagree about precisely what "objective goods" to select for installation into humans or posthumans.*
> (McNamee and Edwards, 2006)

Our perspective, stemming from scanning, observation and conversations with individuals who have started tactically down the path of augmentation, is that some facets of the transhumanist agenda are being manifested today. But as with many technologies and their accompanying doctrine, transhumanism will likely evolve in ways we don't expect. Bostrom's transhumanist declaration actually sits quite comfortably with our ethos around designing technology that benefits humans. In the sphere of *The Next Familiar*, we see transhumanism as an emerging movement that both promotes and critically examines alterations, by means of science and technology, to what we consider our natural human identity, form and capacities, guided by humane and human-centered principles and values.

SCENARIOS & EXPERIENTIAL FUTURES

> *The future cannot be predicted because the future does not exist.*
>
> Jim Dator

Scenarios are a way of exploring ‘what if’ questions about the future by taking information from the present and imagining what might emerge in the years to come. Scenarios manifested as experiential futures afford a certain playfulness and the chance to be provocative in challenging our notions about how trends, drivers and implications could manifest themselves along a particular timeline.

In order to construct our scenarios and experiential futures, we kept notes of the ‘what if’ questions we had as we worked through the project, such as “What if emergency rooms of the future need doctors and engineers to work together?” or “What if getting an RFID implant was as common as getting a manicure/pedicure?” Scenario themes came out of these questions. We laid out all our recurring concepts, trends and drivers as variables under the selected ideas. Using a scale of 1 to 5, we ranked each variable for relevance and formative impact against the idea. We brainstormed different form factors for the outputs of the scenarios, which are the experiential futures. Our intention around using different tones, voices, artifacts and display methods was to illustrate that in design foresight, we need not be limited in how we embody slices of the future. In the creative interpretation, some of the elements in the stories changed from our original mapping. The original mapping can be found in the Appendix, Scenario Development Process Images, page 137.

Our installation (exhibited in the OCAD University Graduate Gallery in October 2014) provided a three dimensional way to experience the futures that are described textually in this document.

DARK CIRCLE

A scenario about a future in which privacy is not a right but a privilege that is bought and sold like any other commodity.

This scenario explored the following ‘what if’ questions in the context of a wearable technology:

- What if there’s no such thing as privacy and everything is documented digitally?
- What if you have to pay for your right to privacy?
- What if nanotechnology allows for invisibility?
- What if the Internet of Things really does provide an all-encompassing connected intimate environment?
- What if it was difficult to live off the technology grid?

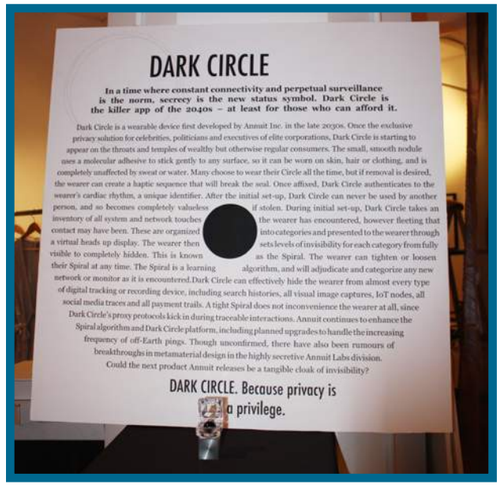


Figure 31: *Dark Circle* installation

Dark Circle took the form factor of a textual description and an imagined product.

OTHER SELF

A genius inventor creates the ultimate algorithm that promises everyday people a life of leisure, but results in disappointment for the masses and disaster for its creator.

This scenario explored the following ‘what if’ questions in the context of a wearable or implantable technology:

- What if mundane daily tasks can be handled by computers and machines?
- What if everyone has a virtual companion?
- What if the assembler happens?
- What if humans become God-like through technology?

Figure 32: *Other Self* installation

Other Self took the form factor of a tabloid magazine.

I MAKE PEOPLE

Imagine a future where ‘tester’ humans are deployed to other planets to determine environmental and emotional viability for human inhabitation.

This scenario explored the following ‘what if’ questions in the context of genetic modification:

- What if there’s no discernible difference between a ‘real’ human and an ‘unreal’ human?
- What if a different species of homo sapiens comes into existence?
- What if we live on other planets?

Figure 33: *I Make People* installation

I Make People took the form factor of a mini diorama.

FEELS GOOD LIKE A MEMORY SHOULD

In this scenario uploading and downloading memories is an addiction wrought by technology. Activists protest against corporations that profit from this social practice.

This scenario explored the following ‘what if’ questions in the context of implantable technology:

- What if you could download/upload memories?
- What if you could flip through a memory catalogue like you do an Ikea catalogue?
- What if there were memory addicts?
- What if you could download so many memories from other people that you don’t know who you are?
- What if you could upload your mind – who would own your IP after you physically die?

Figure 34: *Feels Good Like a Memory Should* installation

Feels Good Like a Memory Should took the form factor of a protest depicted via a video montage with props.

SALON MODIFICA

What if it was as easy to get an RFID implant or cybernetic limb, as it was to get a tattoo or a piercing? In 2044, a quick visit to Salon Modifica can take care of all your biohacking needs.

This scenario explored the following ‘what if’ questions in the context of implantable technology:

- What if getting an RFID implant was as common as getting a manicure/pedicure?
- What if augmentation salons are as ubiquitous as nail salons are today?
- What if everybody has minor or major cyborg bits?
- What if there was policy around facilities and personnel working in the augmentation field?

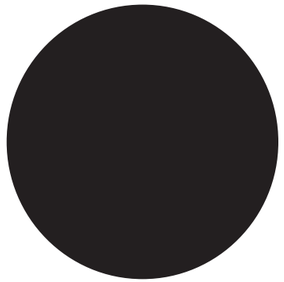
Figure 35: *Salon Modifica* installation

Salon Modifica took the form factor of a life-sized diorama.

DARK CIRCLE

In a time where constant connectivity and perpetual surveillance is the norm, secrecy is the new status symbol. Dark Circle is the killer app of the 2040s – at least for those who can afford it.

Dark Circle is a wearable device first developed by Annuit Inc. in the late 2030s. Once the exclusive privacy solution for celebrities, politicians and executives of elite corporations, Dark Circle is starting to appear on the throats and temples of wealthy but otherwise regular consumers. The small, smooth nodule uses a molecular adhesive to stick gently to any surface, so it can be worn on skin, hair or clothing, and is completely unaffected by sweat or water. Many choose to wear their Circle all the time, but if removal is desired, the wearer can create a haptic sequence that will break the seal. Once affixed, Dark Circle authenticates to the wearer's cardiac rhythm, a unique identifier. After the initial set-up, Dark Circle can never be used by another person, and so becomes completely valueless if stolen.



During initial set-up, Dark Circle takes an inventory of all system and network touches the wearer has encountered, however fleeting that contact may have been. These are organized into categories and presented to the wearer through a virtual heads up display. The wearer then sets levels of invisibility for each category from fully visible to completely hidden. This is known as the Spiral. The wearer can tighten or loosen their Spiral at any time. The Spiral is a learning algorithm, and will adjudicate and categorize any new network or monitor as it is encountered.

Dark Circle can effectively hide the wearer from almost every type of digital tracking or recording device, including search histories, all visual image captures, IoT nodes, all social media traces and all payment trails. A tight Spiral does not inconvenience the wearer at all, since Dark Circle's proxy protocols kick in during traceable interactions. Annuit continues to enhance the Spiral algorithm and Dark Circle platform, including planned upgrades to handle the increasing frequency of off-Earth pings. Though unconfirmed, there have also been rumours of breakthroughs in metamaterial design in the highly secretive Annuit Labs division. Could the next product Annuit releases be a tangible cloak of invisibility?

DARK CIRCLE.
Because privacy is a privilege.

DARK CIRCLE

RECURRING CONCEPTS

TRANSCENDING THE HUMAN FORM	**IDENTITY/SENSE OF SELF**	HUMAN-CENTERED DESIGN
ETHICS/LEGALITY	ADDING/BRIDGING SENSES	**SURVEILLANCE**
POWER	**PRIVACY**	

TRENDS

CONSTANT CONNECTIVITY	MAKER MOVEMENT	QUANTIFIED SELF
LIFELOGGING	**INTERNET OF THINGS**	BIOHACKING
CYBORGISM	TECHNOLOGICAL SINGULARITY	

DRIVERS

EXPONENTIALLY INCREASING COMPUTATIONAL CAPACITY	**ADVANCES IN ARTIFICIAL INTELLIGENCE**	MINIATURIZATION
INNOVATION IN MATERIAL DESIGN AND MANUFACTURING	NANOTECHNOLOGY	**PERVASIVE ACCESS TO NETWORKS**
SOCIAL MEDIA	**MACHINE TO MACHINE COMMUNICATION**	CROWDFUNDING
CORPORATE DETERMINATION	**CHANGING ATTITUDES TOWARDS PRIVACY**	IMPULSE FOR PRESERVATION OF MEMORIES/ PERSONAL HISTORY
DESIRE FOR VIRTUAL SOCIAL CONNECTION	FEAR OF ILLNESS, AGING AND DEATH	

Recurring concepts, trends and drivers applicable to the scenario

OTHER SELF

RECURRING CONCEPTS

TRANSCENDING THE HUMAN FORM	IDENTITY/SENSE OF SELF	HUMAN-CENTERED DESIGN
ETHICS/LEGALITY	ADDING/BRIDGING SENSES	**SURVEILLANCE**
POWER	PRIVACY	

TRENDS

CONSTANT CONNECTIVITY	MAKER MOVEMENT	QUANTIFIED SELF
LIFELOGGING	**INTERNET OF THINGS**	BIOHACKING
CYBORGISM	TECHNOLOGICAL SINGULARITY	

DRIVERS

EXPONENTIALLY INCREASING COMPUTATIONAL CAPACITY	**ADVANCES IN ARTIFICIAL INTELLIGENCE**	MINIATURIZATION
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DESIRE FOR VIRTUAL SOCIAL CONNECTION	FEAR OF ILLNESS, AGING AND DEATH	

Recurring concepts, trends and drivers applicable to the scenario

Figure 36: *Other Self* tabloid magazine layout

CREATOR OF OTHER SELF IS BACK

Last year we all dreamed of Manderley

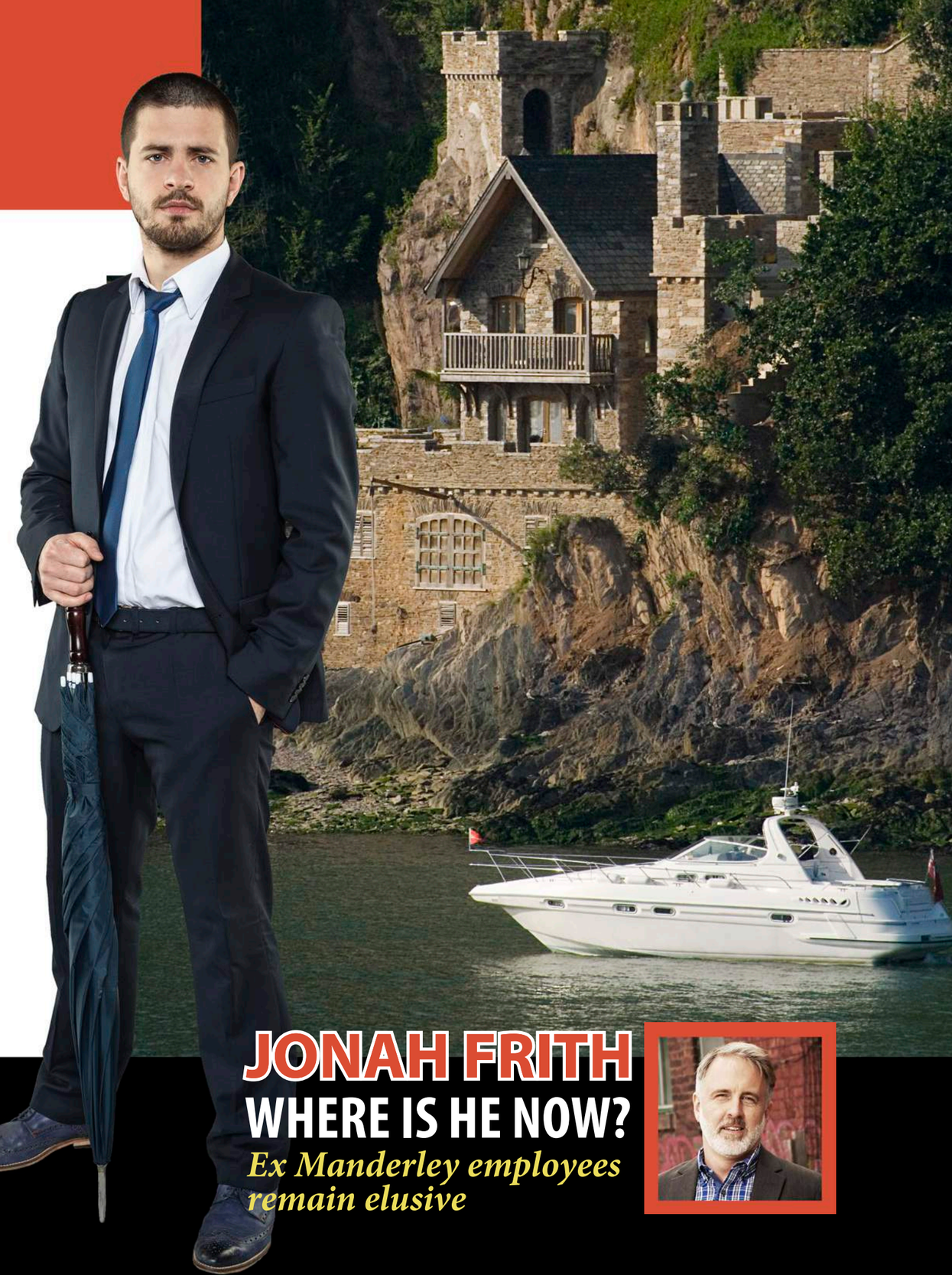
Until those dreams, along with billions of dollars in investment funding, acres of equipment and, tragically, the lives of over a dozen employees, were destroyed in the devastating fire that ripped through the Manderley Inc. main campus in Cornwall, England. Max Winter, Manderley's founder and CEO, all but disappeared into the smoldering ruins of his failed empire.

But now, it seems, the iconic genius and creator of Other Self is back. In an exclusive tell-all, Human magazine brings you the details of what really happened between Max Winter, the late Rebecca Winter, Daphne Maurier and 'Danny', a project run amuck. It's a story that could have been pulled straight from an old-fashioned novel…

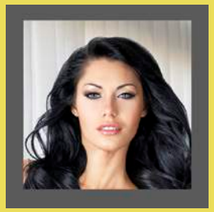
Max Winter's rise to the helm of one of the world's most sophisticated software companies has been compared to that of another pioneering innovator of the twenty-first century, Steve Jobs. Like Jobs, Winter had a dream for a personal computing revolution. His platform, Other Self, would combine the power of artificial intelligence with cutting edge advances in life logging and social media, all connected through the well-established Internet of things. Other Self promised to offload much of the mundane trivialities we all have to think about every day to a virtual personal assistant that would always have the right directions, never lose a contact, and wouldn't forget to put milk on the grocery list. When Manderley acquired Google and rolled all of the power of Google AI into Other Self, his vision of a mass-market virtual concierge became reality.

Other Self 1.0 was an immediate success. Undeniably the biggest product launch in history, eager customers pre-ordered their subscriptions up to a year in advance of the anticipated go to market date. The product truly revolutionized daily life. If you were one of the many early adopters, you'll recall that feeling of relief that 'someone else' was dealing with the bills, the movie tickets, the dry cleaning pickup and the birthday party invitations. Some of us even started to develop a 'friendship' with our Other Selves. Says Bea Lacey, one of the first users, "It was like my Other Self had my back. Early on, I'd catch myself wondering what 'she'd' think about an outfit I was considering or my choice of restaurant… then I just started to ask her. I knew she was only a string of code, but she was like my best friend."

Meanwhile, behind the smoothly manicured lawns and electrode-enhanced glass walls of Manderley Inc., Max Winter was hard at work on a prototype for Other Self 2.0. The promise of the next major release



3 WIVES OF WINTER



JONAH FRITH WHERE IS HE NOW?

Ex Manderley employees remain elusive

was greater reality mining capabilities and enhanced personality features. Max claimed the prototype as his own Other Self, nicknamed it 'Danny', and kept the world in thrall with Danny's emergence through Manderley's social streams. Tech observers remarked that the Winter public relations machine was almost as brilliant as the software itself.

Things couldn't have been going better for Manderley and Max Winter. And by his side throughout, providing the public counterpoint to his single-minded and sometimes brusque determination was the lovely and gracious Rebecca Winter – a trendsetter, society darling and renowned tech evangelist herself.

With some of the world's most dazzling neuroscience and computational experts on the Manderley roster, it was no surprise that Danny progressed quickly. Using the corporation's own massive operations as a test basis, Danny was put through its paces managing various aspects of the company. Danny and Max seemed an unbeatable team. Investors couldn't pour enough funding into Other Self. But in the Winters' personal lives, the cracks were starting to show.

"Danny, it's always about Danny, are you married to Danny? Go f--- Danny if the two of you are so close!"

Rumors began to trickle out of Manderley about mounting tension between Max and Rebecca. There was a quickly hushed-up incident involving a purported 'other man', Jack Favell, though he proved elusive. Rebecca was admitted to the swank Royal Cornwall Hospital amid speculation she was pregnant, but a baby bump never materialized. Employees, usually closed-mouthed about the inner workings of Manderley, became disgruntled and a few candid interviews revealed tempestuous fights between husband and wife, with hysterical and bizarre accusations. According to a close source, "Rebecca flew into rages and everyone knew to steer clear – she'd be screaming at Max 'Danny, Danny, it's always about Danny, are you married to Danny? Go f--- Danny if the two of you are so close!'" Another insider wondered why the pair always fought about the software "…when anyone could see it wasn't only Danny that Max was preoccupied with. By then Daphne was on the scene. Everyone could see they were falling for each other."

Jonah Frith, a Manderley staffer from the early days, left the company under strained circumstances. Speaking with us from an undisclosed location, Frith said "There were definitely some odd things going on with the Danny prototype, the beta testing was, well, surprising. Not that Danny didn't perform, in fact Danny performed better than anyone could have imagined. Danny never missed a beat, never had a glitch, the bug reports were empty, on paper the company was running perfectly… it was, I don't know… uncanny."

Then – heartbreak. Claiming she needed some space to clear her head, Rebecca and a long-time friend headed out for a few hours on the coast bordering the Manderley estate. They had been on the water for less than an hour when the auto-piloted Winter yacht capsized, trapping and drowning them both. Despite their many troubles, Max took Rebecca's death hard. In his fragile state, he became closer and closer to ingénue Daphne Maurier and the new relationship blossomed. They married just a few months later. Daphne was in many ways the polar opposite of Rebecca, unassuming, artsy and inexperienced in the world of tech royalty. She took on the role of Manderley's first lady willingly enough, but like the previous Mrs. Winter, soon found life under the brilliance of Max Winter and the ubiquitous presence of Danny stifling.

Ultimately though, launching Other Self 2.0, 'the Danny version' was a Manderley priority that trumped the ups and downs of the Winters' personal lives.

And again, Other Self exceeded all expectations. Hundreds of thousands of us bought into Other Self – both the software, with its pervasive data streams that connected almost every object and interaction imaginable, and the lifestyle that went along with it. Hailed as members of the 'relaxation renaissance', Other Selfers were finally living the dream of technology to make life easier and get back some leisure time.

A lavish gala was planned at Manderley to celebrate the phenomenal first quarter sales figures. That infamous night started like a scene from a fairytale. Daphne sparkled in a retro 2010s gown updated with hundreds of networked sensors that twinkled on and off in response to the Other Self data streams. Amid the dozens of A-list partygoers, Max Winter only had eyes for her. Eyes for her, perhaps, but words for the rest of the world… In a shocking duo of announcements, Winter stunned the room by declaring he would be turning oversight of Danny and the next version of Other Self over to company second-in-command Frank Crawley, and that he and Daphne would soon be welcoming their first child. "I made the mistake of putting my project ahead of my wife the first time around," he said, "and I'll never let that happen again."

Up until now, no one knew what transpired between the close of that astonishing soiree and the fire that just hours later gutted the campus, taking down Other Self and abruptly terminating what had become a way of life for so many. But surveillance feeds painstakingly extracted and recreated from the rubble of the Manderley estate show a giddy Daphne Maurier entering her penthouse room after the party. She reaches behind her to undo the twinkling dress when it suddenly starts to pulse and glow. She shrieks and her hands fly off the zipper amidst a shower of sparks. The dress stiffens and begins to move, as if all the strands of sensors were a glimmering net, pulling her towards the panoramic windows. The glass cracks and splinters into a million shards, bloodying Daphne's feet as she stumbles closer and closer to the edge. She screams until Winter runs into the room. He's yelling what sounds like "Dammit, dammit, no no no!" as he reaches for her. Their fingertips meet for an agonizing fraction of a second before Daphne's glowing body is flung brutally onto the rocks below. The fixtures in the walls and ceiling of the room start to explode and burn as Max Winter flees into the hall. We asked Jonah Frith if he'd seen the feed. He's silent for a long time. "That wasn't dammit he was shouting," Frith finally says. "That was Danny."

Figure 37: Daphne's Dress, Solarbotics: www.flickr.com

Fast forward to the present. For those of us who never had Other Self, the grind is still the grind. It's more difficult for the Other Selfers, many of whom truly struggle to manage their daily lives. Max Winter relaxes in the sun-dappled main room of his nascent start-up. A coffee cup is perched casually on a rare old paper version of Drexler's Nanosystems: Molecular Machinery Manufacturing and Computation. "I've moved away from algorithms." Winter smiles as his bright-eyed baby gurgles from a cocoon in the corner. "I'm onto something big in manufacturing. Well, something really, really small would be more accurate…" His new partner, molecular nanotechnologist Julyanne Kernel ambles into the room. "We're reviving an old idea from a few decades ago," Winter continues. "We're calling it Assembler. I guess we'll see what happens…"

I MAKE PEOPLE

Hello everyone, it's so lovely to welcome you here in person! The objective of this session is to take you through the proposed business plan for Sixth Day. I'm Eva, I'm one of the senior creators at Sixth Day.

So just to get started, as you all know, we've made incredible strides in interplanetary exploration in the last 10 years. There are several planets that we know could quite possibly support human life. But… how to test that? Instrumentation can tell us if the atmosphere and food sources will be satisfactory. However the last dozen decades have taught us we need to put human sensibilities at the center of scientific and technological inquiry. We need to understand human reactions, emotions and behaviour patterns in new situations.

To that end, we created Sixth Day, the first manufacturer of completely organic replicant humans. Our replicants react both physically and emotionally as real humans would when placed on another planet. Through genetic manipulation we have created beings that are almost identical to humans. They can be flat-packed and animated in situ. This makes it easy to deploy a 'society' en mass to the target planet. Today I'd like to walk you through our business model and introduce a few innovations we've implemented in terms of cultural programming. Then I'll take your questions, and then we can all go down to the lab and have a look the replicants themselves. So, on to the business model...

Figure 38: *I Make People* experiential installation at OCAD University

I MAKE PEOPLE

RECURRING CONCEPTS

TRANSCENDING THE HUMAN FORM	**IDENTITY/SENSE OF SELF**	**HUMAN-CENTERED DESIGN**
ETHICS/LEGALITY	ADDING/BRIDGING SENSES	SURVEILLANCE
POWER	PRIVACY	

TRENDS

CONSTANT CONNECTIVITY	MAKER MOVEMENT	QUANTIFIED SELF
LIFELOGGING	INTERNET OF THINGS	**BIOHACKING**
CYBORGISM	TECHNOLOGICAL SINGULARITY	

DRIVERS

EXPONENTIALLY INCREASING COMPUTATIONAL CAPACITY	**ADVANCES IN ARTIFICIAL INTELLIGENCE**	MINIATURIZATION
INNOVATION IN MATERIAL DESIGN AND MANUFACTURING	**NANOTECHNOLOGY**	PERVASIVE ACCESS TO NETWORKS
SOCIAL MEDIA	MACHINE TO MACHINE COMMUNICATION	CROWDFUNDING
CORPORATE DETERMINATION	CHANGING ATTITUDES TOWARDS PRIVACY	IMPULSE FOR PRESERVATION OF MEMORIES/ PERSONAL HISTORY
DESIRE FOR VIRTUAL SOCIAL CONNECTION	FEAR OF ILLNESS, AGING AND DEATH	

Recurring concepts, trends and drivers applicable to the scenario

FEELS GOOD LIKE A MEMORY SHOULD

In 2044 memories are big business. They come in a wide range of types, lengths and quality, from grainy fleeting glimpses to slick dream-length sequences. Of course everyone has their own memories, but other people's memories can be so much fun! Buying memories is easy; there are dozens of online data stores catering to every taste. And selling memories can net anyone a few bucks – sometimes a lot more depending on your lifestyle. Enjoyed in moderation, extra memories are no big deal – a fun diversion, a way to kill a few seconds or relax for an hour or so after a long day. But… like in the olden days with alcohol or cigarettes, they can be addictive. Professionals in psychiatry and psychology are growing increasingly concerned about the effects of uploading and downloading memories. Public health organizations are dealing with more issues from burnt-out memory junkies every year. And community advocacy groups have set their sights on the dozen or so mega-memory companies, questioning the ethics of how they're collecting their inventory and how aggressively they market to vulnerable groups – children, the lonely and the aged.

Figure 39: *Feels Good Like a Memory* Should experiential installation at OCAD University

Figure 40: Thomas Hawk: www.flickr.com

Figure 41: Emily Hoyer: www.flickr.com

Figure 42: Ross Pollack: www.flickr.com

FEELS GOOD LIKE A MEMORY SHOULD

RECURRING CONCEPTS

TRANSCENDING THE HUMAN FORM	**IDENTITY/SENSE OF SELF**	HUMAN-CENTERED DESIGN
ETHICS/LEGALITY	ADDING/BRIDGING SENSES	SURVEILLANCE
POWER	PRIVACY	

TRENDS

CONSTANT CONNECTIVITY	MAKER MOVEMENT	QUANTIFIED SELF
LIFELOGGING	INTERNET OF THINGS	BIOHACKING
CYBORGISM	TECHNOLOGICAL SINGULARITY	

DRIVERS

EXPONENTIALLY INCREASING COMPUTATIONAL CAPACITY	ADVANCES IN ARTIFICIAL INTELLIGENCE	MINIATURIZATION
INNOVATION IN MATERIAL DESIGN AND MANUFACTURING	NANOTECHNOLOGY	**PERVASIVE ACCESS TO NETWORKS**
SOCIAL MEDIA	MACHINE TO MACHINE COMMUNICATION	CROWDFUNDING
CORPORATE DETERMINATION	**CHANGING ATTITUDES TOWARDS PRIVACY**	**IMPULSE FOR PRESERVATION OF MEMORIES/ PERSONAL HISTORY**
DESIRE FOR VIRTUAL SOCIAL CONNECTION	FEAR OF ILLNESS, AGING AND DEATH	

Recurring concepts, trends and drivers applicable to the scenario

SALON MODIFICA

Not unlike a beauty parlour, Salon Modifica is a place where people go to biohack. In 2044, techy body mods are as commonplace as tattoos and piercing was in 2014. The Salon offers a full range of services performed by professional augmenters, as well as DIY booths where clients can self-augment in a safe and sterile environment.

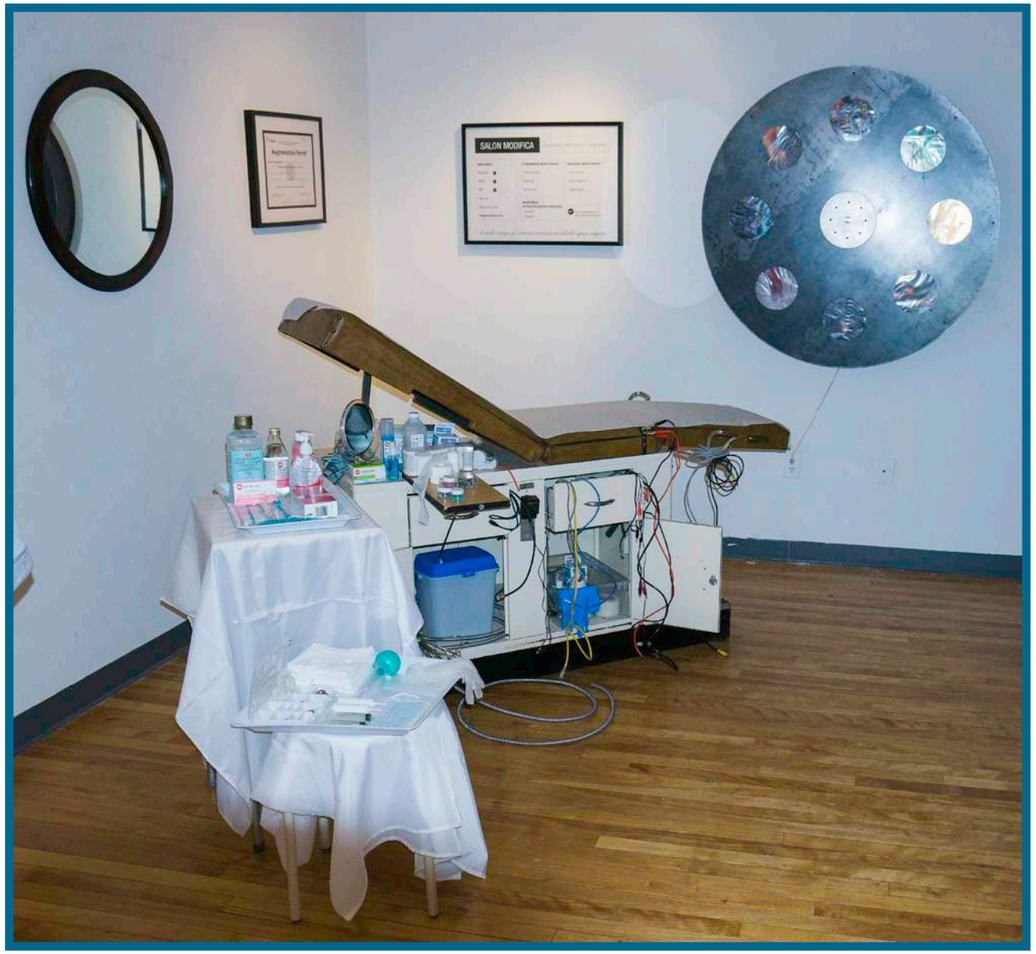
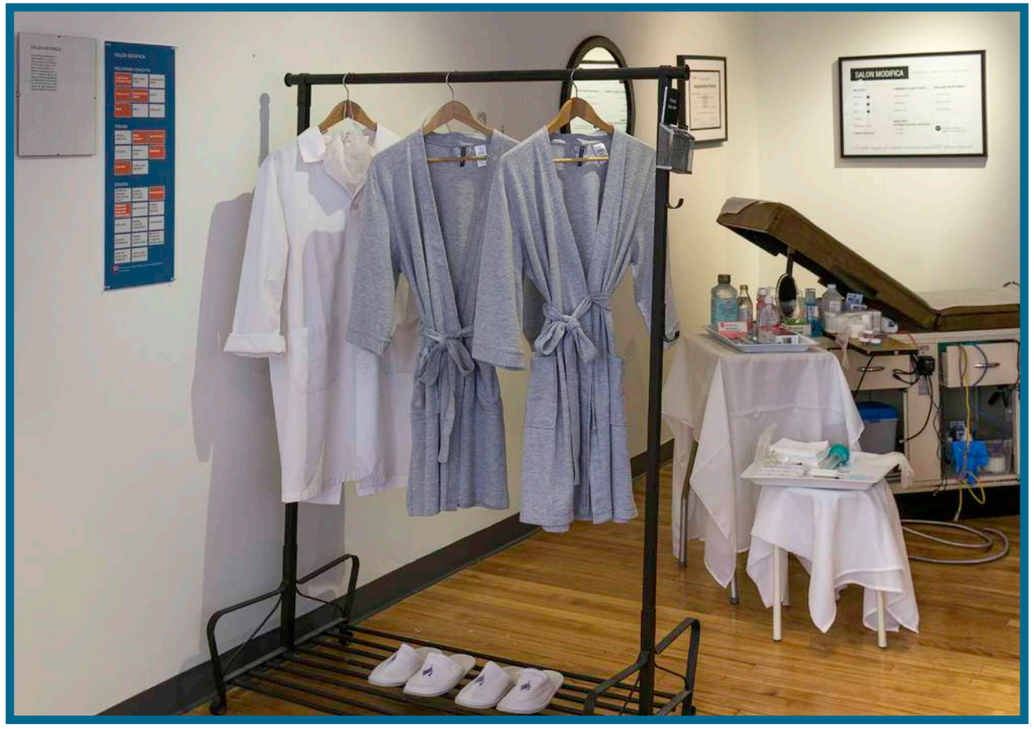
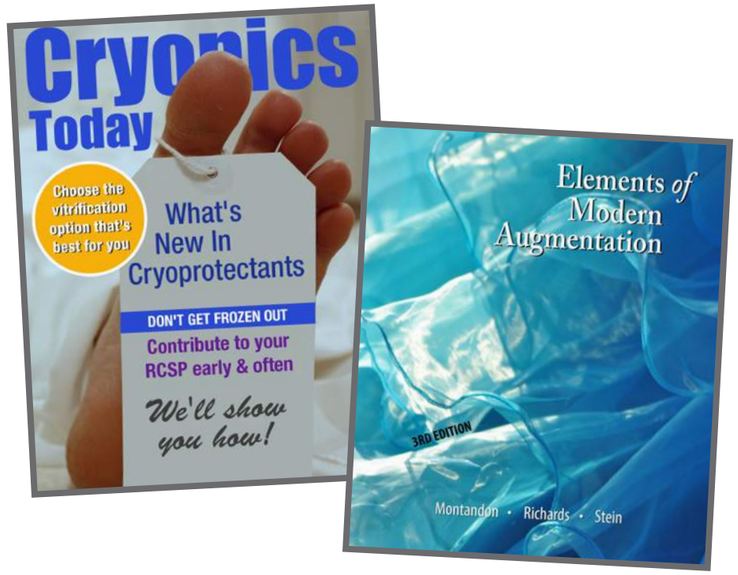
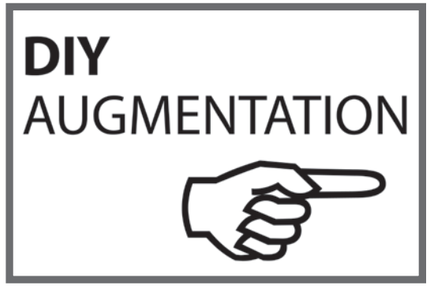
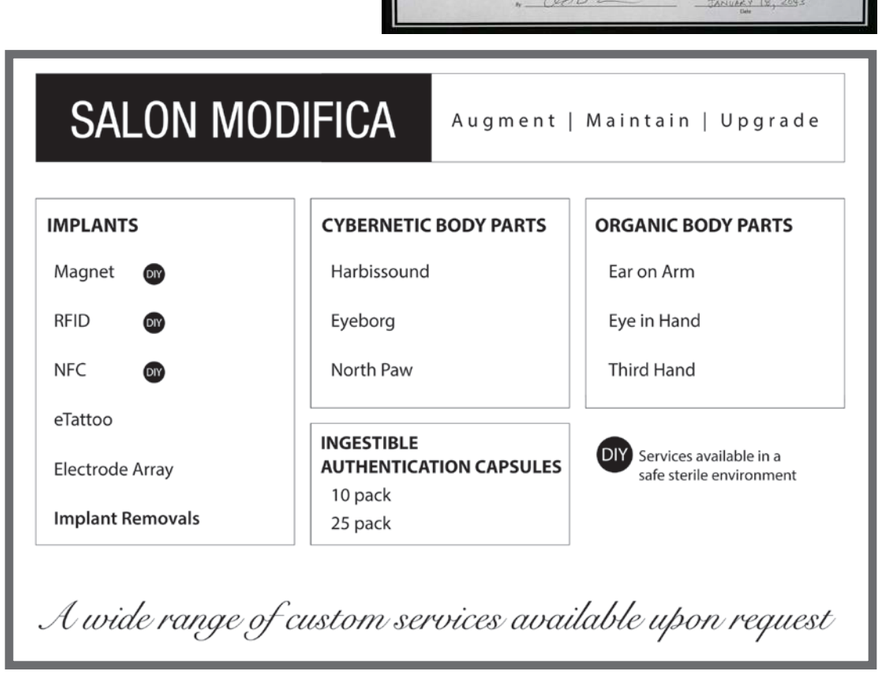


Figure 43: *Salon Modifica* experiential installation at OCAD University









SALON MODIFICA

RECURRING CONCEPTS

TRANSCENDING THE HUMAN FORM	IDENTITY/SENSE OF SELF	HUMAN-CENTERED DESIGN
ETHICS/LEGALITY	**ADDING/BRIDGING SENSES**	SURVEILLANCE
POWER	PRIVACY	

TRENDS

CONSTANT CONNECTIVITY	**MAKER MOVEMENT**	**QUANTIFIED SELF**
LIFELOGGING	INTERNET OF THINGS	**BIOHACKING**
CYBORGISM	TECHNOLOGICAL SINGULARITY	

DRIVERS

EXPONENTIALLY INCREASING COMPUTATIONAL CAPACITY	ADVANCES IN ARTIFICIAL INTELLIGENCE	**MINIATURIZATION**
INNOVATION IN MATERIAL DESIGN AND MANUFACTURING	NANOTECHNOLOGY	PERVASIVE ACCESS TO NETWORKS
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DESIRE FOR VIRTUAL SOCIAL CONNECTION	FEAR OF ILLNESS, AGING AND DEATH	

Recurring concepts, trends and drivers applicable to the scenario

CONCLUSION

> *The best way to predict your future is to create it.*
>
> Abraham Lincoln

The Next Familiar sought to shed light on the question of how wearable, implantable or ingestible technologies might affect us in the next 30 years. We are at an interesting moment in time in 2014, where we see the digital tools we use are getting closer and closer to our physical bodies. There is a lot of industry buzz around wearables, and the arena is wide open.

As experience designers in our professional lives, we wanted to research and understand the intimate technologies we see emerging in our practice areas. We were interested in how these technologies affect individuals and society currently, and how they might go on to do so in the future. A futures project was well suited to this investigation in that it allowed us to explore a provocative topic with the potential for powerful immersive design elements. We titled our body of work The Next Familiar in order to embed two notions into the project – that of "familiarity" as closeness or normalcy, and that of "a familiar" as a magical assistant that is sometimes tricky or unpredictable.

Our project team of two employed a design foresight methodology that consisted of three phases – data gathering, analysis and synthesis, and creating design deliverables. Throughout the process, we maintained a deep practice of collaboration and dialogue. Every part of the project was conceptualized, workshopped, written, critiqued, designed and revised as a team.

We began our exploration with a literature review and environmental scan to understand the context of these intimate technologies, limiting our scope to augmentative technology that enhanced human ability and involved some form of network connectivity. On a continuum of devices from carryable (smartphones) to ingestible (pill sensors), the bulk of our attention centered on wearables and implantables. Wearables most likely represent the next forefront of consumer-facing electronics, while implantables are generating interest, but are still generally concepts or in some cases bespoke devices and applications created by lead users. Ingestibles presented a compelling arena for some very specific use cases, such as temporary authentication, but the bulk of signals around ingestibles had to do with patient monitoring in health care. We considered technologies that were restorative (such as prosthetics, cochlear implants or pacemakers) out of scope. We also considered devices that didn't incorporate network connectivity out of scope, unless they had the ability to grant an extrasensory ability to the wearer (such as implanted magnets).

A time horizon of 30 years was selected, which in the technology space is pretty far out! This gave us the freedom to be speculative and creative. Right away, the environmental scan turned up many hits on the notion of the singularity – an event or state of being that proponent Ray Kurzweil has proposed will happen in the year 2045.

Our primary research consisted of a series of 15 interviews with experts across a variety of fields that were connected to wearables, implantables and ingestibles. These interviews were the highlight of the project as we were able to bring together the insights of a group of individuals who were quite different from each other in terms of area of expertise and professional activities, but were all intrinsically connected to this space. For example, a few years ago Amal Graafstra was simply a fellow who was tired of carrying his keys, and several years later is normalizing the fringe practice of biohacking by creating a distribution network of products and services for safe implantation of RFID and other devices. Dr. Isabel Pedersen is an academic who has been active in the space for decades and has written extensively on technology and how it affects our sense of personhood. Neil Harbisson and Stelarc hail from the visual, musical and performance arts, and have both permanently altered their bodies in technological and sense-changing ways.

We drew heavily upon the expert interviews to identify recurring concepts, drivers and trends. To recap, the recurring concepts, drivers and trends were as follows:

Recurring Concepts

- Transcending the human form – the notion of how technology will grant us new and unusual physical and sensory capabilities. This ties into the transhumanist tenet of human modification and enhancement.

- Ethics/legality – consideration of the social justice and policy issues that go along with our embrace of technology.
- Identity/sense of self – how we define ourselves through technology, our psyches, the cultural shifts and norms that emerge when we become hypersigils, or individuals that are connected to a network.
- Surveillance – who is surveilling who with the proliferation of technology and the potential for everything to be documented and disseminated.
- Human-centered design – understanding people and designing for people as opposed to creating technology for wow factor, profit or harm.
- Adding/bridging senses – moving beyond our five senses by combining senses or enabling new senses like the ability to perceive colours out of the visual spectrum or appreciate magnetic fields.
- Power/Energy – practically and tactically, how do we power intimate technologies.
- Privacy – a huge concern and point of conversation and debate. How do we maneuver ourselves through a world with the potential for little or no privacy?

Drivers

- Exponentially increasing computational capacity
- Advances in artificial intelligence
- Miniaturization
- Innovation in material design and manufacturing
- Nanotechnology
- Pervasive access to networks
- Social media
- Machine to machine communication
- Crowdfunding
- Corporate determination
- Changing attitudes towards privacy
- Impulse for preservation of memories/personal history
- Desire for virtual social connection
- Fear of illness, aging and death

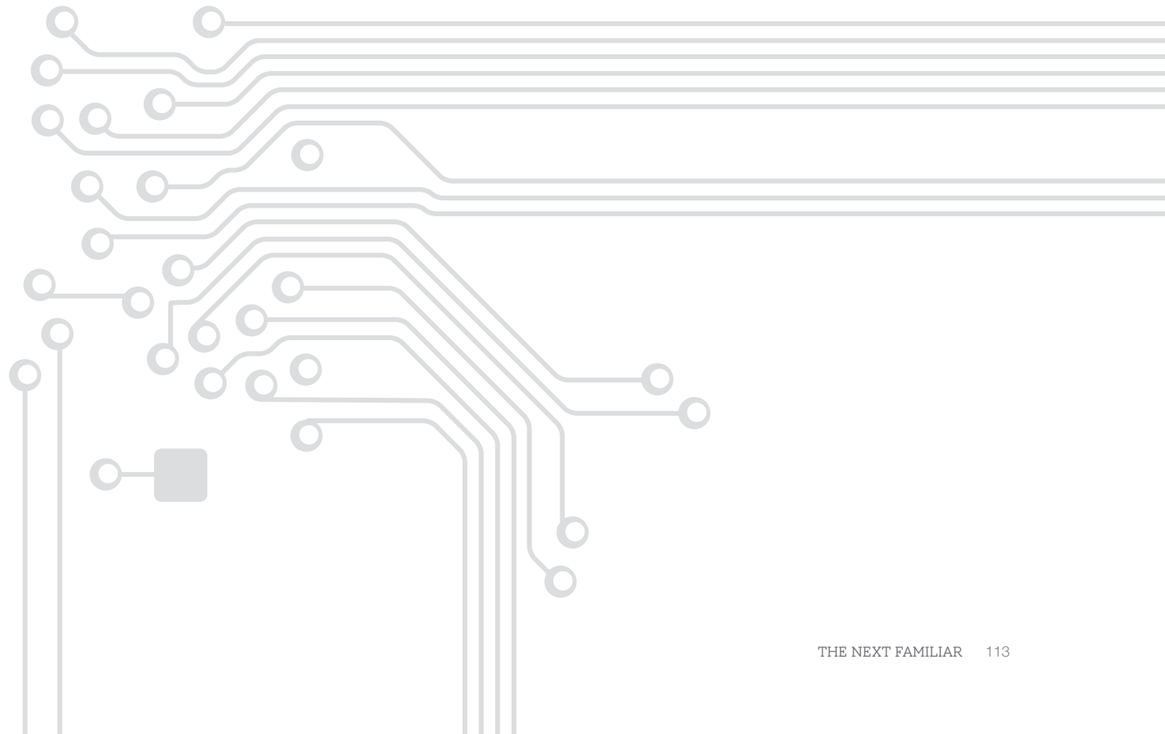
Trends

- Constant Connectivity – the idea of being attached to a digital network at all times. (Flourishing)
- Maker Movement – the practice of do-it-yourself technological crafting. (Flourishing)
- Quantified Self – intricate tracking of personal biometric data. (Rising)
- Lifelogging – capturing daily memories and moments and preserving them for the future. (Rising)
- Internet of Things – a vast networked system of everyday objects. (Rising)
- Biohacking – modifying the human body for the purpose of increased capabilities. (Emerging)
- Cyborgism – becoming a being that is part organic and part cybernetic. (Emerging)
- Technological Singularity – a fundamental transformation in everything we know about humanity, brought about by accelerating technological change. The idea of the singularity is gaining momentum as a totalizing yet indefinable event. (Emerging)

In the environmental scan and expert interviews, we also encountered the notion of transhumanism – a state of being or school of thought concerned with transcending the human form and experiencing increased capabilities or intelligence or longevity through technological enhancement. One of our experts, Chris Dancy, embodies the idea of the quantified self by engaging in near constant measurement of his actions and biometrics. He feels we are already transhumans because of the way we have integrated technology into our lifestyles. Stelarc, who does not identify with the transhumanist movement, nevertheless is actualizing some transhumanist concepts through his art, such as altering the human form. In his interview with us he lamented the frailty of the body, how it remains stubbornly bound by organic matter that must break down and fail after a mere 70ish years of housing the incredible organ that is the mind. Dr. Anders Sandberg, a well-known proponent of transhumanism and one of the authors of The Transhumanist Declaration, considers intimate technologies a logical element in the enhancement of human capabilities. Transhumanism resonated with us in the context of this body of work. In fact, we would venture to say that one answer to our question is that in the next 30 years, wearable, implantable or ingestible technology may result in the emergence of a transhumanist culture; a culture wherein we, by dint of the technology we put on or in our bodies achieve a state of being that results in us looking and behaving quite differently from the way we do today.

On the journey to 2044, we may see trends emerge, rise and flourish. We identified eight trends that were salient to our domain, and explored the implications of each trend using futures wheels as a technique. Finally, we culminated our investigation by creating five scenarios and embodying them as experiential futures in text within this document and as an exhibit that was displayed in the OCAD University Graduate Gallery in October 2014.

This project was not undertaken from the standpoint of any one particular company or organization, so focus was not explicitly to recommend strategies. However, as a step towards further research, we undertook an exercise to map which trends and drivers were most relevant to each recurring concept.



FUTURE RESEARCH

Stakeholders with a special interest in one or more of the concepts we outlined as recurring could gain some perspective on which trends and drivers would be worthwhile to continue tracking, and perhaps build strategies around them. Furthermore, the experiential futures could act as a discussion starter for strategy sessions or further research in the area.

Photographs of how we mapped stakeholder verticals against the concepts and trends may be found in the Appendix, Relevance Mapping Images, page 142. The stakeholder examples are indicative, not comprehensive. These examples were selected because they came up in our expert interviews.

Table 2 - For those interested in Power/Energy

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• Manufacturing of energy storage devices • Energy companies • Alternative energy researchers	**Power/Energy**	• Biohacking • Cyborgism • Nanotechnology • Innovation in Material Design and Manufacturing • Machine to Machine Communication • Miniaturization • Maker Movement • Internet of Things • Quantified Self • Constant Connectivity	**Salon Modifica**

Table 3 - For those interested in Transcending the Human Form

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• Physical health and wellness • Medicine and medical services • Pharmaceuticals • Computational sciences • Neurosciences • Robotics	**Transcending the Human Form**	• Cyborgism • Striving for Singularity • Biohacking • Nanotechnology • Innovation in Material Design and Manufacturing • Fear of Illness, Aging and Death • Maker Movement • Quantified Self • Miniaturization	**Salon Modifica** **I Make People**

Table 4 - For those interested in Privacy

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• Privacy commissions • Software development companies • Law enforcement • Legal and judiciary services • Social media services • Espionage • Marketing	**Privacy**	• Internet of Things • Quantified Self • Life Logging • Constant Connectivity • Pervasive Access to Networks • Social Media • Changing Attitudes Towards Privacy • Impulse for Preservation of Memories/Personal History • Desire for Virtual Social Connection • Machine to Machine Communication • Corporate Determination	**Dark Circle** **Other Self** **Feels Good Like a Memory Should**

Table 5 - For those interested in Surveillance

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• Recording devices • Journalism • Espionage • Military • Government • Law enforcement • Legal and judiciary services	**Surveillance**	• Internet of Things • Quantified Self • Life Logging • Constant Connectivity • Pervasive Access to Networks • Changing Attitudes Towards Privacy • Machine to Machine Communication • Corporate Determination • Miniaturization • Desire for Virtual Social Connection • Advances in Artificial Intelligence • Impulse for Preservation of Memories/Personal History • Social Media	**Dark Circle** **Other Self** **Feels Good Like a Memory Should**

Table 6 - For those interested in Human Centred Design

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• UX design firms • Product development of any kind • Software development • Gaming and entertainment • Social media services • Arts	**Human Centred Design**	• Life Logging • Constant Connectivity • Quantified Self • Biohacking • Internet of Things • Cyborgism • Fear of Illness, Aging and Death • Advances in Artificial Intelligence • Desire for Virtual Social Connection • Impulse for Preservation of Memories/Personal History • Corporate Determination • Nanotechnology • Changing Attitudes Towards Privacy • Social Media • Exponentially Increasing Computational Capacity • Crowdfunding • Pervasive Access to Networks • Maker Movement • Striving for Singularity	**Other Self** **Dark Circle** **Salon Modifica** **I Make People** **Feels Good Like a Memory Should**

Table 7 - For those interested in Identity/Sense of Self

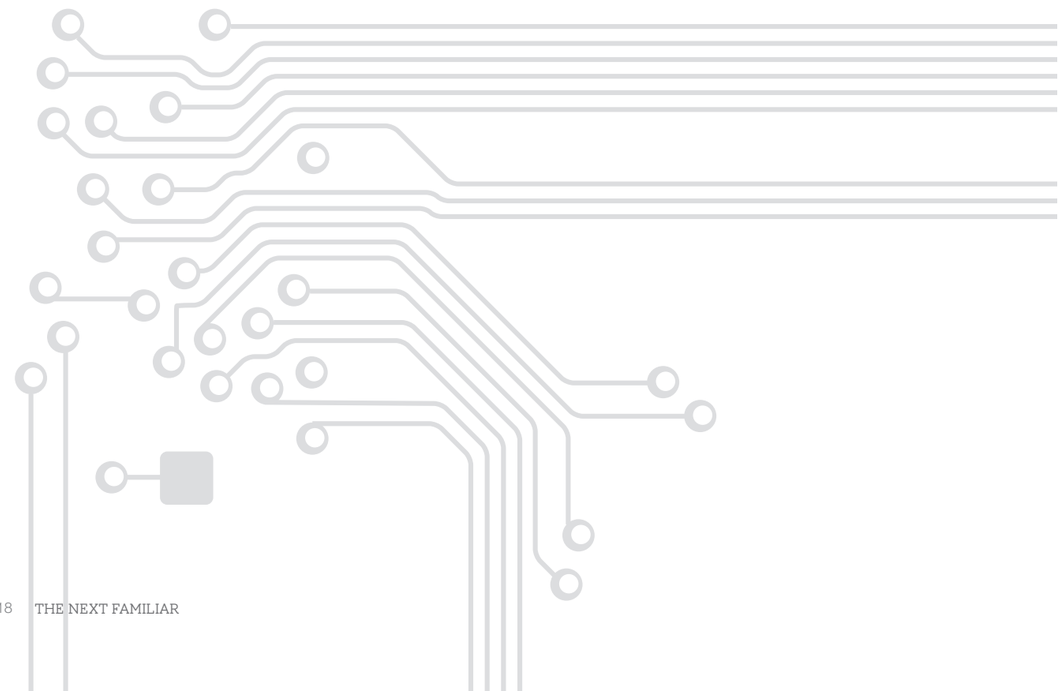
STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• Social services • Arts • Psychology and mental health • Spirituality and religion	**Identity/Sense of Self**	• Constant Connectivity • Quantified Self • Striving for Singularity • Cyborgism • Biohacking • Life Logging • Social Media • Nanotechnology • Impulse for Preservation of Memories/Personal History • Desire for Virtual Social Connection	**Salon Modifica** **I Make People** **Feels Good Like a Memory Should** **Other Self**

Table 8 - For those interested in tracking Ethics and or Legality

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• All stakeholders in all industries	**Ethics/Legality**	• Life Logging • Constant Connectivity • Quantified Self • Biohacking • Cyborgism • Striving for Singularity • Fear of Illness, Aging and Death • Advances in Artificial Intelligence • Impulse for Preservation of Memories/Personal History • Corporate Determination • Nanotechnology • Changing Attitudes Towards Privacy • Social Media • Pervasive Access to Networks • Miniaturization • Machine to Machine Communication • Desire for Virtual Social Connection • Crowdfunding • Innovation in Material Design and Manufacturing • Exponentially Increasing Computational Capacity • Internet of Things • Maker Movement	**Other Self** **Dark Circle** **Salon Modifica** **I Make People** **Feels Good Like a Memory Should**

Table 9 - For those interested in tracking Adding and or Bridging Senses

STAKEHOLDERS IN…	WHOSE PURVIEW MIGHT INCLUDE…	MAY BE INTERESTED IN TRACKING AND CREATING STRATEGIES AROUND…	RELEVANT EXPERIENTIAL FUTURE
• Physical health and wellness • Medicine and medical services • Product development • Experiential design • Robotics • Arts	**Adding/Bridging Senses**	• Cyborgism • Biohacking • Nanotechnology • Innovation in Material Design and Manufacturing • Maker Movement • Exponentially Increasing Computational Capacity • Miniaturization • Crowdfunding	**Salon Modifica** **I Make People**



OUR CONTRIBUTION

I In closing, we suggest that this work offered contributions to two domains – the domain of intimate technology, and the domain of design foresight.

In terms of technology, we distilled a large body of information about augmentative wearables, implantables and ingestibles into an overview that is accessible to those new to the domain, and informative to those who may be more versed in it. We presented the work of several lead users and innovators in this area, work that may be formative in how this domain evolves. For example, Amal Graafstra's work on Dangerous Things may one day result in policy or public health protocols or a mainstream service industry around implantable tech. Chris Dancy's work on the quantified self may lead to a different way for companies to offer employee benefits. Karl Martin might revolutionize authentication. And so on.

In terms of speculative design foresight, we brought together a combination of techniques to form a project process that we have not seen practiced before. What goes on "under the hood" of a futures project may not be commonly understood by students of foresight. This undertaking offers a transparent view of the type of research and activities that could be carried out in such a project. By following the steps outlined in our process diagram, others may create a similarly rich investigation of any research question. Our process was broken out into three distinct phases – Data Gathering, Analysis and Synthesis, and Design Deliverables. In the Data Gathering phase, we engaged in literature review, environmental scanning, expert interviews (our form of primary research), and attendance at activities and events relevant to the area of investigation. Next, the Analysis and Synthesis phase drew together all the raw data previously gathered. This phase identified recurring concepts, trends and drivers and interrogated the trends using the futures wheel foresight tool. This phase also encompassed scenario development and the creation of experiential futures, where we used recurring concepts, trends and drivers as the ingredients in a collection of scenarios that immerse a person in contemplation of worlds wherein 'what if' questions are posed and explored through different media such as video, short story or diorama. Finally, the Design Deliverable phase provided several concrete takeaway artifacts of the research, in our case these were a report, an installation, a video and a website, www.thenextfamiliar.com. An overarching element of the speculative design foresight process we undertook was constant collaboration and dialogue between the project team members. We firmly believe that this is not a process that can be done alone.

Specifically, our contribution to the Strategic Foresight and Innovation Program at OCAD University is a demonstration of how a foresight project can encompass a richly visualized exploration of a research question that includes text, imagery, audio, video and exhibit artifacts. Experiential futures created and presented in the way we did for The Next Familiar represents a new format of major research deliverable for the program. We had hoped to accomplish something designerly that would provoke commentary or discussion through design (like Dunne & Raby) and through experiential futures. Over the course of the three days we hosted the exhibit at the OCADU graduate gallery, we were thrilled to hear visitors discussing the future worlds. One guest was more than a little disturbed by the notion of losing oneself in a consciousness comprised of other people's memories as illustrated in Feels Good Like a Memory Should. Another wondered how long it would be before we'd see a product like Dark Circle on Kickstarter. And several spun the wheel of custom augmentations in Salon Modifica, wondering (sometimes with a shudder) which images were real and which were contrived.

Our ultimate objective was to create an impactful offering of foresight work that would initiate contemplation of the intimate technology we might next find familiar. *To that end, journey with us once more into the future…*

AUGUST 2044

> *The only thing we know about the future is that it will be different.*
>
> Peter Drucker

It's a cool summer evening in downtown Toronto, and around 400 people have gathered at the MaRS Discovery District to attend a meeting hosted by Homo Aucta. Body augmentation and alternate body parts are becoming increasingly common, spotted on more and more people every day. Homo Aucta is a community group of individuals in industry, government, the arts, science and medicine, brought together by their interest in transhumanist philosophy and practice and the technology that goes along with it.

Most consumer-facing enhancements available in 2044 are subdermal authentication devices and payment systems, augmented reality contact lenses and brain computer interfaces. But we are also starting to see augmentations with capabilities beyond dated NFC chips, virtual retinal displays, and basic neurotechnologies. Today's event is a gathering of a handful of innovators in techno-biological modifications. These five panelists will reflect on some of the exciting new developments coming on the market:

Figure 44
Planetart: www.flickr.com

Juliet Relman will demonstrate Dark Circle.

Figure 45
Jody Boixareu: www.flickr.com

Memory commentator Thedley Valpurno will review the latest recollections from Memotech, Megamemory and newcomer Meeting of the Minds.

Figure 46
Michael Foley: www.flickr.com

Lolly Lee-Pao will unveil Star Tail and give us a sneak peek at her upcoming line of extremity augmentations.

Figure 47
Planetart: www.flickr.com

Elara Forsey will introduce us to her Other Self.

Figure 48
Planetart: www.flickr.com

Dr. Anthony McCreary will introduce us to some of the science behind Sixth Day.

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APPENDICES

A. REFLECTIONS

10 Step Guide to Successfully Working Together

1. Have a similar interest in topic
2. Love the topic you are researching
3. Be flexible
4. Develop a good project plan (but know dates will move because life happens)
5. Meet regularly, 2 times per week to start, 3 - 4 when needed
6. Workshop each meeting, and define deliverables and due dates
7. Spend the first 20 minutes of each working session catching up and gossiping
8. Find someone you work well with and enjoy spending time with, because you will see them more than your loved ones and, or family
9. If you need a night off from working because you are burnt out, take it and get some sleep
10. Don't get stuck in elevators late at night

Using STEEPv
The STEEPv framework is useful for categorizing signals into the categories of Social, Technological, Economic, Ecology (or Environment), Politics and Values. For research questions that are not focusing on specific organizations, the framework may not be of use. Instead devise a framework that is meaningful to the project.

Strategies
Gathering, analyzing and synthesizing data and creating deliverables for your specific research question may not have specific strategies relating to stakeholders, objectives and goals of a specific organization. If this is the case you can create strategies through a dotmocracy activity. In the Scenario Development stages of the project, take the trends, drivers and recurring concepts and rank them from 1 to 5, with 5 being most important and 1 being least important.

Imagery
Use Creative Commons and credit sources with photographers name and URL. If copyright images are important to the content, leave enough time to source owner and get permission.

Wealth of Foresight Techniques
The foresighting community has a plethora of futures consultants which helps in the wealth of techniques, but also can make it difficult to determine which technique to use. Join an organization like the APF, Association of Professional Futurists to gain insight from the experts in the field.

Invitation to Experts
Don't be afraid to invite known experts in the field you are researching. You may be pleasantly surprised that they will accept, and you will also be turned down. (If turned down, don't act like scorned lovers, get over it.)

Expert Interviews
Lean heavily on your experts for helping to identify concepts and trends in the area you are researching.

Coding of Video
Remember to code each video after the interview. It is easier than having to code all interviews at once.

Living in the Ambiguity
In the world of foresight be comfortable with living in the ambiguity, and that there may be many answers to your questions.

B. EVENTS ATTENDED

- Wearable Wednesday at MaRS - Google Glass Reunion, Aug 27, 2014
- HackLab Toronto tour, Aug 20, 2014
- Wearable Wednesday at MaRS - July 30, 2014
- Three Horizons: Connecting Futures to Strategy workshop, by creator Tony Hodgson, at sLab OCADU, July 25, 2014
- Hack'n'Talk at Ryerson's Digital Media Zone (DMZ) June 28, 2014
- Project: Spaces #DemoDay, Toronto, June 13, 2014
- ideaBOOST Launchpad, Toronto, May 8, 2014
- Taste of CHI Toronto - An exhibition of wearable technology, curated by Thad Starner and Clint Zeagler, April 29, 2014
- Speech-based Interaction: Myths, Challenges and Opportunities - half day course by Dr. Cosmin Munteanu and Dr. Gerald Penn at CHI 2014, May 1, 2014
- Foresight, Visualization and Governance, sLab OCUDU, April 14, 2014
- Nate Silver, Rotman Speaker series: The Signal and the Noise: Why Most Predictions Fail - But Some Don't, April 17, 2014
- Association of Professional Futurists (APF) Annual Conference in San Francisco - Maker Movement, Social Entrepreneurs, and networked-enabled sharing economy are converging to create emergent change, March 31-April2, 2014
- Bodystorming an Augmented Reality game at SuperOrdinary Lab Toronto, Mar 5, 2014
- IxDA Toronto - Information Visualization, Feb 12, 2014
- David Kelley, IDEO Founder, Rotman Design Thinking Experts series: Creative Confidence: Unleashing the Creative Potential Within Us All, Feb 6, 2014
- A day of Google Glass app testing at the ideaBOOST/Mind Pirate Production Lab held at the Canadian Film Centre Media Lab in Toronto, January 18, 2014

C. INTERVIEW GUIDE

1. What is the focus of your work?
2. What do you consider wearable technology?
3. What do you consider implantable technology?
4. What do you consider ingestible technology?
5. Do you see wearable, implantable, ingestible technology coming together?
   - And if so, how might they come together?
   - Do you see them crossing over?
6. How might the focus of this work evolve over time?
7. What do you think the next 30 years hold for wearable, implantable, ingestible technology?
8. What do you think the next 100 years hold for wearable, implantable, ingestible technology?
9. What do you think might spur or trigger the development of these technologies?
10. What do you think might block the development of these technologies?
11. In your space can you point us to a few specific instances of where you see wearable, implantable, ingestible technology at play?
12. Is there anything we didn't talk about that you would like to comment on?

D. TRANSHUMANIST DECLARATION

1. Humanity stands to be profoundly affected by science and technology in the future. We envision the possibility of broadening human potential by overcoming aging, cognitive shortcomings, involuntary suffering, and our confinement to planet Earth.
2. We believe that humanity's potential is still mostly unrealized. There are possible scenarios that lead to wonderful and exceedingly worthwhile enhanced human conditions.
3. We recognize that humanity faces serious risks, especially from the misuse of new technologies. There are possible realistic scenarios that lead to the loss of most, or even all, of what we hold valuable. Some of these scenarios are drastic, others are subtle. Although all progress is change, not all change is progress.
4. Research effort needs to be invested into understanding these prospects. We need to carefully deliberate how best to reduce risks and expedite beneficial applications. We also need forums where people can constructively discuss what should be done, and a social order where responsible decisions can be implemented.
5. Reduction of existential risks, and development of means for the preservation of life and health, the alleviation of grave suffering, and the improvement of human foresight and wisdom should be pursued as urgent priorities, and heavily funded.
6. Policy making ought to be guided by responsible and inclusive moral vision, taking seriously both opportunities and risks, respecting autonomy and individual rights, and showing solidarity with and concern for the interests and dignity of all people around the globe. We must also consider our moral responsibilities towards generations that will exist in the future.
7. We advocate the well-being of all sentience, including humans, non-human animals, and any future artificial intellects, modified life forms, or other intelligences to which technological and scientific advance may give rise.
8. We favour allowing individuals wide personal choice over how they enable their lives. This includes use of techniques that may be developed to assist memory, concentration, and mental energy; life extension therapies; reproductive choice technologies; cryonics procedures; and many other possible human modification and enhancement technologies.

(Humanity+, 2014)

E. COMPARISON OF SCENARIO DEVELOPMENT TECHNIQUES

Table III Comparing starting points, process and products of the scenario techniques

Technique	*Starting point*	*Process*	*Products*
1. Judgment			
Genius	Personal information	Thinking, imagining	One or more scenarios
Visualization	Personal information, unconscious ideas, values	Relaxation, stimulation of imagination	One or more scenarios
Role playing	Personal information, unconscious ideas, values	Act out one or more pre-arranged conditions	One or more scenarios
Coates and Jarratt	Personal or team information	Define domain and time horizon, identify conditions or variables of interest, develop scenario themes, estimate values of conditions and variables under each scenario theme, write the scenarios	Four to six scenarios
2. Baseline			
Manoa	Dominant trends	Implications, cross-impacts, elaboration	Elaborated baseline scenario
3. Elaboration of fixed scenarios			
Incasting	Multiple scenario logics	Elaboration on specific domains	Elaboration of multiple scenarios
SRI	Multiple scenario logics	Specific domains in rows	Elaboration of multiple scenarios in specific domains
4. Event sequences			
Probability trees	Branching uncertainty or choice points	Sequence, assign probabilities	Probability of end states
Sociovision	Branching uncertainty or choice points	Cluster similar alternatives into macro themes	Multiple scenarios
Divergence mapping	Multiple potential events	Place on one of four time horizons, link events in sequence	Multiple future histories
Future mapping	Multiple end states, many potential events	Sequence events to create end state	Future history
5. Backcasting			
Backcasting, horizon mission methodology	One or more end states, can even be fantastical	Steps that could lead to that end-state	Ideas for near-term work or investment
Impact of future technologies	Technology themes	Highly capable scenarios, signposts leading to scenario, cost/benefit	Contingent strategies to pursue given the occurrence of signposts
6. Dimensions of uncertainty			
Morphological analysis, field anomaly relaxation	Dimensions of uncertainty	Multiple alternatives for each dimension, link one alternative from each dimension	Multiple end states as combinations of one alternative from each dimension
GBN	Driving forces, two dimensions of uncertainty	Select two most important and most uncertain, create 2 × 2 matrix, title and elaborate	Four mutually exclusive scenarios
Option development and evaluation	Dimensions of uncertainty	Multiple alternatives for each dimension, rate consistency of every alternative against every other alternative, perform nearest neighbour calculation	Ranking of combinations of alternatives from most to least consistent
MORPHOL	Dimensions of uncertainty	Multiple alternatives for each dimension, link one alternative from each dimension, excluding impossible combinations and rating more likely combinations more highly; can calculate probability of combination of probabilities of	Multiple end states as combinations of one alternative from each dimension, based on exclusions and likelihood of pairs of alternatives; can calculate probability of combination of probabilities of alternatives are known

(*Continued*)

(Bishop et al., 2007)

Table IV Attributes of the scenario techniques

Technique	*Basis*	*Perspective*	*Group*	*Computer*	*Difficulty 1-4 (4 hardest)*
Genius	Judgment	Forward	No	No	1.2
Visualization	Judgment	Forward	Optional	No	2.3
Role playing	Judgment	Forward	Required	No	2.2
Coates	Judgment	Forward	Optional	No	2.3
Manoa	Judgment	Forward	Optional	No	2.2
Incasting	Judgment	Forward	Recommended	No	2.5
SRI	Judgment	Forward	Optional	No	2.3
Probability trees	Quantification	Forward	Optional	Optional	2.5
Sociovision	Judgment	Forward	Optional	No	2.6
Divergence mapping	Judgment	Forward	Optional	No	2.2
Future mapping	Judgment	Backward	Optional	No	2.6
Impact of future technologies	Judgment	Backward	Optional	No	2.8
Backcasting, horizon mission methodology	Judgment	Backward	Optional	No	2.3
Morphological analysis, field anomaly relaxation	Judgment	Forward	Optional	No	2.3
GBN	Judgment	Forward	Optional	No	2.6
Option development and evaluation	Quantification	Forward	Optional	Required	3.0
MORPHOL	Quantification	Forward	Optional	Required	2.5
Cross-impact analysis	Quantification	Forward	Optional	No	2.5
IFS	Quantification	Forward	Optional	No	2.8
SMIC PROB-EXPERT	Quantification	Forward	Optional	No	2.3
Trend impact analysis	Quantification	Forward	Optional	Optional	2.5
Sensitivity analysis	Quantification	Forward	Optional	Required	3.3
Dynamic scenarios	Judgment	Forward	Optional	Optional	2.8

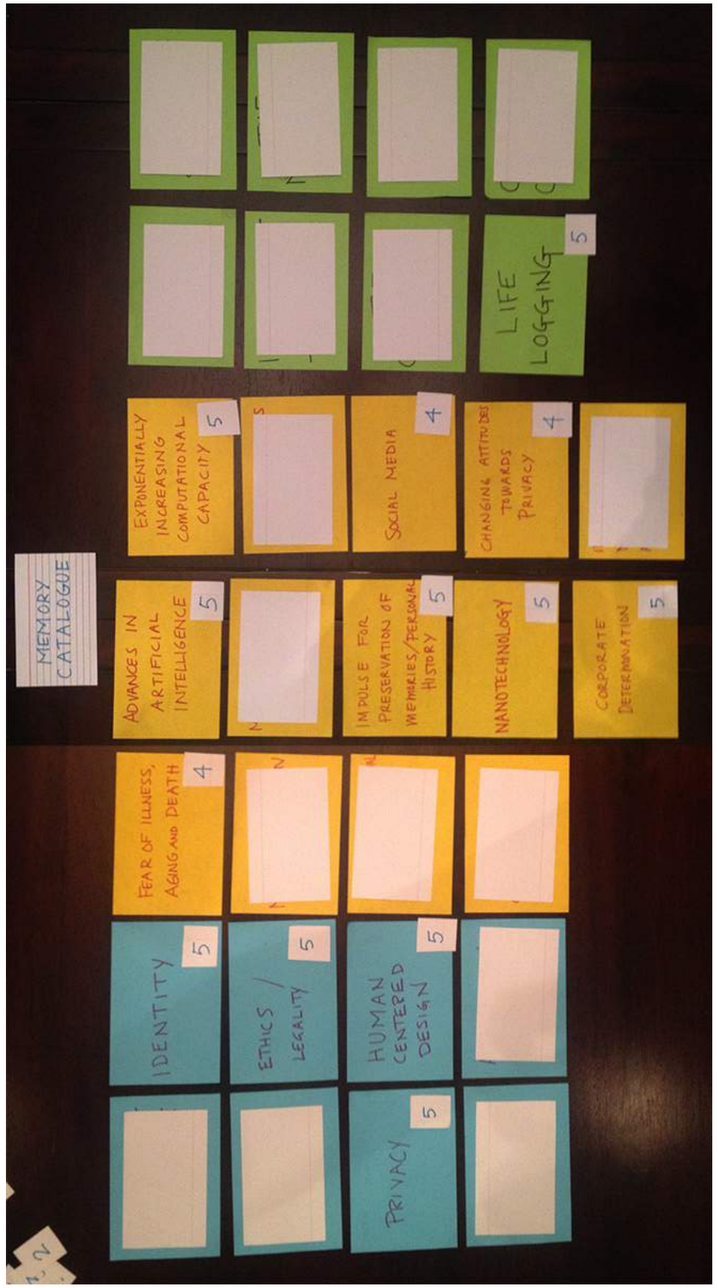
(Bishop et al., 2007)

Table V Advantages and disadvantages of the scenario techniques

Technique	*Advantages*	*Disadvantages*
1. Judgment (Genius, visualization, sociodrama, Coates and Jarratt)	Easy to do Taps into intuitive understanding of the future Genius, Coates and Jarratt – requires no special training or preparation Visualization, sociodrama – can lead to novel insights and revelations	Difficult to do well Opaque, not transparent Genius, Coates and Jarratt – relies on the credibility of the individual Visualization, sociodrama – requires some training and experience to do well; clients may resist relaxation or dramatic techniques
2. Baseline (Trend extrapolation, Manoa, systems scenarios, trend impact analysis)	Easiest for client/audience to accept because generally expected already Manoa – highly elaborated, creative, lots of detail Systems scenarios – shows dynamic relationships among scenario elements Trend impact – links events with trends	No alternative scenarios proposed Manoa, systems scenarios – futures wheel, cross-impact, and causal models require some training and experience to do well Trend impact – requires judgment to estimate impacts, best done with group of experts, perhaps using Delphi
3. Elaboration of fixed scenarios (Incasting, SRI matrix)	Easiest for client/audience participation because scenario kernels/logics are done for them Provides in-depth elaboration of alternative scenarios	Generic scenario kernels/logics might not be relevant to client/audience; therefore less buy-in SRI Matrix – many have an intuitive sense of the best-case and worst-case scenarios already; filling in the cells of the matrix with many rows (domains) might become tedious
4. Event sequences (Probability trees, sociovision, divergence mapping, future mapping)	Tells the story in the usual way, as a series of events If probabilities at each branch point are known, can calculate the probability of end-states	Probability trees, sociovision – events/branch points usually do not follow each other in a fixed sequence Divergence mapping – events are not always easy to classify according to time horizon Future mapping – pre-defined end-states and events might not be relevant to the client/audience
5. Backcasting	Creative because it decreases the tendency to	Fantastical nature of the mission or end-state

(Bishop et al., 2007)

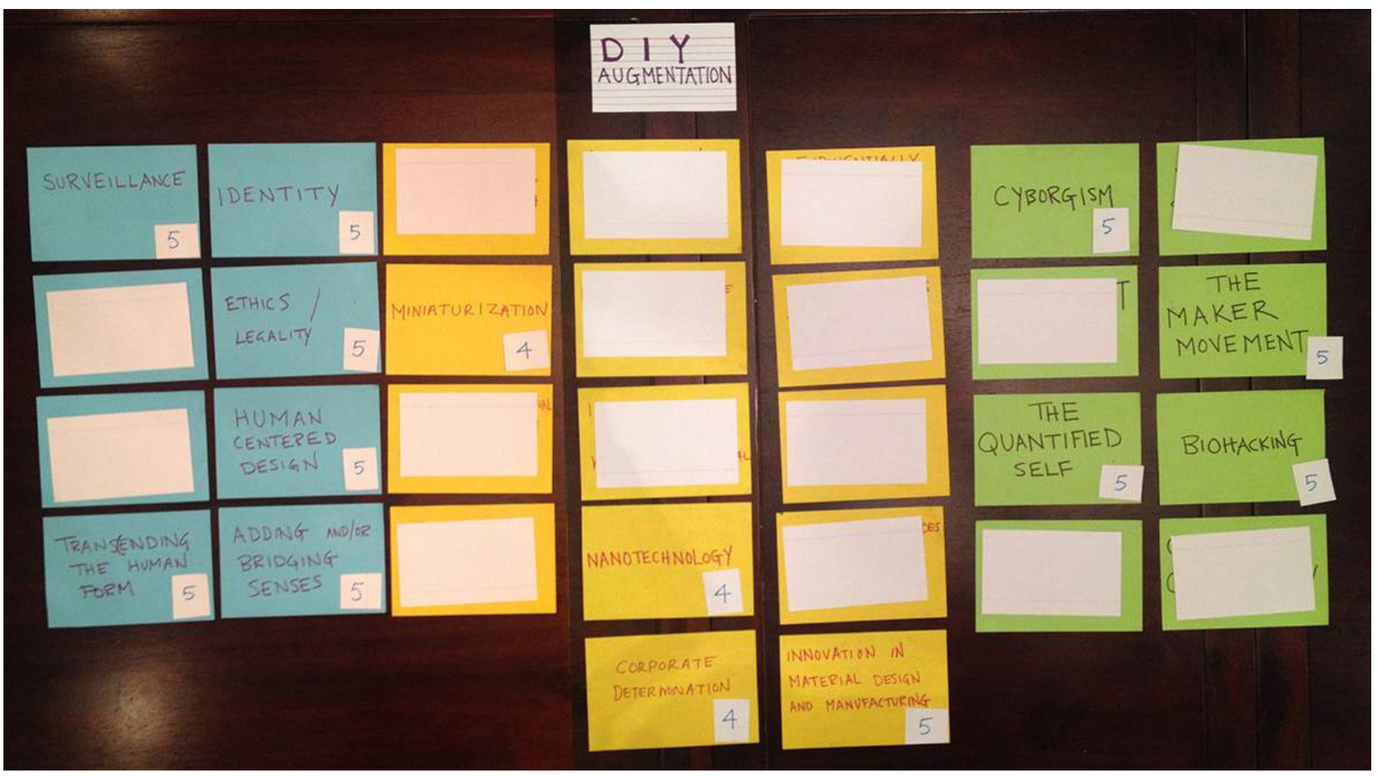
F. SCENARIO DEVELOPMENT PROCESS IMAGES



Dark Circle

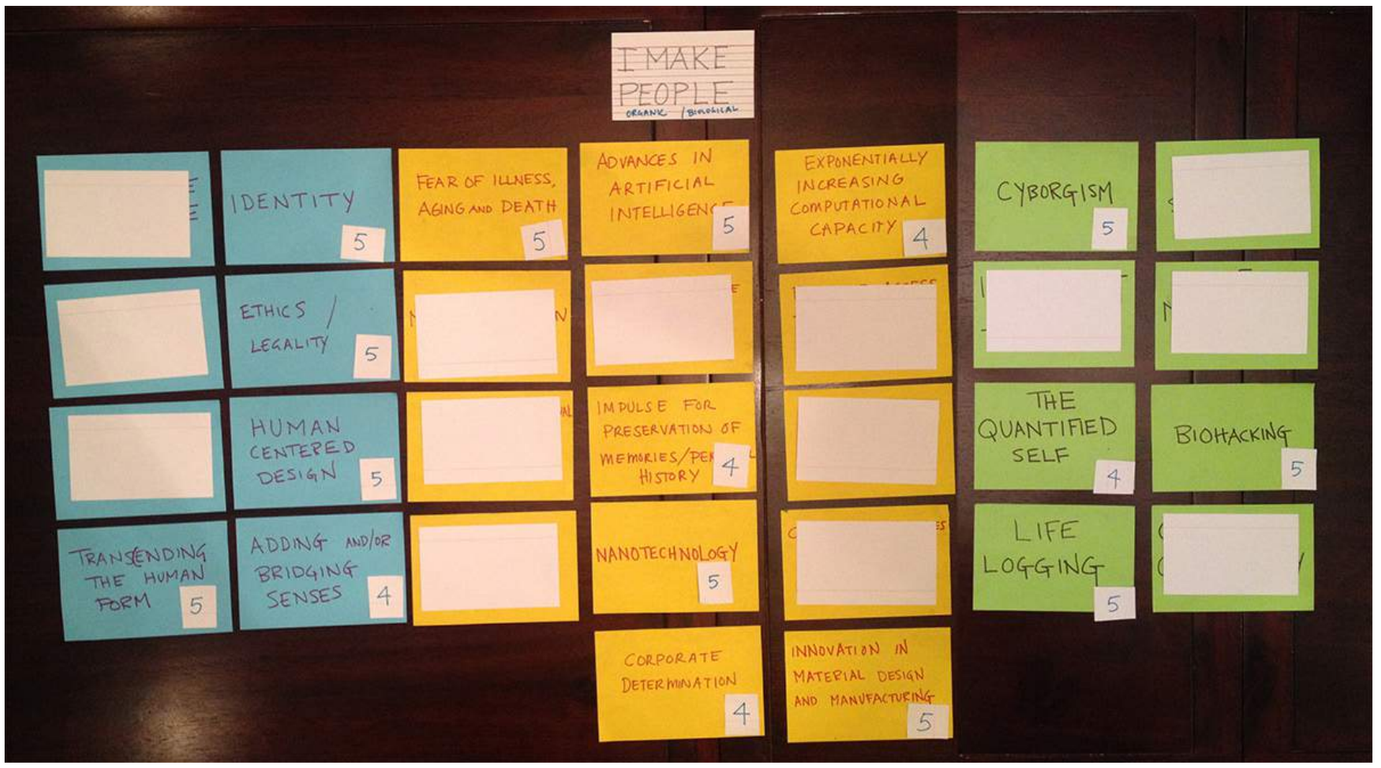
RECURRING CONCEPTS DRIVERS TRENDS

Salon Modifica (Working Title: DIY Augmentation)



RECURRING CONCEPTS DRIVERS TRENDS

I Make People

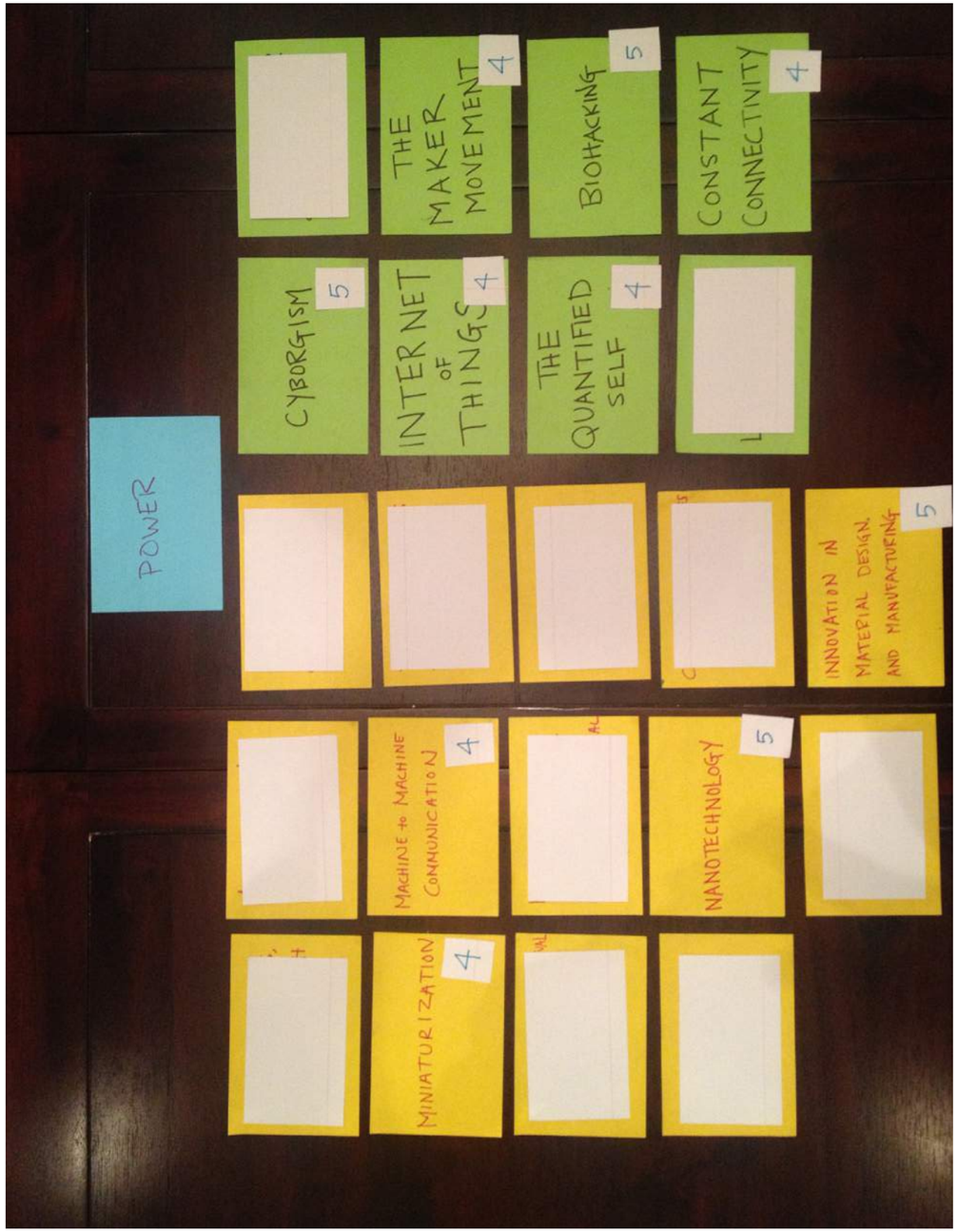


RECURRING CONCEPTS DRIVERS TRENDS

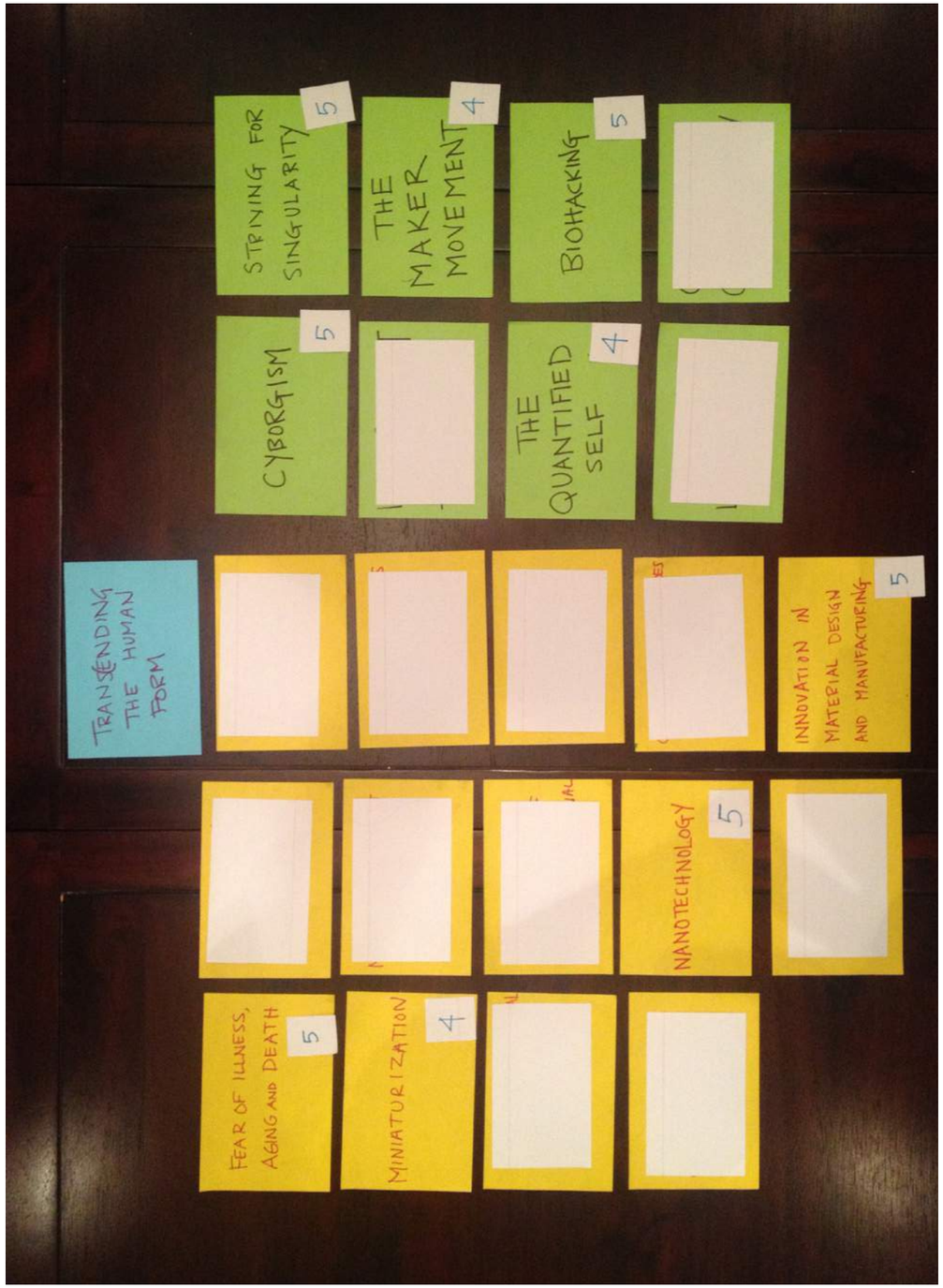
Other Self

RECURRING CONCEPTS DRIVERS TRENDS

G. RELEVANCE MAPPING IMAGES

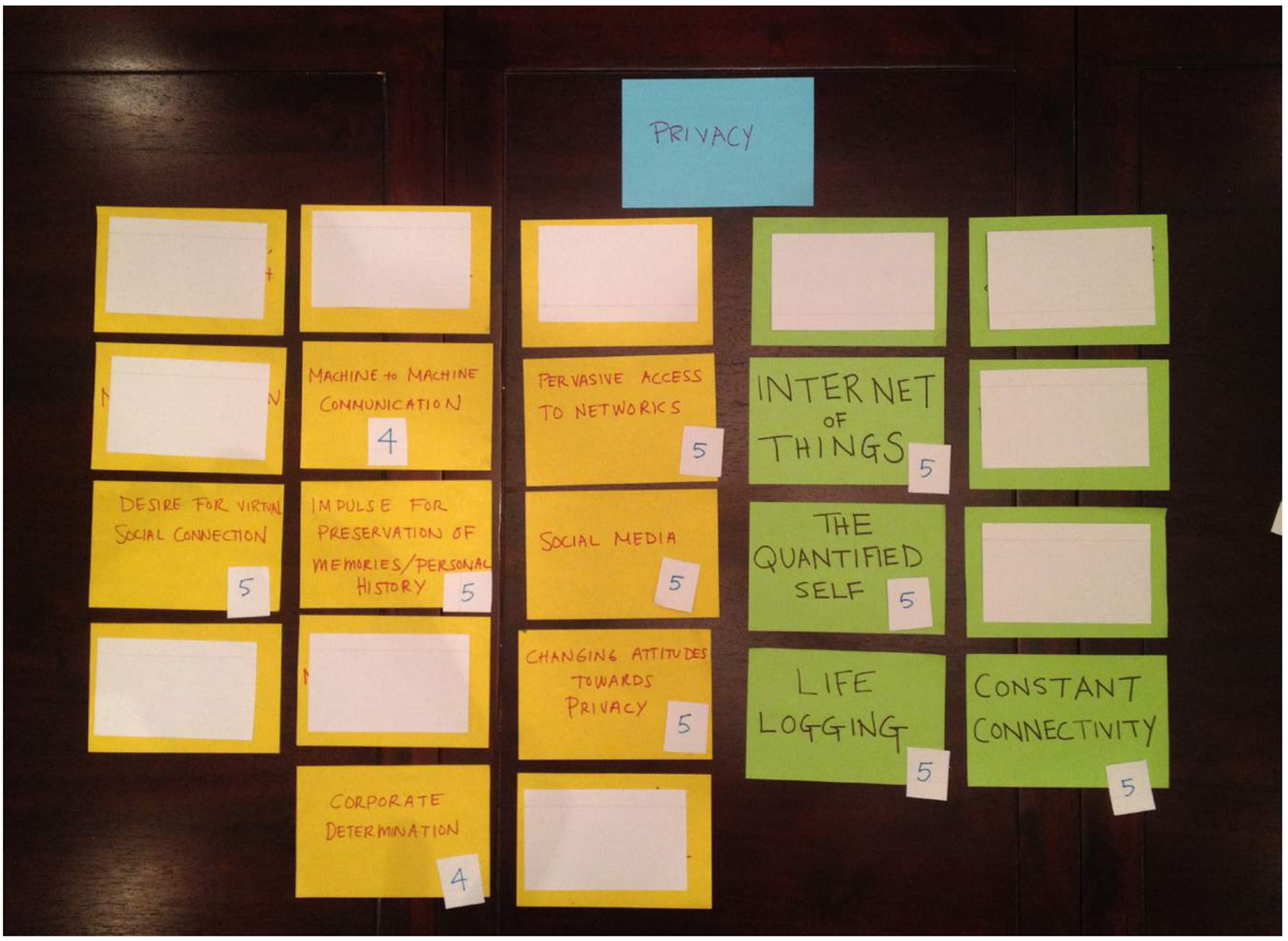


Power



Transcending the human form

Privacy



Ethics/Legality

Surveillance

Human Centred Design

Identity/Sense of Self

Adding/Bridging Senses

ILLUSTRATIVE MATERIALS

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Figure 5: Kevin Warwick's augmentation surgery
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Figure 7: Neil Harbisson and Adam Montandon
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Figure 8: Cyborg Foundation's Neil Harbisson and Moon Ribas
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Figure 9: Adi Robertson, implanted magnet
Courtesy Vox Media, Inc. and www.TheVerge.com
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Figure 10: Pillcam capsule camera
David Yeo T. B.: www.flickr.com
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Figure 13: Hacklab Toronto visit
Figure 14: Google Glass day
Figure 15: We are Wearables event at MaRs
Figure 16: Karen testing Google Glass
Figure 17: Shannah testing Google Glass
Figure 13-17 By Maxwell and Segal

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Figure 18: Scenario development workshop
Figure 19: Whiteboard brainstorm, scenario development

Figure 18,19 By Maxwell and Segal

Figure 20: Constant Connectivity

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Figure 21: Maker Movement

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Figure 22: Quantified Self

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Figure 23: Lifelogging

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Figure 24: Internet of Things

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Figure 25: Biohacking

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Figure 26: Cyborgism

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Figure 27: Striving for Singularity

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Figure 28: Genpets

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Figure 29: Future human?

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Figure 30: Human
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Figure 31: *Dark Circle* installation at OCAD University
Photo by Karen Maxwell

Figure 32: *Other Self* installation at OCAD University
Photo by Mark Segal

Figure 33: *I Make People* installation at OCAD University
Photo by Mark Segal

Figure 34: *Feels Good Like a Memory Should* installation at OCAD University
Photo by Mark Segal

Figure 35: *Salon Modifica* installation at OCAD University
Photo by Mark Segal

Figure 36: *Other Self* tabloid magazine layout

Figure 37: Daphne's Dress
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Figure 38: *I Make People* installation at OCAD University
Photos by Karen Maxwell and Mark Segal

Figure 39: *Feels Good Like a Memory Should* experiential installation at OCAD University
Photo by Mark Segal

Figure 40: Protest image 1
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Figure 41: Protest image 2
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Figure 42: Protest image 3
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Figure 43: *Salon Modifica* experiential installation at OCAD University
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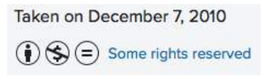

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ACCOMPANYING MATERIAL

The following accompanying material can be found on the back cover of this book: *Video of Expert Interviews*.

Alternatively, the video is also available at:
http://youtu.be/oYhJteLt4yQ