# ENRICHED REALITY

- TO PERCEIVE THE WORLD IS TO SUCCESSFULLY PREDICT OUR OWN SENSORY STATES -

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IN THE 2012 TRENDS REPORT, WE EXPRESSED THE IMPORTANCE OF PEOPLE EMBRACING CHANGE AND UNCERTAINTY AS SOURCES OF STIMULATION (SEE CURIOUS MIND TREND). WE DISCUSSED THE IMPORTANCE OF NURTURING CREATIVITY AND IMAGINATION IN ORDER TO BE SUCCESSFUL IN THE PROJECT ECONOMY.

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In the Reinvention Era, people will look for ways to enhance their perception of themselves and of the world around them. Only a small fraction (less than a ten-trillionth) of the electromagnetic spectrum is visible to humans . People perceive enough to get by within their ecosystem, but if they want to reinvent new futures, they will have to increase their perception of themselves and of the environment. People will increasingly realise that technology can enhance their perception and build more empathy and efficiency to their lives. Technology will be instrumental in enabling people to perceive more by tapping into hidden channels of perception.

Enriched Reality is where technology and human interaction integrate harmoniously with minimum friction. This Enriched Reality will be made possible by technology that is invisible, ambient, and that seamlessly enhances people's perception by tracking, monitoring, sensing, and recognising behaviours and situations.

People will aspire to become Perceivers: ones who discover hidden channels of perception about themselves and the world around them with the aid of technology. They experience Enriched Reality by using new technologies that enable them to know themselves better and increase self-awareness.

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People will embrace technology when they see that it can provide tangible benefits, such as enhancing their mental and physical abilities or permitting them to experience more of the physical environment. Enriched Reality will be embraced at different levels depending on people's age and socio-demographic, but mostly depending on their culture and their specific needs. Japan, for example, has been very open and inclusive of technology; Near Field Communications (NFC) has an adoption rate of 85% in Japan compared to 10-15% in the US. It is interesting to monitor how cultures are integrating technology into everyday activities and examine their perceived benefits and drivers for adoption. We can argue that the increase in global competition, higher life expectancy, and a new population comprised of digital natives will lead to the acceptance of more pervasive technology throughout the world. Indeed, seers will create a new paradigm whereby there is a causality effect between the improvement of human perception and machine perception. The more people use technology, the more their perception will improve. And in turn, they will improve technology's perception of themselves and of the overall environment. As a result, technology will become more human, displaying intelligent and empathetic behaviours toward users and the environment. Technology will increasingly be non-intrusive, learning about users and enhancing their perception, not replacing it. In the Reinvention Era, interaction between humans and machines will become frictionless; a coexistence with both parts learning to achieve Enriched Humanity.

# PEOPLE WILL EMBRACE TECHNOLOGY TO BECOME PERCEIVERS

The subset of perception we are able to detect is referred to as "unwelt", but there is a bigger reality called "umgebung" that people are currently unable to detect (see Additional Insights). Technology can help people become Perceivers, detecting more than their currently "limited" cognitive framework is able to. The more people use technology, the more their perception will improve. And in turn, they will improve technology's perception of themselves and of the overall environment. People are able to see how they respond to specific situations, track their moods, and learn new techniques for improvement and learning. This will translate into a plethora of innovations geared at enhancing people's perception of themselves. In the field of affective technology, for example, the MIT Media Lab developed Ginger.io, an app that checks how people are feeling emotionally and physically. The

app discovers the user's specific patterns and is able to predict the beginning of issues such as anxiety or the flu (see Case Studies). Another example of providing neurofeedback (see Additional Insights) is MyndPlay (see Case Studies), a system that teaches the mind to meditate and focus through stimulus/response training; it provides detailed brainwave feedback and the tools to develop greater mental awareness and emotional control. Innovation in sensor technology such as FEEL (see Case Studies) measures the electrodermal activity for signs of stress, anxiety, and arousal while the user is performing specific tasks. This helps the user perceive which activities provide negative or positive impact and adapt behaviour accordingly. Additionally, wearable technology like Smart Bra will improve people's performance by providing biofeedback and potentially detect illnesses that require treatment (see Case Studies).

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People will also aspire to Enriched Reality because it enables them to perceive more of their surroundings and improve their situational awareness (see Additional Insights). For example, Augmented Reality (AR) provides people with access to layers of information about their surroundings that are impossible to perceive through human vision. This can help guide processes such as learning about the engine of a car, or simply assist in providing additional information such as rental apartments available within a specific vision field (see Case Studies). In the same way, Quick Read (QR) codes and Near Field Communication help develop a deeper relationship between the user and the environment. In some instances, these technologies create opportunities for transmedia storytelling, where pieces of content are not only linked together, but are in narrative synchronisation with each other (see Additional Insights). Seers will seize opportunities to understand their unique opportunity to improve many aspects of life spanning health, wellbeing, fitness, shopping, media, entertainment, and more. Such services will continue growing as people are keen to improve their perception of themselves and

THE MORE PEOPLE USE TECHNOLOGY, THE MORE THEIR PERCEPTION WILL IMPROVE. AND IN TURN, THEY WILL IMPROVE TECHNOLOGY'S PERCEPTION OF THEMSELVES AND OF THE OVERALL ENVIRONMENT.

understand how the world around them, their actions, and the choices they make impact their quality of life. In a bid to improve people's perception, some scientists are experimenting with artificial synesthesia. Synesthesia is a perception condition of mixed sensations, where a stimulus that would normally be experienced in one way is also automatically experienced in another way (see Additional Insights). Technology can help challenge this by linking sensory experiences to new outcomes. For instance, it is possible to induce visual sensations through sound (see Case Studies). Such experiments are usually geared at helping people who are sensory impaired (blind, deaf, etc.),

but they could lead to innovations that help people perceive more than most and imagine new possibilities.

# TECHNOLOGY WILL BECOME MORE HUMAN TO SUPPORT THE PERCEIVERS' NEEDS

Technology will become more intelligent, empathetic, and human to be non-intrusive and enable frictionless interaction. Machines will increasingly understand the user's feeling (frustration, stress, overall mood) and will anticipate the user's state thanks to developments in sensors, algorithms, and programs that help computers perceive human emotions. The more that machines are used, the more they learn about the users and enhance their

perception of the users; in turn, the machines can develop new abilities that are aimed at enhancing the user's perception. As people use technology, the devices will have more empathy for the users and fit more naturally in the human environment. For example, The Affective Computing Group at MIT (see Case Studies) is looking for novel ways to make more intelligent and perceptive technology in order to reduce the gap between inanimate and animate objects. The idea is to build objects that work as services. We can imagine a multitude of uses for such intelligent technologies, becoming helpful agents with artificial or augmented human-like brains. For example, Verizon recently patented a set-top box, which is a media-presentation system that selects advertisements based on "ambient actions" in the room. For Perceivers, such tools will become incredibly important to experience the full potential of Enriched Reality. Advances in facial and voice recognition will enrich the interaction people have with machines and help with security and privacy

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concerns. EyeVerify (see Case Studies) uses eyeprints to tailor and protect interaction based on the user's profile. For such technology to become part of the everyday life, it is important that it answers real needs and provides tangible benefits for the users; it must also fit "naturally" within the user's context and environment. This will be critical to ensure the broad adoption of such intelligent technology goes beyond just early-adopters or "geeks".

Additionally, as this intelligent technology will rely on user data to function appropriately, it will be important to ensure that users stay in control of all their data. Ideally, there will be a user-centric data ecosystem that enables users to view all their data from one place, as opposed to device specific ecosystems where the data is dispersed. This would allow more security and privacy as well as the ability to create a rich perception of the user, enhancing the performance and experience of both the user and the devices.

Furthermore, developments in robotics will enable people to delegate tasks to robots with human characteristics such as intelligence, empathy, recognition, etc. For example, Baxter (see Case Studies) is a robot with eyes on a screen that register emotions like happiness or surprise. Baxter adapts to changing conditions and can be taught to perform new tasks. Robots like Baxter will play an important role in enabling innovations in many areas - from science to entertainment (see Case Studies) - by perceiving human emotions and identifying challenges and opportunities that people do not perceive on their own. As a result, robots, like smart objects, will become a part of people's everyday lives; there will be more opportunities to customise their behaviour and to tailor it to specific user's needs. The RoboAppStore, a marketplace for bots, provides apps for consumer robots like the NAO Robot, the iRobot Roomba vacuum cleaner, or Sony's Aibo robot dog. Developers are hoping that in the future more bots will have an open-source operating system such as the ROS (Robot Open Source platform) to allow for more customisation. In the Reinvention Era, the interaction between people and technology will become more intelligent, sensorial, and empathetic, and will contribute to create an everyday Enriched Reality.

1. David Eagleman, The Umwelt in John Brockman, This Will Make You Smarter (2012)

2. http://www.imediaconnection.com/content/33275.asp

# ADDITIONAL INSIGHTS

# DAVID EAGLEMAN AND THE UMWELT:

The small subset of the world that an animal is able to detect is its umwelt. The bigger reality, whatever that might mean, is called the umgebung. The interesting part is that each organism presumably assumes its umwelt to be the entire existing objective reality. Why would any of us stop to think that there is more beyond what we can sense? A good illustration of our unawareness of the limits of our unwelt is that of colour-blind people: until they learn that others can see hues they cannot, the thought of extra colours does not enter their conceptual reality. The more science taps into those hidden channels, the more it becomes clear that our brains are tuned to detect a shockingly small fraction of the surrounding reality. Our sensorium is enough for us to get by our ecosystem, but it does not approximate the larger picture. It would be useful if the concept of the umwelt were embedded in the public lexicon. It neatly captures the idea of limited knowledge, of unobtainable information, of unimagined possibilities. (John Brockman, This Will Make You Smarter, 2012)

#### DONALD HOFFMAN AND THE SENSORY

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**DESKTOP**: Our perceptions are neither true nor false. Our perception of space and time and objects is part of our "sensory desktop", which functions much like a computer desktop.

A graphical desktop is a guide to adaptive behaviour: it enhances useful behaviour and hides what is not useful, making it easier to grasp the distinction between utility and truth. Our sensory experiences – vision, sound, taste, touch, etc. – can be thought of as a sensory desktop that has evolved to guide adaptive behaviour, not report objective truths. As a result, we should take our sensory experiences seriously. Our sensory experiences have been shaped by natural selection to guide such adaptive behaviours. Sensory desktops differ across species.

The concept of the sensory desktop can enhance our cognitive toolkit by redefining our attitude towards our perceptions. It is common to assume that the way we see the world is, at least in part, the way it really is. We experience the world of space and time and objects, and it is common to assume that these experiences are, or at least resemble, objective truths. The concept of the sensory desktop reframes all of this. It loosens the grip of sensory experiences on the imagination. Space, time, and objects might just be aspects of a sensory desktop specific to Homo sapiens. They might not be deep insights into objective truths, but rather convenient conventions that have evolved to allow us to survive in our niche. (John Brockman, This Will Make You Smarter, 2012)

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## DONALD HOFFMAN ON SYNESTHESIA:

The phenomenon of synesthesia can help us understand the conventional nature of our sensory experiences. In many cases of synesthesia, a stimulus that is normally experienced in one way is also automatically experienced in another way. Someone with sound-colour synesthesia sees colours and simple shapes whenever they hear a sound. The same sound always occurs with the same colours and shapes. (John Brockman, This Will Make You Smarter, 2012)

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**BIOFEEDBACK** is a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brainwaves, heart function, breathing, muscle activity, and skin temperature. These instruments rapidly and accurately "feed back" information to the user. The presentation of this information – often in conjunction with changes in thinking, emotions, and behaviour – supports desired physiological changes. Over time, these changes can endure without continued use of an instrument. (What is biofeedback?, Association for Applied Psychophysiology and Biofeedback, 18 May 2008)

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**NEUROFEEDBACK** is a type of biofeedback that uses real-time displays of electroencephalography or functional magnetic resonance imaging (fMRI) to provide a signal that can be used by a person to receive feedback about brain activity.

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**THE BIOMIMICRY APPROACH** seeks nature's advice at all stages of design, from scoping to creation to evaluation. Working with "biologists at the design table,"

innovators explore the true functions they want their design to accomplish, and then ask: What organisms or ecosystems depend on performing those functions for their survival?

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**SKIN VISION**, Leonid Yaroslavsky, a researcher at Tel Aviv University, suggests that humans might be able to "see" with their skin. He hopes that biomimicry gives way to the development of new kinds of imaging technology that obviate traditional optics. "Skin vision is not uncommon in nature. Plants orient themselves to light, and some animals such as pit vipers, who use infrared vision, and reptiles, who possess skin sensors, can 'see' without the use of eyes. Skin vision in humans is likely a natural atavistic ability involving light-sensitive cells in our skin connected to neuromachinery in the body and in the brain." READ MORE

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**THE UNCANNY VALLEY** is a hypothesis in the field of robotics and 3D computer animation; it holds that when human replicas look and act almost, but not perfectly, like actual human beings, it causes a response of revulsion among human observers. The "valley" refers to the dip in a graph of the comfort level of humans as a function of a robot's human likeness. The term was coined by the robotics professor Masahiro Mori as Bukimi no Tani Gensh ( ) in 1970. The hypothesis has been linked to Ernst Jentsch's concept of "the uncanny", identified in a 1906 essay On the Psychology of the Uncanny. Sigmund Freud elaborated on Jentsch's concept in a 1919 essay entitled The Uncanny ("Das Unheimliche").

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HUMANOID ROBOT IN SPACE: A consortium of Japanese companies will send a humanoid robot into space in 2013. Its mission will be none other than to keep astronaut Koichi Wakata company and help him run operations on the International Space Station, sort of like a humanoid HAL 9000. Takahashi expects other uses for the technology to come out of the robot's trial run. The robot was developed after JAXA requested ideas for "solving social issues" on the space station. As the humanoid improves, it could be used as a companion for lonely astronauts. The robot is still under construction, but once built, it will be 13 inches tall and weigh 2.2 pounds. It will be able to recognise faces, do simple experiments such as mixing liquid, and send information back to scientists on the ground. The companies, which include car-maker Toyota, will build

two robots, sending one into orbit and keeping one on Earth as a backup. If the project is successful, it could pave the way for more collaboration between humans and robots in space, making life easier for astronauts. READ MORE

**SITUATIONAL AWARENESS** is the perception of environmental elements with respect to time and/or space, the comprehension of their meaning, and the projection of their status after some variable has changed, such as time, or some other variable, such as a predetermined event. Situational awareness (SA) involves being aware of what is happening in the vicinity in order to understand how information, events, and one's own actions will impact goals and objectives, both immediately and in the near future. One with an adept sense of situational awareness generally has a high degree of knowledge with respect to inputs and outputs of a system, and an innate "feel" for situations, people, and events that play out due to variables the subject can control. Lacking or inadequate situational awareness has been identified as one of the primary factors in accidents attributed to human error. Thus, situational awareness is especially important in work domains where the information flow can be quite high and poor decisions may lead to serious consequences (e.g., piloting an airplane, functioning as a soldier, or treating critically ill or injured patients). **READ MORE** 

**TRANSMEDIA STORYTELLING** (also known as transmedia narrative or multiplatform storytelling) is the technique of telling a single story or story experience across multiple platforms and formats using current digital technologies, and is not to be confused with traditional cross-platform media franchises, sequels, or adaptations. From a production standpoint, it involves creating content that engages an audience using various techniques to permeate their daily lives. These pieces of content are not only linked together (overtly or subtly), but are in narrative synchronisation with each other. READ MORE

**MINTCHIP** is a pilot program by the Royal Canadian Mint seeks to digitise cash using a chip onto which people can preload money. Users can securely load an electronic value onto a smartphone, USB device, or tablet, or upload it to the cloud, and transfer money by email or by tapping two devices together. Although this is still using a government-regulated currency, MintChip enables people to pay more conveniently. "Physical currencies in a global world are inconvenient," says technology futurist Daniel Burrus. "Digital currencies provide the possibility for an international, universal currency that would make things much simpler." In August of 2012, the Royal Canadian Mint launched The MintChip Challenge, a competition for developers to create an app to support MintChip. The winner was MintWallet, by Coronox, which submitted an app concept supported by the Nokia Lumia phone. The app enables people to create payment networks, request money from peers, send money to others, and to create QR codes that others can scan to pay specific people and causes.

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**SOCIAL ROBOTICS** is a research field dedicated to robots that are placed in social spaces. Social spaces are defined as spaces that involve the general public; examples include hospitals, galleries, nursing homes, museums, airports, and domestic environments (not factory robots). The Centre for Social Robotics at the University of Sydney is active in the creation and use of robotics technology in all types of intelligent machines, devices, and products that assist, improve, and enhance people's experience in using these technologies in everyday life activities.

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# SOCIALLY ASSISTIVE ROBOTICS: "We

define socially assistive robotics (SAR) as the intersection of AR (Assistive Robotics) and SIR (Social Interaction Robotics). SAR shares with assistive robotics the goal to provide assistance to human users, but it specifies that the assistance is through social interaction. Because of the emphasis on social interaction, SAR has a similar focus as SIR. In SIR, the robot's goal is to develop close and effective interactions with the human for the sake of interaction itself. In contrast, in SAR, the robot's goal is to create close and effective interaction with a human user for the purpose of giving assistance and achieving measurable progress in convalescence, rehabilitation, learning, etc."

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TALKING, WALKING OBJECTS: There is evidence that objects will create emotional connections with their owners in a more active way. Simon is a humanoid robot that is part of a growing collection of social robots that can see, hear, feel, and react through humanlike sound and movement. There are already a number of high-tech products very much involved in our day-today lives; examples include iPhone's Siri or the Roomba vacuum cleaner. These objects are creating a personality by translating basic human emotions through colour, sound, and basic language. Through these personalities, these objects offer us emotional value, along with other features. Researchers have found that this emotional connection leads people to feel empathy for the product, making them much more accepting of mechanical flaws that would otherwise be seen as a nuisance. **READ MORE**