

Stories of the virtual mind

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Abstract. The use of virtual worlds and immersive technologies have brought many possibilities for experiencing alternative realities, as some has been used in gaming, medicine or learning. We used this Science Fiction Prototype (SFP) to present a fictitious use of immersive technologies and virtual reality, exploring a futuristic method to learn, described in the story as the concept of “programming information directly into the brain”. In the story the main character explores the idea of using the human senses as input/output devices to exchange information with the world, collecting information from our everyday life (life logging); preserving knowledge and creating a way for accelerated learning through programmed physical experiences created within a mixed reality environment.

Keywords. Science fiction prototype, ubiquitous virtual reality, mixed reality, blended reality, human-machine interface (HMI), experiential learning.

Introduction

Imagine the possibility of learning a different language within minutes or the opportunity of becoming an expert in one subject by loading the information directly into the brain, (similarly to what happens to the protagonist in the film *The Matrix* [1]); or the possibility to capture and preserve all the invaluable untransferable knowledge obtained by experience that specialised professionals, such as surgeons, researchers, etc., possess. This Science Fiction Prototype (SFP) delves into an imaginary world where all the information that goes through the senses is captured by an implant and then it can be recreated using virtual reality and immersive technologies.

1. Background

In this paper we incorporate diverse technologies extending them to a future vision of their possible implementations for learning, using the method of science fiction prototyping [2]. We explore the use of immersive technologies and virtual worlds to propose an unusual method of accelerated learning based on Kolb's ideas on experiential learning [3]. He suggested that learning can be acquired from grasping concrete experiences in real-world and by creating abstract conceptualization of new

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information, and then transforming this experience using reflective observation and active experimentation. This develops a preferred way of learning, following patterns defined as “learning styles” [4]. Fleming’s VARK model extended learning styles based on the channels for input/output information, targeting learning as the final objective. These categories are: visual learners, auditory learners, reading-writing preference learners and kinaesthetic or tactile learners [5]. Based on this, the SFP proposes the use of external stimuli as a way to create physical experiences which accelerate learning by implanting information on the learner’s brain. Shibata et al. [6] used “decoded functional magnetic resonance imaging (fMRI) to induce brain activity patterns to match a previously known target state improving performance on visual tasks” [7], inducing “highly selective activity patterns within a brain region, thus allowing the investigator to influence specific functions”. According to them this method “can ‘incept’ one to acquire new learning, skills or memory, or possibly to restore skills or knowledge, which has been damaged through accident, disease or aging, without one’s awareness of what is learned or memorized.” [6]. This research explores plasticity in visual areas of the brain generating visual perceptual learning. In our story we extend this to a hypothetical situation where learning can be obtained not only through visual stimulus but using auditory, olfactory and haptic stimuli simultaneously within an immersive environment to acquire learning.

The use of mixed reality virtual environments in education has been implemented in many projects, e.g. [8] [9]. These examples use virtual worlds as an extension of traditional physical classrooms, motivating visual or auditory learners and enabling geographically dispersed students to attend and participate in lectures. In previous works [10] we proposed the use of a blended reality learning environment to perform laboratory activities, using a mixture between tangible user interfaces embodied in real-world objects and virtual devices, enhancing the learning process for kinaesthetic learners. This SFP explores the illusion that virtual worlds can deceive the mind using different stimuli and immersive technology (as presented in videos such as [11]); having as an outcome an enhanced accelerated learning process. Murray et al. [12] presented the use of immersive virtual reality to treat pain, in an experiment similar to the ‘rubber hand illusion’ [13]. They used a virtual world, a Kinect camera and a sensor to track user’s head movements to create a virtual image of the patient’s amputated arm which was causing him chronic pain. Reportedly, when the user visualized and moved both of his arms in the virtual world using immersive glasses, the pain was reduced [12] [14]. This shows just one of the possibilities of the use of virtual reality and immersive technologies to change brain behaviour and deceive the senses. Some other uses of virtual reality have been related to the treatment of mental disorders such as schizophrenia [15], where avatars used as virtual representations of the voices heard by schizophrenic patients might help them to take control over the hallucinations [16].

Our story delves not only with the possibility of implanting information onto the brain but also with the possibility of recollect information captured by an individual through its senses to then recompose all the elements with the intention of “relive” experiences; capturing valuable information that then could be reused in other persons to transmit and preserve knowledge. A problem described in the story is that people’s memory tends to edit, forget or rewrite specific (maybe vital!) details of the lived experiences, in order to reinforce their values and beliefs. To solve these issues in our futuristic world, population have implanted a life logging device which captures every

detail of the life on an individual, similar as the idea showed on the film *The Final Cut* [17]. Life logging is the process that captures every event in a person's life, generally using sensors and wearable devices such as mobile devices [18] or cameras [19] that get information automatically every certain period of time [20]. Besides the many issues on privacy, an interesting challenge is the management and organisation of all the data recollected to provide meaningful information that can be used in diverse applications such as medical monitoring. In [21] the authors proposed a framework to create a story-based visualization of all the recorded data. In our SFP the main character uses a similar organisation system with the information collected not just to preserve certain memories but to reconstruct the experience captured as it was happening again, using immersive technology.

2. Creative Science Prototype (CSP)

*"Most people die before they are fully born.
Creativeness means to be born before one die" - Erich Fromm*

2.1. Sophia

- "What is reality? Reality, like time is just a concept for human beings. Certain situation could be real for you, but not real for everyone else. I mean, you can believe that something is real, like the existence of God, but for others it can be just a concept, an idea. But, when does it become real? When everyone can feel it with their senses?" With these ideas Sophia always started her talk on 'What is reality?'



Figure 1. Sophia working on her virtual environments

She was a neuroscientist and owner of a company focused on creating virtual experiences for people. The company started with multiplayer videogames, and then,

with the boom of augmented reality (AR) - thanks to devices like AR glasses, AR contact lenses, AR helmets, etc.-, just like many other companies it moved to virtual experiences. In these experiences engineers could create almost anything, and then implemented in immersive devices with special audio, video, haptics and even olfactory devices, they could deceive the senses and the mind. Because of the degree of 'reality' in these experiences, some people had been driven to a point really close to madness, especially when they asked for things like to recreate a dead person, or create the perfect partner. To prevent these cases, the government implemented laws classifying the type of experiences, banning most of the direct human-avatar interaction, and limiting the use of these experiences to 20 hours a month. However, in case of using this as a medical treatment for disabled people, the number of hours could be increased, (filling the appropriated forms!). Due to these restrictions, people usually just asked travelling to real or imaginary places in their immersive experiences; the Caribbean, the Mediterranean, even a different planet or imaginary locations described in a book or movie. Sophia always thought that these laws restricted creativity; still she fortunately could find one or two clients willing to try different experiences.

"Imagination is the beginning of creation. You imagine what you desire, you will what you imagine, and at last, you create what you will" – George Bernard Shaw

2.2. Hank

Hank was a rich septuagenarian widower, obsessed with the possibility to live again the happiest moments of his life, rejoicing again with his childhood, memories of his mother –gone long time ago– and the remembrance of his late wife. This was similar to the idea that people can see their life in a flashback when they have near-death experiences; but with the bonus of choosing which memories they wanted to bring back. This was possible because in this era all the memories were recorded from the beginning of the life of an individual. In older times, people did this voluntarily, uploading their photos, achievements, activities and thoughts to social media. But those methods were primitive, people could select what things to upload, creating a different digital persona from the one they really were. This resulted on people looking successful and popular on the recorded data, but with a reality completely different from what they have declared. Early experiments on memory transfer of information from digital media to the brain, ended up with a person completely different from the one scientists were trying to create. Sophia recalled a very unfortunate incident, when a person completely lost his memory in an accident. The family asked Sophia's company to upload into his memory all the data they recollected from the social media. Obviously as it was previously censored by the patient, when they put this data into the memory it resulted in a completely different persona. The family couldn't recognise their relative.

Nowadays to keep a better record of a person's life, hospitals implant a microscopic chip to new-borns, to record everything from the beginning until the end of their lives. The problem with Hank was that because of a human mistake (it seems that humans will never surpass this characteristic!) he got a faulty implant (or maybe is the technology the one that will never surpass this!). Sophia and her team had been working for several months trying to create a virtual experience based only on digital

photos, old emails, digital voice records, etc. This project had been a nightmare to Sophia, because Hank was never satisfied with the quality of the experience. These kinds of projects were difficult even using real data captured with the implanted device. Sophia discovered that people also perform an unconscious selective mechanism to erase memories and some of them, with the time, get mixed with other experiences, own or borrowed, like movies or someone else's stories. Therefore even when she and her colleagues worked with real data obtained from the microchip, people always surprised when they re-experience a particular memory as they didn't recalled as it was. It is an entirely different feeling to experience your born when you are a baby than re-experience it later when you are an adult!

*"Creativity involves breaking out of established patterns
in order to look at things in a different way" - Edward de Bono*

2.3. Clem

Clem was Hank's second child. She grew up in the middle of a successful business family. As far as she remembers, most of her relatives were involved in the family business since the beginning of the company. This company was the largest chain of food pills in the world. Food pills became a successful business a few decades ago, when people were so busy that they didn't had time to do regular stuff, i.e. for shopping, online commerce appeared; for reading, audio books and immersive books appeared; for food, Clem's family created special pills which can transform in a whole meal and send to your brain the best tasting experience ever (even if you repeat the same pill for all your meals!). Clem was in charge of the company's business planning, for that reason she had to travel almost every week to different parts of the world. She was fluent in four languages, and being a very sociable young woman, she had a good relationship with everyone. But she had a secret that lately was giving her many headaches: she always felt as an impostor, as if she was watching all her life through a monitor; a woman looking like her but living, acting, speaking and interacting different with the outside world. Inside her brain she always had contradictory thoughts, and she needed to translate not only her words to different languages, she always felt as if she was also translating her life. But why does she need to translate each word, each action, and each movement before doing it in the 'real' world? She felt like if there were two persons inside her brain. One with the original intentions, thoughts that had different ways and different goals, which were not appropriate to her; and other showing her the behaviour she was expected to do. She always followed the latter, but the original intentions, before the 'translations' were the things she really wanted to do.

Clem's problem was that her brain carried out two types of memories; she could remember what she did but she could also remember her original thoughts, her original intentions, her original words, even the original experiences inside her mind before the translation she performed every time that she acted in the 'real' world. Sophia's company diagnostic was: "The individual records two different memories; one for the acts that she did in the 'real' life and other for the intentions displayed into her mind". She always had control on her acts, she could always differentiate between what she did and what she thought... until now.

Sophia's team found two implants into her brain: one was an old model containing Clem's unreal experiences; the other one was the one that contained 'real' memories, but the team could not remove any of the implants without losing Clem's personality. They didn't know why her brain was always translating all her thoughts and actions, and recording both, 'real' and 'unreal' experiences. Clem wanted to keep the 'unreal' content and remove the other, but this could collapse her 'real' life. The only way to feed those internal 'unreal' experiences was living and acting in the real world, and therefore keep registering real life events, otherwise she could not feed this second life. It was a vicious circle.

*"You see things; and you say, 'Why?'
But I dream things that never were; and I say, 'Why not?'" – George Bernard Shaw*

2.4. Paulo

But besides her everyday work at the company, Sophia was doing some research on her own. She was obsessed trying to find a way to program a human brain without using an implant, based on the idea that human anatomy had already all the chips required for almost any programming goal. She was always avid to learn, and her maxim goal when she was younger was to be able to hold all human knowledge in her brain, in other words to be a 'know-it-all' literally. On her first experiments she tried to create a method to upload the information to the brain. She thought that if a computer can hold immense quantity of information on a hard drive, well, the brain seemed to do the same on humans. She tried first this method, but the result was something like a humanoid robot, he had memories and information in his head but he didn't know how to use it. This resulted in just a method to implant information in the brain, just like the old practices of hypnosis and subliminal advertising.

Then she discovered that the key to program a brain was the experiences that the person feels when a particular event happens. She read many theories of learning (Pavlov, Skinner, Piaget, Papert, etc.) and she agreed with Fleming's VARK model [5]; in which a person can learn through his/her input devices: the senses (visual, auditory, kinaesthetic, etc.) and this happens when learners are willing to digest and accept the information provided by the senses. This was the moment when she thought of reusing experiences from her clients, preserving memories and specialised knowledge, and transferring it to a different individual. Imagine that you could transfer the experience of a skilled surgeon, or the genius of a musician, or... well the possibilities could be unlimited! This was her main motivation to work every day at the company; she wanted to focus on constructing immersive environments where all the senses could be deceived, allowing users to enter in a different reality, and experience virtual as real to transfer and collect information. She started with visual environments and augmented reality; in these initial environments people were deceived only on their sight but the experience although very realistic wasn't described by her users as complete. The next step was to include more senses to create a real immersive experience. She realised that the mind can be completely abstracted and focus on one environment at a time (what Lifton [22] defined as 'vacancy problem'), just like when people concentrate on their screens watching a movie or having a videoconference and forget time or situations happening around.

Then the first step was to create an environment able to provide external stimulus to human I/O devices (aka senses). She knew that certain sounds change human behaviour, like music, since a tune can change people's mood and make them feel better... or worst. And what is music after all? Is it just a sequence of sounds? Almost all music is written under mathematic measures and certain combinations of volume, timbre, and harmonic patterns which might lead people to a certain mood [23]. For example she recalled reading about the work of John Sloboda [24], which analysed human reaction to certain musical constructions. For example, he discovered that a particular construction called 'appoggiatura' creates sadness on listeners. She also knew about the so-called 'Mozart effect', which seemed to show short-term improvement on the performance of spatial-temporal reasoning [25] as a consequence of arousal or mood [26]. Levitin [27] says that 'musical memories intermingle with events, emotions and other information about the context of the experience of the music' giving it an evocative capacity. For the stimulus of the other senses she studied colour psychology and its relation with human behaviour, physical reactions and its influence on learning [28] [29]; she also studied olfactory memory [30] and stimulus over anthropological comportment as it was reflected on Patrick Süskind's book 'The perfume' [31]; one of her favourite novels.

After years and years of research she created a test environment, but the simple suggestion of the experimentation was a very big problem for the authorities. How could they know that she would not harm the subjects on the test? And also what kind of programed information she could insert into their 'guinea pigs'? Finally after many paperwork and many problems, she was ready to try her environment in a volunteer: Paulo. He was a middle-aged gamer who spent most of his time (and money) betting on illegal 3D casinos, where people can only play if they bet huge amounts of electronic money, and if they do not have money then the owner can lend it to them with the highest rates. In many countries it was illegal of course, as in those cases lender's gains are higher and the probability of win is low (e-money tracking in this business is a real challenge for authorities). Paulo just loved the excitement and intensity of these games and as an optimist at heart; he always thought the next game would be his lucky game. Sometimes he gained enough money to pay the bills, buy food pills and holographic clothes, but most of the time he was in bankrupt. Sophia had chosen Paulo because as an experienced 3D gambler, he had many hours of training using virtual worlds and particularly immersive videogames where the gamer participate on mixed reality tasks to achieve a goal. Paulo accepted because he really needed the money, he had many debts and due to this he had been suffering of anxiety. He just wanted to end this problem and then go to a gambler's rehabilitation clinic.

The test was designed to program Paulo's brain to understand Spanish, (he only knew English and some words in German as he used to have a German girlfriend in college). She collected the data from the chip of many Spanish speaker subjects; creating a repository of the language an educated 30-years-old would possess. She turned on the machine, and set the knowledge to a B2 level, which represents an intermediate level (around 500-600 hours of study [32]); she was calculating a feasible amount of information in order not to overcharge Paulo's brain. After a moment of doubt she started the process. The machine started to recreate an incredible cocktail of sounds, visual images and colours and olfactory inducements along with other

electrical stimuli for skin. Paulo had many sensors attached to his skin to measure his heart rate and body temperature. The machine went on for the first hour, and she felt confident about the process, Paulo's sensors indicated that he was having an experience similar to deep sleep (REM frequency). By the second hour she started to get nervous but she tried to calm down and think that everything was calculated thoroughly. The third and fourth hours were a really painful process for her; Paulo's heart rate had increased as if he was running on maximum speed. She was not sure if she wanted to continue with the process but she was even more afraid of stopping the process and leaving Paulo in the middle. As she didn't know what could be the consequences she decided to wait. The machine stopped at the fifth hour. To be more precise, it took 5 hours 19 minutes and 27 seconds according to Sophia's chronometer. Her heartbeat was so fast that she took a minute to breathe. She checked Paulo's vital signals. They looked fine; his heart rate was decreasing slowly, but he was still, with his eyes closed...



Figure 2. Paulo inside the environment.

3. Reflections

In this CSP we proposed the use of technology to capture, preserve and transfer knowledge, in the form of experiences, from one individual to another. In particular, our stories proposed a fictional scenario using virtual worlds and immersive technology as key elements in the learning process. We described a relation between collecting and storing data using devices implanted in the human brain and transferring this information to a different individual, enabling an imaginary possibility of programming human brains in an accelerated manner using mixed reality environments.

The story superficially touches issues such as free will and human ambition, the role of life logging in an individual's life, and some risks and ethical problems of

capturing, managing, classifying and preserving information. We left our story without a defined end in purpose; with the intention of generate discussion about the benefits and problems of these methods, having in mind all the elements described in the story. What could it be the positive and negative effects on people's lives if everyone could have access through this sort of learning to any subject they would want to learn? Has the human brain the capacity to hold unlimited knowledge? Would it be any side effects? What kind of laws would be necessary to implement in order to regulate this imaginary scenario? What impact would that cause in the world? Would that completely modify for good the present educational model?

We are aware that this SFP do not offer answers to these questions but we hope that it will raise ideas that might identify solutions towards the construction of a new enhanced learning era.

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