The Turing Shroud

Jim HENSMAN[1,a] and Ian UPTON[2,b]
[a] *Serious Games Institute, Coventry University*
[b] *Get-Real Solutions Ltd.*

Abstract. Immersive environments, by merging physical and virtual experiences, allow both local and online participants to meet and collaborate, as well as allowing thoughts and ideas to be collaboratively viewed, discussed and interacted with. Current developments make possible the extending of these environments to incorporate all the senses and increasingly include the use of direct interfaces to the brain. The Science Fiction Prototype uses a story about an attempt to explore the life of the scientist, Alan Turing, to envisage a future where developments of these techniques allows the implementation of systems that can create and recreate past and present reality as authentic collective experiences that can transform the nature of learning, research and life generally.

Keywords. Science fiction, Immersive environments, Virtual worlds, Collective intelligence, Brain computer interface, Interdisciplinary research, Alan Turing

1. Introduction

"The Turing Shroud" explores the possibilities that could arise in the future in learning and other areas through collective intelligence and the contribution of immersive environments and experiences to this. Attention is often focused on the potential of computers and other technologies. The intention is not to ignore this, but to consider their impact together with and in the facilitation of people thinking, learning and working together. Specialisation and its attendant knowledge and organisational silos and barriers, whether it is related to learning, research or work, often limits and restricts our potential. Technology and technique can however be used to help overcome these limitations and barriers as well, facilitating collaborative activity and work across disciplinary boundaries. In the same way that a brain is more than the sum of its individual neurons, so too the collective brain has enormous potential if its power can be harnessed. This Science Fiction Prototype is about some of these possibilities, illustrated and explored in a rather unusual context.

2. Background

2.1. Current Systems

Work by the authors relating to the theme of the story was carried out under several projects over a number of years, both individually and together. Virtual worlds have

[1] Jim Hensman (Corresponding Author), E-mail: j.hensman@coventry.ac.uk
[2] Ian Upton, E-mail: ian@ian-upton.com

been used in learning within many disciplines and in many different ways. Nevertheless, most systems have concentrated on content and the learner's interaction with this, rather than the collective experience and interactions between learners. Coventry University is currently leading a consortium on work particularly aimed at students who go to work on projects in developing countries. An online virtual world environment used in support of this, developed by a co-author of this paper, is used to give students an understanding of wider issues, the cultural and social context for instance. Although the environment can be used for learning about technical and other aspects of work they will be taking part in, the focus is on facilitating group discussion and interaction. Videos providing an overview of this, as well as a longer introduction are available[3], as well as a demonstration of a similar environment[4] that can be flexibly adapted for many learning and research purposes. In other work the authors were involved with, for the Eden Project in Cornwall for instance, social networks such as Facebook were seamlessly integrated into a virtual world environment, providing a range of techniques for group interaction that complemented each other.

A different strand of work centred on Virtual Research Environments (VREs) and included looking at how immersive spaces, which merge physical and virtual environments, could be used to facilitate collaborative thinking, discussion and working. Extensive user requirements gathering had shown that there was widespread interest in cross disciplinary collaboration, but researchers often raised the issue that they didn't know with whom or on what topic they could do this. Earlier work [1] had developed techniques and tools to help deal with this issue. For instance, starting with cancer researchers, links were found to areas including metallurgy, geographical information systems, graphic design and even wallpaper! One development, part of a project called Inspires[5], looked at how tools like this could be integrated into immersive spaces and used with physical groups in real time to facilitate collective engagement and interaction.

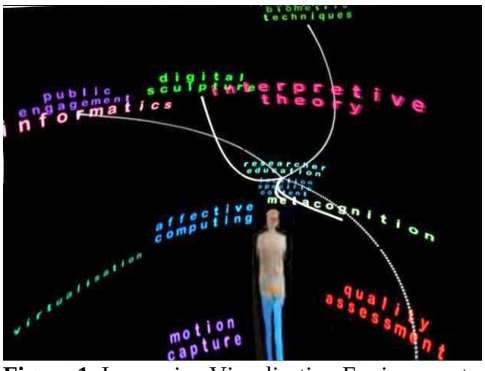

Figure 1. Immersive Visualisation Environment

Figure 2. Interaction with Avatars

Figure 1 shows one setup implemented using a large screen 3-D projection facility, allowing a group to interact in various ways with word clouds representing ideas they are discussing. Words displayed are drawn from what people are saying, using voice

[3] vimeo.com/55523534
[4] vimeo.com/72878340
[5] www.jisc.ac.uk/whatwedo/programmes/di_research/researchtools/inspires.aspx

recognition in some cases, together with information from text messages and social media. Some of the tools mentioned earlier and others interface to the visualisation system through web services to generate new concepts based on the expertise of the participants, visually linking similar concepts together, and allowing collective filtering of ideas through user interaction. A video of the system in operation is available[6].

Immersive space techniques like this have been used for many different purposes. One system[7] using a variation of the technology was used for crowdsourcing, in particular for obtaining public feedback about a major activity being developed for the 2012 Olympics. It was part of a physical event held over three days and provided a visualisation, in a virtual space that mirrored the physical surroundings, of a word cloud - including texts from mobile phones, Twitter and e-mail contributions that people made locally, as well as allowing similar contributions remotely. Another system, called Insert/Extract[8] (see Figure 2), was part of a 3-D immersive installation set up in a Museum, that allowed users to interact with avatars in a very natural way, with added facilities for people in the physical world to appear in the virtual world and vice versa. Many thousands of members of the public participated in this and it demonstrated how easily people, particularly children, adapted to this environment, with important lessons for its potential use in learning.

2.2. The Future - SurroundMind

Immersive systems such as the ones described here to facilitate collective thinking are intended to form a small part of a very general and long-term objective to consider how the internal mental configurations of individuals can be externalised and communicated using all the senses to allow collective intelligence, perception and consciousness to be realised in a group setting. This concept, which has been given the title "SurroundMind" in an allusion to the audio system called SurroundSound, in its widest sense is what the story which is part of this Science Fiction prototype aims to depict. It is obviously something that can only be realistically considered very much in the future. However, a number of aspects of it can be seen at the present time, even if in rudimentary form.

The VRE work carried out by the authors described above falls broadly into the category known as knowledge visualisation [2], which is related to but can be distinguished from information visualisation. Other senses in addition to the visual need to be included and integrated to provide additional sensory inputs and outputs. For example, music and sound can have a powerful effect on emotional state and thus in conveying emotional information. Considerable research is taking place into algorithmic methods to implement this [3]. Other senses also have a role to play. For instance, the well-known VARK classification of learning styles [4], considers the kinaesthetic sense as being of key relevance to learning. Brain interfaces are of course still at an early stage of development, although some developments referred to in the story, such as controlling the narrative of virtual world based soap operas through a direct brain interface, are factually based [5].

[6] vimeo.com/49155054
[7] vimeo.com/15598938
[8] vimeo.com/58571590

3. The Story

3.1. Prologue

The man in the white coat sounded anxious, "Look, Prof, I know you've been given special approval, but we've not done anything quite like this before. We don't know whether we'll be able to get you back to the way you are now. At least let us keep the emergency emotional level cut-outs on in case we detect something potentially dangerous".

"No safety nets", Jeff Lee said firmly, "and if I come back as I was, I probably wouldn't have learnt anything".

Today he would get into the mind of Alan Turing. It was a risk worth taking. He smiled at his two younger colleagues, Maria and Cheng. He could see they were nervous, even though they were trying to hide it. What he was doing was a day-to-day part of learning and research, not to mention leisure, using what were generally referred to as "Experiences". But two things were different.

"It would not normally be allowed with someone who committed suicide", the ethics adviser had said when he had first raised this.

"That's disputed", he had insisted, "and maybe this is the only way to find out". But Jeff had his misgivings as well.

What was completely unknown though was something else. Two years previously, among some household items being auctioned, some letters had turned up, supposedly written by Alan Turing towards the end of his life. Most mysterious were pages with series of numbers on, that been found together with them. These had been expected to be some sort of encrypted writing, but even the best quantum computer crackers had got nowhere with them. But various analyses established that the numbers were not random, that there was probably meaningful information there. Some scientists speculated that it could be a computer program of some kind, perhaps for some device that had not yet been invented. Of course this had further inflamed the controversy about whether the letters had been genuine or not - and had led to intense media interest around what had been called the "Turing Shroud", after the crucifixion relic. If this had been anyone else, the number data would have been strong evidence that it had all been a forgery. But this was the man who had invented computing itself. The man some of whose security related papers were considered so far advanced that they were not declassified till over 70 years after he wrote them. He had also worked extensively on biological systems. What if he had discovered some general principles in this area equivalent to the Universal Turing Machine he devised that could carry out any computation? What if he had been able to represent something, perhaps about himself, which could only be implemented in a system in the future and left this for posterity? The trouble was that the only way to really find out was by what Jeff was going to do. And that was something he had to admit to himself, he wasn't entirely comfortable with. As the final preparations were being made, he thought of how he had got there.

3.2. Jeff's Story

When Jeff was starting out as a graduate student, there were high expectations of the impending "technological singularity", when computers would pass the point where they would surpass human intelligence - with consequences difficult to envisage. But

there were sceptics as well, one of whom, Joseph Gratsky, was to become Jeff's mentor and shape his future career. He remembered Gratsky's virtuoso performance in a packed out lecture hall. "This humble device I have here", he said, holding up an antique device few of them had ever seen, "is one of the first pocket calculators". "The chip it uses", he added, opening up the device, "is so simple that it was once issued in a single bit version. So only marginally more intelligent than some of my more vociferous critics". This always went down well - everyone knew who he was talking about. "But it still was faster in what it did than any human past or present. Very significant, but no singularity. Fast forward to 1997 when a computer beats the world chess champion. Still no singularity. Today we have reached computing power difficult to even imagine then. But the principle is the same. The philosopher, Thomas Nagel, wrote a famous paper entitled, 'What is it Like to be a Bat?' With all our intelligence, this is something we cannot know. Similarly computers, for all their intelligence, cannot imagine what it is to be like humans."

Gratsky of course had not been a technological sceptic, far from it. What he had argued for had been the development of collective human intelligence, augmented and facilitated by machines. Was it machines augmenting humans or the other way round? This had been one of the questions often posed. Jeff, as he had continued his own research, had been happy to consider this an open question. He had even entitled one of his courses, "Humans and Computers – Is There a Them and Us?" What was beyond dispute, was that the combined intelligence and creativity of human-kind and machine-kind together, finding the best combinations and synergies to solve problems and expand knowledge, had demonstrated what could certainly be described as a singularity. Jeff wondered whether some of the questions now being answered could have even been imagined a generation earlier.

He began to feel the effect of the equipment taking hold and closed his eyes. Soon he would be in a mental state similar to lucid dreaming, where he would be in a dreamlike state but still be aware of this and with some conscious control over it. Some people had a natural ability to go into this state, but now it was part of education generally from an early age and with suitable equipment very easy to do and used widely in many ways. Jeff felt a sense of extreme anticipation, but also through his detached self knew what he was feeling - a peculiar sensation. He wondered whether Maria and Cheng could see the smile he had on his face in his internal world.

3.3. Cheng's Story

Cheng had been fascinated by the work that Jeff was doing even as a child. When he was given the opportunity to work in one of Jeff's teams, he was very pleased. Developing techniques for collective intelligence and better interfaces between humans and computers had gone hand in hand, each building on the other. In the past, work on virtual environments for learning and research, combined with knowledge about factors in physical spaces that supported creativity, had led to the increased adoption of composite environments that facilitated different aspects of collaborative working. An important part of this related to immersive spaces which merged the physical and the virtual, allowing physical meetings in one or more locations to be enhanced and facilitated through features in virtual space, which used interactions through all the senses to support collective thinking and learning. These multisensory collective

environments had increasingly also utilised brain computer interfaces. The original large and unwieldy FMRI devices for real-time analysis of brain patterns had become increasingly more portable and precise, utilising nanotechnology and related techniques. Together with massively increased computing power, brain activity and corresponding mental states and thoughts could be increasingly analysed and correlated even down to individual neuron levels in some cases.

The other side of the equation, how to directly alter what was happening in the brain, was more difficult, and he was particularly proud of the work he had been able to contribute to in taking this forward. Jeff had explained the principles of this to him the first time they met. "Evolution has developed sophisticated interfaces to our brain over millions of years through our senses. So our five senses and others, such as our kinaesthetic sense, will always be the starting point when we look at how to influence what's going on up here. But we had got an idea of what was possible a long time ago. As you know, individuals who had brain injuries which left them severely disabled in one or more of their faculties have been able to recover them through other parts of the brain taking over the required functions. So we know the brain has a surprising degree of plasticity. It was the work I did on prosthetic devices when I was starting out that made me realise how much further this could go. Some of the pioneers of devices such as cochlear implants didn't initially believe what they were doing would be possible."

"My father was profoundly deaf and had one of those", Cheng interjected, "and I know we took the technology for granted by then. But I can remember being puzzled when I first started thinking about it."

"Yes", Jeff said, "the key question was how electrical signals generated by sound could be connected to the brain's auditory system. In the early days particularly, the resolution of the sensors used was very course, and the connections made almost random. Yet the brain was able to adapt and learn over a period of time and users were able to recover surprisingly sophisticated powers of hearing. As devices and our ability to monitor the brain got better we were able to improve the quality and the learning process dramatically to what we have today, where we can effectively restore normal hearing as well as sight and other senses. Of course that work was just a start in a way, because we also wanted to be able to connect to higher order mechanisms - thoughts, feelings and emotions."

Since Cheng had started working with Jeff, things had moved a lot further. Wearing comprehensive augmented sensory interfaces, such as active contact lenses for vision, was now as normal as wearing clothes. In fact a common product slogan was "I feel naked without my …", for whatever device was being promoted. A brain interface was now an easily attachable external device, normally hidden under the hair - although also available as a fashion accessory. All the interfaces were seamlessly integrated to provide an experience that could blend the physical with the virtual to the requisite degree depending on the particular requirement. You could have your normal physical experience subtly augmented with appropriate information, or have an experience that was effectively completely virtual, using different states suitable for what was required. This could be anything from what would seem to be a dream, through lucid dreams, to one's where you were fully awake but all your sensory interfaces controlled virtually. The direct brain interface could also be used in different ways depending on the requirement. This could be from selecting options and controlling communication and other devices, to facilitating complex collective

experiences. Cheng was an extreme sports enthusiast and in developments he had been involved with in this area was able to combine both his work and leisure interests. Using smart reactive clothing together with the sensory and brain interfaces, it was possible to simulate these experiences to a high degree. This meant, for instance, that the friends he went skydiving with could each experience in their own location all the interactions of a group skydive. Of course, although this was an exciting experience in its own right, they used it primarily to develop their skills for when they came together to do it in real life. Where some of these new developments really came into their own was in learning, and this was an area Cheng felt that had been most transformed by the work he was part of.

3.4. Maria's Story

Maria had started working as a teacher in her own country and been sent on a course to learn about some of the new techniques being introduced. As part of this, there had been a special lecture on the future of learning. That was where she met Jeff Lee and got fascinated in what he was doing. Experiential learning, aiming to provide learning experiences in as authentic real-world settings as possible, was the norm at all levels of education. This used the kinds of technology Jeff was working on to augment the experience and support learning. As the technology advanced, virtual experiences, including using brain interfaces and dreamlike states, were also increasingly used. But from her own use of these in teaching, Maria wasn't sure whether they were always as effective as intended. She quizzed Jeff about this after his talk.

"Even with all the personalisation features, the systems seem to work better with some kids than others. Sometimes it's not just about ability, more about interest and motivation."

Jeff nodded his head. "You have hit on one of the key areas we're trying to address. As you know, game-based learning is a key element in all education now. This uses the fact that gameplay is instinctive and one of the key ways we learn from birth. There was a time when some people seemed to believe that there was some kind of cut-off point after which it was no longer important for learning, but of course it is important at any age and now a key part of education at every level. But we acquire other motivations and interests as we grow up, which associate emotions with different activities, including learning. This can be negative or positive in various degrees, and is affected by a whole raft of things, cultural, familial, peer influenced, and so on. How we can use some of the new brain interface developments to work with this is a key focus area for us."

"It also seems easier to apply the systems to some subjects compared to others", Maria continued.

"You're also right there", Jeff added, "we would love to be able to help create a few new Shakespeares or Mozarts for instance, but we're not as far advanced in areas like that."

This had got Maria thinking, and led eventually to the path which would take her to where she was now, working with Jeff in this area. There had been work going back many years which had identified emotional states based on brain monitoring in real time which had been used to modify user experiences. Maria smiled when she thought of early experiments she had read about that controlled the narrative of virtual world-based soap operas this way. But it worked, and further developments had led to

increasingly sophisticated applications, including in learning. Live action role play, where participants enacted different scenarios had become very popular in both entertainment and learning and newly developing combinations of virtual and physical experiences were able to take this further. Advances in interfaces to directly influence the brain could enhance what was done through sensory input, but also go in new directions. One of these was in influencing emotional state, which had become a major field of work with applications in every area from medicine to entertainment. Some of the work in the earlier days was inevitably controversial, and Maria remembered the heated discussions she had with her flat mate at that time, Sophia.

"So let me get this straight, you want to reinforce positive emotions associated with learning. Isn't that very … behaviourist. You know, you give the rat an electric shock if it's doing it wrong and a piece of cheese if it gets it right."

Maria laughed, "If only it was as simple as that. Emotion got bound up with thinking very early in evolutionary history. Emotional correlates with things like learning are incredibly complex and learning itself has many different aspects. The overall aim is to get the student to want to learn, to find what they associate with a good experience and then work on linking that to what they feel about learning."

Maria had been originally teaching in the area of the humanities and this now also formed a focus for her research. Because work in this area concentrated on generic factors, such as creativity, this also had a major impact on learning experiences in other disciplines, as well as in environments for research and more generally. Distinctions between different disciplines were increasingly blurred as concepts and methods that went beyond traditional boundaries increasingly became the focus for learning and research. The distinctions between learning and life generally also had changed dramatically. For a long time most learning had to take place after anyone's formal period of education, but now the concept of lifelong learning had an even more fundamental importance and learning had to be intimately integrated into work and all aspects of living. This was not a passive process - the aim was that people would contribute to the creation of new knowledge. Every stage of learning was linked to the real world and real problems, so that the transition from formal education to work was mainly a change in emphasis rather than a structural break.

This seamless transition was aided by the varieties of experience that were available. Maria's own research itself was increasingly conducted in a collaborative thinking space which used a variety of different types of experience and included other researchers from a wide variety of areas, students and the public. In fact with regard to the development of knowledge generally, research, learning and public involvement had increasingly merged, with aspects distinct to each, but also many environments where interactions took place between them, which she found very stimulating. Maria particularly liked the free-flowing collective dream experiences where new ideas could be formulated, modified and connected - and using the rapid prototyping facilities integrated into it, tested and evaluated, sometimes all within the same session. Particularly exciting were the new connections that could be made during these activities, often from researchers, research and other areas that would seem to initially have no apparent connection to the subject under discussion. Links could be created which could then sometimes re-divide and redefine the whole topic in a dynamic and developing ecosystem of knowledge. Her own work had often made dramatic changes in direction and scope through this process, and had been enormously aided and

enriched because of it. She also enjoyed participating in sessions of this type initiated by others, which her brain interface would connect her with when she wanted to. These excursions could not just involve thinking and discussion but any area of creative activity - collective art, music, writing or media production, for instance, aided by the wide variety of brain controlled devices that existed.

One area which she had originally got involved with in this way appeared to be a diversion - albeit an interesting one. This was digital biography, which was to have some surprising repercussions for her work. This had originated as just a means of including digital materials within the biographical field, but increasingly the emphasis was not just on finding out about somebody, but getting to know them, and with the development of experiences, this began to include being able to meet them, even if they were no longer alive. This work intersected with role-play gaming where real or hypothetical situations were recreated for players to interact in, with the biographical subject effectively being a simulated non-player character in this genre. But one factor, which affected a wide range of other experiences as well, always acted as a limitation. How could we know what they felt like? If we were part of an experience where we were in the role of someone from that time, it would not be authentic for us to feel, believe and understand like someone from today. This was where some of the more recent work in directly influencing the brain came in. Maria had appeared on a media program, called "Inside the Minds of the Past" explaining this.

"Tell me how I can feel like someone else?", the interviewer asked.

"If I was deaf and used a hearing prosthetic device, it would have simulated what a person without that disability could hear. Now consider what would happen if a spider was put in front of me. I have no problem with spiders, so my emotional arousal signal in relation to fear would be small. But supposing we amplified that signal greatly and stimulated the locations in my brain which aroused fear with it. I would then feel like someone who had a phobia for spiders", Maria replied.

"I presume the aim of this work isn't just to find ways of making us scared."

"In practice, quite the opposite of course. This kind of technique is extensively used in treating phobias. And we can't usually just increase or decrease certain emotions. Sometimes we need very complex translations between different emotions combined with other stimuli", Maria answered.

"What about people from the past. You can't go and stick one of your monitoring devices on Alexander the Great can you?"

"This relies on building up a model based on historical materials and analysis. Of course people had significantly different attitudes and beliefs then, but also similarities. We still read and use the works of Aristotle, who tutored Alexander. We still laugh at the humour of Aristophanes."

The experiences that were now available made learning about the past and across cultures and languages much more authentic and were also extensively used across disciplines. In the sciences it allowed students to take part in the experience of some of the great discoveries and inventions of the past. In geography and related areas, historic explorations could be relived, and so on similarly for other subjects. Experiences could be personalised to fit the prior knowledge, interests and motivation of the students, but were also usually collective. Maria explained this to a group of research students who were about to do their internship as part of her team.

"Our activities, whether at work, at school or at home, are predominantly carried out with other people, so it is sensible that we learn that way as well. We can still tailor things to individuals, but construct collective experiences around these. It's all part of making the learning experience authentic. But it also teaches students about the mutual benefits they get through learning interactively and collectively with others."

"What about evaluating individual work?", someone asked.

"What individuals do within collective experiences are an ideal way to gauge their level of understanding and expertise in real situations. We can design special experiences to evaluate individuals more comprehensively if necessary and even use certain experiences where all the other participants are non-player characters if we need to compare people", Maria replied.

"How do the experiences take into account people learning at different rates?", someone queried.

"This is where the techniques we have learnt from games and related areas allow us to dynamically modify scenarios and different individual's paths through them. Our ability to use feedback from brain interfaces, so that we have independent information about engagement, arousal levels and so on, also means we can adapt various characteristics of situations and environments to optimise learning as we go along. We also include a lot of sophisticated monitoring of various indicators that the individual will not be aware of, but which we as designers can later use to improve the overall system", Maria answered. Some people also raised ethical concerns. With the increasing power of the devices and techniques being used, many ethical and related questions arose. With the enormous beneficial potential also came it's obverse. Even with the many safety mechanisms and techniques that existed, there were dangers. Dreamlike experiences were usually restricted to having some kind of lucid constraint, so the subject could exit the experience if they needed to. Getting into the mental state of people with certain disorders or who had exhibited certain behaviours was controlled as far as possible, although doing this with special constraints and safety provisions had also led to major therapeutic advances.

3.5. The Turing Experience

When the news about the Turing find became known, Jeff had been very excited. He had always been fascinated by Turing and his work and had published papers about aspects of Turing's research - including his famous Turing test to define thinking like a human. Jeff got together with Cheng and Maria to discuss what they would do.

"We don't even know what the numbers mean", Cheng said, "there is a risk involved."

"I don't mean to pull rank", said Jeff, " but because of the risk I can't allow anyone else in the team to do it first. If it's OK, then others can try it out."

"But what if it's not OK?", Maria queried.

"Nothing ventured", Jeff said, trying to sound unconcerned. "This is a unique opportunity. If Turing actually did figure out something, this might dramatically advance the whole area."

Faced with the challenge, the team had focused on enhancing and extending their systems. The challenge had caught the imagination of some of the best minds around the world and the multidisciplinary team that had been working on the problem had made some key breakthroughs recently which made Jeff feel they were ready to try things out. The fundamental problem was that brains had many similarities but also

major differences, especially at a detailed level. What was needed was a way of detecting the high-level thought patterns from one brain and translating these appropriately for another. Sophisticated techniques based on algebraic topology had been developed that could take into account both the spatial configuration and connectivity of any specific brain as well as information from its neuronal state. This was then abstracted into a form which could be translated, using some of the most powerful processing devices yet devised, to stimulate another brain for which a similar analysis had been carried out. This work already had been responsible for dramatic improvements in experiences used in every field. But Jeff felt this was going to be the crucial test. They didn't have Turing himself there so that they could analyse his brain, so they would have to assume that the numbers in the letters was already in some abstracted form that could be interpreted by Jeff's brain interface. He was sure that the systems they had developed were so powerful that any discernible patterns there would be identified and translated sufficiently for him to understand.

Jeff was now deep into his experience. Both the preparation he had done beforehand as well as the sensory stimuli that had been provided as he went into this state allowed him to move easily - first into the setting of Bletchley Park during World War II and then into the post-World War II world. He knew that the brain detectors would not be using the special data as yet, they would wait till they detected he had reached a suitable point, which he could also influence from his lucid state. He was now in Manchester and visiting Turing in a University building. He felt incredibly intellectually stimulated, with many new ideas coming into his head which he was discussing with Turing. He could also sense a feeling of sadness, although the system had been set to influence his moods as little as possible. Now he was entering a house in Cheshire, which he recognised as where Turing lived. Suddenly he knew the time was right and instinctively felt the change as the data started kicking in. He could see Turing beckoning him into a room. He followed. Suddenly he saw it. For a moment he stood there in amazement, feeling as if everything was real, that he was no longer in a dream and in control. Then the lucid dreaming mechanism re-established itself. He had seen what he needed to see. He started pulling himself out. His surroundings seemed to shrink into the distance. He opened his eyes.

"I don't understand." Cheng scratched his head. "How come we never figured that out?"

"Because we were looking for things like text or program codes", replied Jeff, "we didn't think of images. It also used a type of data compression different to ones we use today, but with some similarities. If Turing was responsible, he probably invented that as well. My brain picked it up immediately of course because it was visual."

"I appreciate the significance of an apple", said Maria, " because that was found by Turing's bed and we know he was fascinated by the story of Snow White and all that. But it wasn't an ordinary apple was it?"

"No", said Jeff, "it filled the whole room. It was like that picture you may have come across by the surrealist, Magritte."

"Where has all of this got us then?", mused Cheng. "We still don't really know whether the data was a forgery or not. And we haven't really got into Turing's mind, have we?"

"Maybe not, but if it was him, he certainly lived up to the sense of humour we know he had," said Jeff laughing.

"But wait a minute", said Maria, "we might not have found out a lot about Turing, but as a by-product of doing the work triggered off by all this, we have made very significant advances in brain interface systems, which particularly will help us in some of our historical investigations, including undoubtedly understanding Turing better. It's, as if somehow, he realised that this was the best way to help us. To make a contribution to the knowledge of the future."

"I certainly wouldn't put that past him", said Jeff. They all nodded in agreement.

4. Conclusion

The story has been used to explore how the development of technologies to facilitate and enhance collective experiences and intelligence could transform the nature of learning and other aspects of life - which would be increasingly integrated with learning. There are dangers and challenges associated with these developments which the story also aims to raise. Using a science-fiction scenario is an ideal way to explore possible future developments. Of course things we do today will be part of creating that future, but it is also useful to consider what might be possible, to help determine some of the directions we take now. Developments around the concept of what has been called "SurroundMind" it is felt could act as a bridge from current technologies to the future. Beyond this, exploring and working towards a Science/(Art) of Knowledge, which integrates the different aspects of this area in the way that is projected for the future in the story, would be an important endeavour. The story is set in a time around the last decades of the 21st century. Some of the possibilities presented might seem to stretch what could be achievable by then, but it is only necessary to go the equivalent length of time backwards, to a period when computers didn't even exist, to sense what could be possible in the future. And of course even envisaging the possibility of computers, which the object of the story, Alan Turing, figured importantly in, was key to their future development. Similarly it is hoped that some of the musings about the future we make now can contribute in some way to their achievement.

References

[1] Hensman, J., Despotakis, D., Brandic, A., Dimitrova, V. (2010). Tools to Find Connections Between Researchers – Findings from Preliminary Work with a Prototype as Part of a University Virtual Research Environment. In: Erik Duval, et al. (eds.). *Proceedings of the 2nd International Workshop on Research 2.0*. At the 5th European Conference on Technology Enhanced Learning: Sustaining TEL. Barcelona, Spain, September 28, 2010, CEUR-WS.org. Vol- 675, ISSN 1613-0073

[2] Burkhard, R.A. (2005). Towards a Framework and a Model for Knowledge Visualization : Synergies Between Information and Knowledge Visualization 1 Introduction : Knowledge Visualization in Organizations. *Knowledge Creation Diffusion Utilization*, pp. 238-255.

[3] Williams, D., Kirke, A., Miranda, E. R., Roesch, E. B. & Nasuto, S. J. (2013). Towards Affective Algorithmic Composition. In: *Proceedings of the 3rd International Conference on Music & Emotion (ICME3)*, Jyväskylä, Finland, 11th - 15th June 2013. Geoff Luck & Olivier Brabant (Eds.). University of Jyväskylä, Department of Music.

[4] Fleming, N.D. & Mills, C. (1992). Not Another Inventory, Rather a Catalyst for Reflection. *To Improve the Academy* 11, pp. 137-155.

[5] Stephen Gilroy, Julie Porteous, Fred Charles, Marc Cavazza, Eyal Soreq, Gal Raz, Limor Ikar, Ayelet Or-Borichov, Udi Ben-Arie, Ilana Klovatch, Talma Hendle. (2013). A Brain-Computer Interface to a Plan-based Narrative. In: *Proceedings of the 23rd International Joint Conference on Artificial Intelligence (IJCAI 2013)*, Beijing, China, August 2013. (Forthcoming)