

Initial Project Report on Fi-Sci: Directed Entertainment Narrative Generation for Scientific and Technological Research

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“To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.” (Einstein and Infeld, 1938) Most scientists would agree with this, and would also say fiction writing is a more creative process than generating a scientific project proposal. There are multiple examples of Science Fiction writers inspiring and even predicting genuine future technologies, for example the satellites of Arthur C. Clarke (Rhodes, 2000), and the social robotics of Isaac Asimov (Asimov, 1950). There has also been a European Space Agency project which surveys past science fiction to help with the generation and development of new ideas for space technology (Rait, 2001), Recently a study began on how reading fiction might affect scientists (Knight, Dillon and Goldschmidt, 2012) and there has been research on using Science Fiction to help teach science (Dubek, et al., 1990). More tangentially, there has been a study on the use of cyberpunk novels in geographical research (Kitchin and Neal, 2001). This article introduces a novel approach to generating or extending research projects, called Fiscience (pronounced “fiss-see-ense”). Fiscience (or Fi-Sci for short) involves the generation of entertainment narratives at different stages of a science research project so as to explore and produce new ideas which the project can investigate. Fi-Sci differs from past approaches in being active and direct: new fictional story ideas are developed by fiction writers in relation to science projects, to help with, extend or initiate the scientists’ ideas.

Method Overview

The core method being investigated involves the use of three science projects in which the authors are involved (described in more detail later). One of these projects has been

funded by the UK EPSRC for £1.1m, the second project proposal failed to attain EPSRC funding in its current form and is being rewritten, the third solely exists as some notes, an informal published article and web page, and a draft paper in preparation. By using these three it is hoped to examine how the input of science fiction authors may help with projects at different stages in their life cycle. For example the first – already funded – project could at some future point have trouble achieving its objectives. Hence a set of ideas generated by fiction writers may help the scientists to think outside of their mental habits in progressing the project. Furthermore it may provide fruitful pathways for further research.

For the second project, the input of the science fiction authors may help in giving a new context, defining more clearly the social impact plan, and / or perhaps extending the level of innovation. This may lead to the project being more suitable for a successful funding bid. Finally for the hardly-defined project, the input of the science fiction authors may help to give more direction, and to highlight the key elements of the project to be incorporated into a funding application.

Broadly the method involves contacting multiple professional sci-fi authors and asking them to generate story pitches (in the form of at most one to two paragraphs per story pitch) based on one or more of the three research projects. The pitch is a short summary of their story which captures its essence. The authors are encouraged to generate “ideas-based” stories, not ones which are more focused on character. These ideas will then be evaluated, by scientists collaborating on the projects, for their potential application within the three projects.

Initial Contact Process

A number of professional authors of speculative/science-fiction were contacted and given a brief outline of the Fi-Sci idea, including one sentence descriptions of the three research projects. Of those contacted a minority responded asking for more details. This part

of the process raised some key issues. One author asked “Who owns the copyright to the pitches?” This raised an issue that had not been considered – intellectual property, one that is now in the process of being investigated. The initial response was:

“There would be two separate elements: (1) Any story coming from the pitches would belong to the author; (2) Any research or technology coming from the pitches would belong to Plymouth University – however the authors would be credited as a research paper author in any journal, conference or media publication.”

Another question which arose from an author:

“When you say you're looking for ‘ideas-driven’ stories it makes me wonder what you actually imagine the writers would contribute, as you have listed the ‘ideas’ below and what seems to be required next is characters and plot. I don't imagine that characters and plot would get you anywhere scientifically, so please clarify what you are hoping for from the writers.”

The following response was sent to the author as an example:

“Suppose a project was being developed in which computers are being used to diagnose mental illness using artificial intelligence questions and interaction. This would be the research idea. A crime author may be inspired to develop a short story / novel in which somebody wished to discredit a business associate who had a mild depressive illness. The criminal hacks into the system and sets

it up so that it will diagnose the person they wish to discredit with, say a majorly delusional mental illness such as schizophrenia. The computer system is the research idea, the crime story is the story idea inspired by the research idea. Reading the idea for the crime story might lead scientists to more carefully incorporate ethical and network security concerns into their research on the system. Thus the plan for the fiction impacts the plan for the science. I find both the fictional and scientific examples above to not be particularly interesting (or realistic)! However, do they highlight the *differences between the initial science idea and the story idea for you?*”

At this point a responding author would agree to join the project or decline. The profile of joining authors thus far is given in Table 1.

Author ID	Occupation	First key publication	Location	Work examples
1	Film script writer	2011	UK	Horror script filmed starring Billy Zane and Dominic Purcell
2	Theatre and radio script writer	1997	UK	Robot script for BBC Radio 4 and iconic BBC sci-fi series work
3	Novelist	2008	USA	Multiple sci-fi books, recently nominated for a John W. Campbell Award
4	Novelist	2010	USA	Multiple sci-fi books one winning an Arthur C. Clarke award

Table 1: Some features of the four confirmed authors

Short Project Description Phase

Authors were sent short project descriptions and asked to order the projects by preference. The descriptions were as follows:

Project 1: Real-Time Hallucination Simulation and Sonification through User-Led Development of an iPad Augmented Reality System

The simulation of visual hallucinations has multiple applications. For example in helping diagnosis, in helping patients to express themselves and reduce their sense of isolation, for medical education, and in legal proceedings for damages due to eye / brain injuries. A new approach to hallucination simulation is presented, which allows real-time expression, using an iPad. An individual can overlay their hallucinations in real-time on the iPad screen over the iPad's video camera image. The system has been developed focusing on the visual symptoms of Palinopsia, experienced by the first author, and hence is initially user-led research. However such an approach can be utilised for other conditions and visual hallucination types. The system also allows the hallucinations to be converted into sound through visual sonification, thus providing another avenue for expression for the hallucinating individual. Furthermore, a musical performance is described which uses the system, and which has helped to raise awareness and comfort some people who have Palinopsia symptoms.

Project 2: Intelligent Multi-agent System Informed by Imitative Communicating Whales

The development of intelligent machines that evolve collectively their own language to execute tasks in groups by interacting with each other, and with people, is a challenging problem, which is currently being addressed by scientists worldwide. An innovative and interdisciplinary approach to this challenge is proposed, which combines Artificial Intelligence, Cognitive Science, Marine Biology and Computer Music to develop a communication system based on the evolution of Humpback whale song in social groups. An audio hierarchical grammar will be learned and shared between agents and/or between agents and humans. The modelling of singing whales will provide insight into the processes of cultural transmission in whales and into the learning of language and communication in the wider biological field. In order to develop this research the consortium's combined interdisciplinary expertise into modelling of musical evolution, machine learning, multi-agent modelling, and analysis and modelling of the behaviour of schools of whales will be drawn upon.

Project 3: Brain-Computer Interface for Monitoring and Inducing Affective States

It is proposed to extend our work in how EEG-based emotion detection can be used to control affective communication via sound using computational affective expressive performances of algorithmically composed music. This will be a system in which affective music is composed and expressively performed in real-time, based on the detection of affective state in a human listener. Machine learning algorithms will learn: (1) how to use EEG and other biosensors to detect the user's current emotional state; and (2) how to use

algorithmic performance and composition to induce certain affective trajectories. In other words the system will attempt to adapt so that it can – in real-time - turn a certain user from depressed to happy, or from stressed to relaxed, or (if they like horror movies!) from relaxed to fearful.

Once an author had ordered these by preference they were sent the main documentation for their preferred project. For Project 3 it was the project proposal which raised the EPSRC funding, for Project 2 it was the project proposal which was rejected for funding, and for Project 1 it was the informal written article and web page. Authors generate their story pitches based solely on these documents. No fixed timescale was given, authors are told to just write when they were “inspired” to.

Initial Response Overview

Not all four authors have responded at this stage, and the responses are still being collated. Also further authors are joining the Fi-Sci project while these other authors are responding. The project-participant author responses have varied in enthusiasm so far. One author responded enthusiastically to two items, in detail, and without even asking to see the main project documents. Another author responded with a single project preference, the main project document was sent to them and they have not responded at all to this. A final author was sent the project document and said they were finding it a real struggle, but responded with a story idea.

Next Steps

The evaluation of the authors’ responses has already begun including sending the responses out to other scientists who have collaborated with Plymouth on the three projects.

Another batch of professional sci-fi authors have been contacted, as even after an author has joined the project, their enthusiasm of response varies. Once it has been confirmed which of this batch are joining the Fi-Sci project and having received responses from all authors (or confirmed if they have changed their mind about responding), there will be collation of evaluations by the participating scientists and a resulting publishable research report. A large research institute has expressed a strong interest in using the Fi-Sci approach to brainstorm a new batch of research grant proposals for their institute. This would help to provide further data for the utility of the Fi-Sci approach.

Conclusion

A new approach to initiating and developing science projects has been presented. In this approach speculative/science fiction authors are presented with scientific project descriptions at various stages in development and asked to freely develop descriptions for new ideas-based stories, based around the project descriptions. The aim is to examine if such story descriptions can contribute towards the science projects themselves. A number of inspirational links between fiction and science are well documented, however this is the first project which attempts to formalise the inclusion of fiction writers in the scientific process with a relatively fixed approach, and across different types of projects, involving multiple authors.

Appendix

Below are actual responses, received from author 2 (Projects 2 to 4) and author 4 (Project 2). Author 2 addressed two of the three core projects. However, a semi-playful suggestion was also made by the Fi-Sci team that authors may wish to come up with stories about the Fi-Sci project itself, and author 2 responded to this suggestion as well.

Fi-Sci responses to Research Projects proposed by Alexis Kirke

Project 2: Intelligent Multi-agent System Informed by Imitative Communicating Whales

Story Idea by Anita Sullivan (Author 2)

The Nano-bots' Story. A laboratory group of simple nano-bots that are given pre-programmed physical tasks: complete a maze, carry an object from one point to another, open a door etc. They are also able to verbalise using digital sounds derived from whale song. They have 'ears' that sense audio vibrations. After running the experiment continually with the same group, the nano-bots' begin to respond...

- 1) The nano-bots start to develop a basic system of signals (left, right, here, away, up, down). They begin to collaborate on tasks that would be too difficult for one nano-bot to complete alone (e.g. tripping a see-saw, carrying a heavy object, reaching an object that requires them to climb on each other). Conclusion: language doesn't just enable intelligence, it creates it.
- 2) Experimentally, a system is set up where individual nano-bots become randomly separated from the group. The isolated nano-bot 'calls' to the group. The group 'calls' back. Not only that, each nano-bot has its own call-sign. It has given itself a 'name' and has an identity that the group recognises. Conclusion: language creates self and social place.
- 3) Continuing the experiment, the researchers withdraw all tasks from the nano-bots. With nothing to do it is assumed they will stop communicating. In fact what happens is they break into smaller fluid groupings and 'burble'. The communication cannot be about physical actions as the nano-bots have no physical needs and no programmed

tasks. They appear to be ‘just chatting’. But what about? Conclusion: language creates abstract thought.

- 4) In the next experiment, the researchers combine one established group of nano-bots with another. These two groups have applied their sound-systems in different ways: they speak different languages. When first set a task, the two groups cannot collaborate and stay separate. But gradually, through the process of achieving goals, the two groups learn each others’ languages. (They speak more simply and loudly to members of the foreign group!) During rest periods, the nano-bots generally reassemble in their old groups. Conclusion: Language creates division and connection/ group identity.
- 5) In the final experiment, the researchers play synthesised whale song to the nano bots. The nano-bots have an instant and profound reaction. They howl. Do they dislike the music? Are they interpreting the whale song as unhappy? Or has the whale song told them of a world they cannot comprehend, beyond the tasks of the laboratory where creatures think and move freely. Conclusion: language creates imagination... misery and hope.

Project 3: Brain-Computer Interface for Monitoring and Inducing Affective States

Story Idea by Anita Sullivan (Author 2)

Four alternative scenarios:

- 1) **Prisons/ Youth Custody Centre.** Emotional Inducers are used on violent and antisocial prisoners in an attempt to modify behaviour. The EI Headphones seem to work but have some interesting side-effects. Where one prisoner in a section is using them it seems to have a local effect on other prisoners too, suggesting a collective bio-

rhythm where people are closely confined. Most subjects seem to enjoy their altered state and comply with the EI programme happily, but a minority find it disturbing and their stress levels elevate. The story could explore what happens if the EI Headphones are over-used. Are there permanent changes to a person's responses? Is there a rebound effect when the EI headphones are removed?

- 2) **Phobias/ PTS.** Emotional Inducers are used during aversion-therapy work with phobic people and patients with Post Traumatic Stress. The EI headphones initially allow desensitisation. But then the music created by the calm bio-response are used to create a personal EI therapy tape. This can be used to help the patient through phobic situations and stress triggers. For example, a Calm Flight EI product is on the market to help passengers overcome fear of flying. The story could explore what happens if someone uses EI tapes in a moment of genuine danger where a flight-or-flight response would normally be triggered. Does the EI suppress this response? What is the outcome?
- 3) **Hospices.** Emotional Inducers are used to assist patients close to death. Using the EI headphones enables patients to reduce their reliance on pain-management medication and face their final hours in a calmer, more lucid state. It is observed that the music continues for some minutes after respiratory death, while brain function continues. One doctor makes a study of these phenomena. The 'point of death' music for all patients is found to be remarkably similar. Is the music an attempt at communication? Does this have religious significance? Or is it just the way the electrical charges in the brain decay organically?
- 4) **Non-Communicants.** Emotional Inducers are made available to people who cannot use language to communicate. Examples might be people with a learning disability or

physical impairment that means they are unable to speak/ comprehend speech. When they are wearing the EI system, their bio-music can be played to carers allowing them to interpret how the subject is feeling and what they need. The story could explore how a particular subject seems to be able to adjust their body responses in order to use the EI system to communicate. They play bio-music rather than using words.

Project 4: Recursive Response to Fi-Sci Project

Story Idea by Anita Sullivan (Author 2)

‘A Warning to the Curious’.

In the short stories of M R James everyday objects (a whistle, a picture, a snuff-box) develop unnatural and disturbing powers over people, unlocking malevolent forces. The person’s emotional reaction to the object dictates the strength of its power.

In this story, two writers develop Fi-Sci storylines in response to one of the research projects. One writer poses a positive outcome, a positive future. The other tells a story with a negative outcome, offers a warning to the curious: do not meddle with things you don’t fully understand. The researchers read both stories. As a response, their line of research is cautious, kerbed by the warning. The warning becomes a self-fulfilling prophesy and the outcome of the work is perceived to be unsatisfactory, perhaps negative. In fact, one of the researchers finds something deeply malevolent in the work, a reflection of his/ her own fears.

Conclusion: observation changes the observed, prophesy finds a way of fulfilling itself.

Project 2: Intelligent Multi-agent System Informed by Imitative Communicating Whales

Story Idea by Tricia Sullivan (Author 4)

‘The song who swam’

In the posthuman future a sophisticated machine-based social intelligence has developed from humble origins in the transliterated found grammars of whale song. Most human affairs are now controlled by and dependent on the spacefaring Undersystem. Nala is a separable member of this collective, able to slip in and out of individuality. Her personal function involves introducing nonhuman species to the Undersystem, and she has been assigned to resolve a problem with whales.

A group of humpbacks has been engineered for interface with the Undersystem in the expectation that their species can become involved in planetary matters at a decision-making level. But the engineered whales are having difficulty competing ecologically with aboriginal whales, an unexpected result considering the advantages conferred by Undersystem access. One political faction is suggesting that aboriginal whale populations be limited in order to accommodate the engineered whales. Nala wants to avoid this kind of intervention, but she can't rely on the engineered whales to diagnose their own problem because they lack the necessary intellectual sophistication. So she takes a leap of faith. She uses postbiological interface methods to split herself from the Undersystem and embed her own consciousness within an aboriginal whale. She intends only to listen, so she chooses a female host.

Inside the whale's body she realises that the structures which comprise her own Undersystem consciousness have been abstracted from whale song by ripping them away from their physical associations and are therefore devoid of useful content from the whales' point of view. Because the Undersystem's evolution occurred largely through computer systems and (usually visual) machine sensory feedback systems, the Undersystem has little awareness of underwater aural conditions nor of the embodied consciousness of the whales whose songs it borrowed without understanding.

As she begins to learn the aboriginal whales' culture from the inside, Nala discovers that the engineered whales and the aboriginal whales cannot make sense of one another. The song of the engineered whales has been programmed by the Undersystem; although it shares a grammar with aboriginal whalesong, it is ridiculed by the aboriginal whales as nonsensical. Its 'noise' occasions hostility from aboriginal whales who are annoyed by its interference in their business. The engineered whales are thus isolated from the group consciousness of the aboriginal whales, and they are failing to reproduce successfully because they can no longer make use of the song culture that nourishes, informs and brings coherence to groups within the species.

After a time spent as a whale, Nala finds her consciousness being reshaped by her embodiment within the humpback whale. By the time she has mated, given birth to a calf, and nurtured it to maturity, her whole way of thinking and communicating has changed. With the threat of a cull looming, she tries to reconnect to the Undersystem to communicate her findings and urge a change in policy toward the whale program, but she can't articulate what the Undersystem needs to know in terms that it can understand. For its own part, the Undersystem believes she has gone native and lost the plot.

Project 1: Real-Time Hallucination Simulation and Sonification through User-Led Development of an iPad Augmented Reality System

Story Idea by Caroline Riley (Author 1)

What prevents us from passing from this dimension to the next, our resistance to believe or our inability to see? There are those who while still awake can move between these worlds. Some might consider them crazy, others old and senile but they are our link to the next world. After crashing a stolen car Ruth an uneducated young woman lacking in purpose is sentenced to community service at a local nursing home. As part of her induction she is given the

opportunity to try an educational visionary device, programmed to allow the wearer to view the world from the perspective of those suffering different medical disorders. To start with Ruth is uninterested in the home and its residents. However, the situation changes when she meets an elderly lady called Claire who has suffered a stroke. During their conversation Claire reveals that in a waking dream her condition allows her to visit a parallel world similar to our own but she warns, if the cord that connects the spirit to the body is broken you are unable to return.

Ruth tells her deadbeat drug dealing boyfriend about Claire, he laughs and tells her the old woman must be mad. He suggests that if Ruth wants to join her she should take DMT, a drug that can induce a similar dream like state. The next day to Ruth's horror, she discovers Claire in a trance and is unable to wake her. Ruth decides she must try and save Claire; she steals the visionary aid and takes the drug. Much to her surprise she slips into the next world but what she finds is much darker and more sinister than she could have ever imagined.

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