

Micro-Futures

Vic Callaghan¹
Essex University, UK

Abstract. One of humankind's oldest quests has been to find the '*elixir of life*', a mythical potion that would grant the drinker immortality (and preferably, eternal youth!). One of the most famous tales of a search for this fabled tonic was that of the first emperor of a unified China, Qin Shi Huang (246 BC. to 210 BC), who, in the latter part of his life, is said to have become preoccupied with finding this illusive concoction. This article is presented at a workshop that is taking place in the heartland of what was Qin Shi Huang's empire (China), and touches on a modern day search for an *elixir of life*, this time a high-tech approach based on computers and artificial intelligence technology, that goes by the name of '*The Technological Singularity*'. However, as fascinating as a search for an *elixir of life* may be, the real motivation of this paper is to introduce micro-fiction as a methodology for capturing and communicating visions for scientific, business and societal innovations. To those ends, *The Technological Singularity* is described and used as a means to illustrate the workings of micro SciFi-Prototyping (micro-SFPs).

Keywords. Singularity, intelligent environments science-fiction prototyping, futurology, micro-fiction, elixir of life.

The Technological Singularity

In terms of artificial intelligence, the technological singularity can be understood as the moment in time when computer technology enables machines to become more intelligent than people. Clearly, such an occurrence would have profound consequences for humankind as, from a positive viewpoint, people would have powerful analytical tools at their disposal that would hugely benefit society whereas, from a negative perspective, human existence would be threatened by the arrival of a competing greater intelligence! This is a hugely complex issue with many uncertainties regarding the feasibility and timescales for developing such technology, through to arguments about if and how such advanced technology might be constrained to be useful and subservient to people. Apart from discussions about the technology, researchers debate more fundamental questions such as the very nature of consciousness and free-will and whether any of these qualities can emerge from deterministic machines that most current AI is built on. Generally, there are three main ways that people imagine such a technological singularity might be brought to fruition which, broadly speaking, can be characterized as outcomes of *whole brain emulation*, *transhumanism* or an *intelligence explosion* [1]. Brain emulation refers to building an artificial version of the brain (eg a software simulation) that, in cognitive terms, would function like the real brain. Of course this supposes that science will eventually acquire a sufficiently detailed understanding of the brain that is needed to accurately emulate it which, as the primitive state of today's neural computing will testify, has so far eluded science. Transhumanism refers to augmenting (massively) human intellectual and

¹ Corresponding Author: Prof Vic Callaghan, University of Essex, COLCHESTER, Essex CO43SQ, UK; Email: vic@essex.ac.uk

physical capacities by the use of add-on or replacement parts. The drivers for this may come from a medical need (repairing malfunctioning bodies), extending life or enhancing human capability. An intelligence explosion is based on acceleration theories and concerns the ever increasing pace of technological progress. For example, one could imagine a scenario where ever smarter tools make even smarter tools resulting in a cumulative cycle, or intelligence explosion. The vision for such intelligence is that it would be equivalent to human-like intelligence thereby enabling a machine to successfully perform any intellectual task that a human being can do. To distinguish it from current application-specific artificial intelligence, it is more commonly referred to as Artificial General Intelligence (AGI) which is synonymous with what most people understand as the technological singularity.

1.1 Brief history of the technological singularity

From a computing perspective, similar ideas can be traced back to people such as Richard Thornton who in 1847 commented on the potential for the (then) recently invented mechanical calculator and speculated that one day they might “*grind out ideas beyond the ken of mortal mind*” [2]. More recently (1950s) computing pioneers such as Alan Turing spoke of machines outstripping humans intellectually and even taking control [3]. Similarly, in the same decade, John von Neumann was quoted as mentioning a singularity when he said the “*ever accelerating progress of technology and changes in the mode of human life, which gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue*” [4]. A little later (in the 1960s), thinking along similar lines, Irving John Good, (like Turing, a UK mathematician), became the first person to write about an intelligence explosion, where he envisaged computing machines that possessed intelligence slightly greater than ours, recursively augmenting themselves, by way of a sudden surge, to super-intelligence [5]. Later Vernor Steffen Vinge, another mathematician and a science fiction author, popularized the concept via a 1993 article, “*The Coming Technological Singularity: How to Survive in the Post-Human Era*”, which contained the much quoted statement “*Within thirty years, we will have the technological means to create superhuman intelligence. Shortly after, the human era will be ended.*” [6] Vinge’s article built on two earlier Sci-Fi novels he wrote which are also noteworthy as they might be interpreted as a type of early SciFi-Prototype [7]. These stories were roughly contemporary to articles written by Hans Moravec, a computer scientist and futurist who generalized Moore’s law (development speed of integrated circuits) to make predictions about the future where robots evolve into a new artificial species. More recently (2005), Ray Kurzweil published his epic “*The Singularity is Near*” which is a comprehensive and popular account of the issues [8]. According to Kurzweil the singularity will occur around 2045 which is broadly consistent with the views of other experts who seem to place it around 2040 [9].

1.2 The technological singularity and product innovation

Clearly, the Singularity and AGI is all about future technology. In fact, it is so far into the future that most traditional methods of reasoning about it, and the innovations it might bring, are not effective. The most common way of dealing with this problem is to employ expert assessors [9]. However this approach has well-known problems which Armstrong eloquently summarized using a “predictability diagram” (or more

strictly, ‘quality of predictability’), see figure 1. The key message that this diagram tries to convey is that any predictions about the singularity (AGI on this diagram) are unreliable. Perhaps this is not surprising as experts are frequently seen to disagree about issues; law being one well-known arena where experts express extreme (frequently opposite) viewpoints, being engaged by different parties to support their particular views.


Expert Opinion	Past Examples	Scientific Method	Deductive Logic
quality of predictability increasing 			
AGI	historians psychologists sociologists	economist , chemists, physics biologists chemists	Mathematics

Figure 1 Armstrong’s quality of predictability’ diagram [9]

Part of the difficulties that experts face in hypothesizing about the future is the lack of context; they are not present in the future and are frequently forced to take a very narrow perspective. Although, short of visiting the future, it is impossible to create an accurate context, there are some methods that try to complete parts of the wider picture, filling gaps in scientific or social knowledge with micro-fictional elements (informed guesses), clearly identified as such. In this way a mix of science fact and fiction offers an improved (but imperfect) way of reasoning about aspects of technological advances. This article describes one such technique called *science-fiction prototyping* (*Sci-Fi-Prototyping*, *SF-Prototyping*, or *SFP* for short) that was developed by Intel’s futurist Brian David Johnson as a means to innovate new products [10]. In particular, this article explores a compact version of this technique, micro-SFPs, as a simple shorthand for reasoning or communicating about aspects of the singularity. As was noted in the preceding section Vinge, one of the best known proponents of the Singularity, both prototyped and popularized the Singularity concept via science fiction novels such as the 1986 “*Marooned in Realtime*” (a world of rapidly accelerating change that eventually exceeds human comprehension) and the 1992 novel, “*A Fire Upon the Deep*” (the evolution of a super-intelligence with unlimited power via exponentially accelerating development) which has, in turn, motivated this article to combine SFP with the singularity [7].

2. Micro-Fiction

2.1 Sci-Fi Prototyping

Science-fiction Prototyping (SFP) is a product-innovation methodology that uses science-fiction imagery and narratives as a tool to communicate and explore ideas for new products. It works by extrapolating forward in time, directions for R&D (and potential product outcomes) and testing the viability (or attractiveness) of the ideas by couching them in a social context provided by the narrative or imagery. The roots of this methodology can be traced back to an encounter between a rather odd mix of people. It began when the author (Vic Callaghan) invited Brian David Johnson (then Director of Future Casting, Interactions and Experience Research at Intel Labs) to give

an invited talk at IE'07 (<http://www.uni-ulm.de/ie07/>), which he duly did, giving a presentation entitled “*Do Digital Homes Dream of Electric Families?*” - *Architecting Consumer Experience*“. The pivotal conversation happened at a tavern in the beautiful old German town of Ulm where, after a long day at the conference a small group (Brian Johnson, Vic Callaghan, Simon Egerton and Michael Gardner) retired to enjoy a few cool beers and chew over the eternal question of “life, the universe and everything”. The conversation took a few twists and turns eventually touching on everyone’s motivations for entering the world of science. It turned out that, science-fiction had been, and remained, a huge inspiration in the lives of those assembled ranging from writing fiction [11] to teaching and research that was motivated by science-fiction [12] [13]. This conversation led to the development of Science-Fiction Prototyping and the formation of the Creative Science Foundation. From a commercial viewpoint the ideas were motivated by a need to encourage more creating thinking as part of product innovation [14]. As Brian Johnson was working for Intel, their needs were driven by the peculiar product life-styles of integrated circuits which can take between 7-10 years from concept to the factory gate, plus another 15 years of field use. This created a challenge for Intel’s integrated circuit designers to forecast specifications up to 10 years ahead of when they go on sale! Because the future doesn’t exist, it required some element of informed imagination. Johnson observed that scientist and engineers were educated to think in a structured and incremental, way, which had advantages in terms of product continuity but didn’t always catch the movements of a fast changing market where a more imaginative “out of the box” process might be useful. However, describing products that don’t exist or testing the concepts in a meaningful context created huge challenges both in terms of imagination and tools; Science-Fiction Prototyping (SFP) became this tool, providing a language to describe, communicate and test ideas of future products. A more detailed account of this history is given on <http://victor.callaghan.info/history/csf/>.

2.2 Brief History of Micro-fiction

“*For sale: baby shoes, never worn*” is frequently cited as a small novel which, according to science fiction writer Arthur C. Clarke, was written by the American author and journalist, Ernest Miller Hemingway, in the 1950s as part of a dinner party bet that he could write a story in just 6 words! [15] Whatever the truth is, it is clear that writing such ultra-short stories has become a popular style of fictional literature developing in a somewhat ad-hoc, crowd driven way. As a consequence, there aren’t any widely accepted standards for this genre of fiction with lengths varying from 6 to 1000 words and various names being used, such as micro-fiction, nano-fiction, flash-fiction, sudden-fiction or postcard-fiction, to name but some. While it has a modern feel, fitting well with high-tech formats such as mobile phone text messages, it turns out that micro-fiction is neither new nor an exclusively western invention, having historical precedents in Latin-America, Europe and Asia where it has existed for many centuries. For example, there is an obvious relationship between micro-fictions and older fables, parables, anecdotes, sayings, proverbs and maxims that act as small prototypes conveying moral or righteous messages. In terms of other cultures, in Latin-America very short stories are often called *microrrelato* or *ficcione*, in France *nouvelles* and in China, *minute-long* or *smoke-long* stories. In Japan there is a form of very short story called *Haibun* which can be traced back to the seventeenth century, and the more modern version *ketai* fiction that fits in a mobile-phone text message.

Fitting short-stories to modern technology such as phones has certainly reenergised the genre and, as some argue, fits the twenty-first century lifestyles where entertainment and knowledge tends to be consumed in short chunks leading to forms commonly referred to as ‘*mobile-phone fiction*’ (stories of 160 characters) or ‘*Twitter Lit*’ (stories 140 characters) [16].

2.3 *Types of Micro-fiction*

As was noted above, there is no widely agreed specification for a micro-fiction, with different communities setting their own standards. What can be said is that they range in size from 6 to 1000 words with their popularity being (approximately) inverse to the size, peaking at 25-30, words which roughly equates to Twitter or mobile phone formats. For readers interested in looking at short fictions, good examples can be found at *Wired* (6-word) [17], *Espresso Stories* (25 words) [18] and *Creative Science* (30 words, 140 characters) [19]. Given this article is tightly coupled to high-tech thinking, it has adopted Twitter sized fiction for its micro-fictions. Of course, the core thesis of this article is not that micro-fiction can be used to write entertaining stories but, rather, that it can be used as a tool for describing innovative product prototypes by adopting a similar, if shorter, structure to the SFPs described earlier in this article, a form that is labelled micro-SFPs. The methodology used to write micro-SFPs is described in the next section.

2.4 *Constructing Micro-SFPs*

In Johnson’s book he suggests the use of five steps to create an SFP:

1. Selecting the product (or service) and building an imaginative world,
2. Identifying a product (or service) inflection point,
3. Analysing the ramifications of the product (or service) on people,
4. Identifying a human inflection point, and
5. Reflecting on what was learnt.

Johnson wrote the original 5-step guide for scientific product innovation, as he was working in a science and engineering company (Intel) but the above presents a more generic version, since it has since become clear that SFP can be used to explore innovations in other disciplines, such as business [20]. The process was originally intended to be used by practitioners to extrapolate their own work forward in time, to explore how developments might perform in the future. Thus it starts by describing the product or process, then identifies what is different about it, followed by describing the consequences for people, before identifying the impact on the human user, concluding by reflecting on what was learnt; all coached in an engaging story.

Clearly getting all these aspects into a 25-30 word story, needed for Twitter/Text Micro SFPs, is challenging and so the following simplified approach may be useful:

- Start by identifying the technology, process or service,
- Then create a plot.
- Start big, then reduce it to <140 characters

In general Twitter-Text SFPs amount to a sentence or two, totalling 140 characters or less (around 28 words but to allow for hashtags, 25 words is a better target). For product innovation the Micro-SFP needs to focus on some technology (eg machine, gadget, service etc) and the plot should include an action (to illustrate its use), plus characters (pronoun or indirect references are ok) framed in a simple (if partial) narrative, as in any story. The following sections provide a few examples of Micro-SFPs, arranged around a few core singularity themes, together with some background explanatory information.

3.0 Micro-SFPs – A Few Examples

As was explained earlier in the article, the singularity is moment in the future when machine intelligence will surpass human intelligence. The timing and nature of this event are hugely controversial but those with a more optimistic mind, estimate that moment to be somewhere around 2040, whereas those who are more doubting place it 100 or more years away (if ever!). These variances arise not just because of the different views on technological progress, but fundamental questions that challenge the very nature of intelligence, consciousness and the universe. However, while this article acknowledges these controversies, for the sake of illustrating the workings of micro-SFPs it assumes the singularity will happen sometime in the foreseeable future. Moreover, it assumes it will arise from one of the paths favoured by the main singularity proponents [1], using these as themes for the Micro-SFP examples. Thus the following Micro-SFPs are grouped under the headings of ‘*Whole Brain Emulation*’, ‘*Transhumansism*’ and ‘*The Intelligence Explosion*’.

3.1 *Whole Brain Emulation*

Whole brain emulation describes a vision whereby it would be possible to build an artificial version of the brain, such as a software simulation, which should function (cognitively) like the real brain. If this was done at a sufficiently detailed level, the hope would be that a feeling of individuality and self (consciousness) would exist in a form that is indistinguishable to the feelings of the donor. In many senses, dreams might be regarded as a type of simulation [22]. Simulation challenges the certainties of the nature of reality begging questions such as, are we part of simulations or dreams. While the singularity movement is relatively new, such ideas can be traced back to philosophers such as Plato (~423-347 BC, Greece), Descartes (1596-1650, France), Berkeley (1685-1753, Ireland) or to more modern thinkers such as Russell (1872-1970, UK) and Bostrom (contemporary, UK) [21] as well as being the food of science fiction [22] and Hollywood [23]. Quite what it would be like to be such an emulated brain, or the opportunities, would seem to be firmly in the realm of imagination as the following few micro-SFPs seek to illustrate.

1. **Death is optional** - *Dr Xu spoke compassionately to Mei “its terminal but, if you can afford a Resurrection13 scan, we can rebuild Lei & you in SimHeaven”.* (24 words, 132 characters)
 - this micro-SFP imagines two types of technology, a very advanced scanner (the Resurrection13) that is capable of capturing the most detailed workings of

the brain (physical, electrical, chemical and biological) and another advanced virtual-reality technology that can use this to reconstruct simulations of people that are indistinguishable from their original self. Of course, it also assumes a convincing simulation of wider environments which may or may not be like that of their current life, in fact they may be more like descriptions of heaven (which would be acceptable to many). In addition it raises the issue of cost; those with money can become immortal, those without die!

2. **Make Up** – *Amy, you look and sound dazzling, Ben will fall in love instantly; yeh, amazing what PersonaShop3 can do for a girl!* (21 words, 115 characters)
 - This micro-SFP imagines that either a fully simulated world has been built, or that blended reality is in widespread use (eg more advanced versions of Google glasses) [24]. Furthermore it assumes that the people in these worlds are completely aware of the virtual aspects of their world. In such worlds a whole range of new affordances become possible, many of which would seem like magic in our world which the SFP assumes people would use (perhaps in partial compensation for loss of their real existence!). To those ends, it describes a new type of ‘make-up’ set, PersonaShop3, which allows the user to alter aspects of their own physical appearance and persona.
3. **Existence** – *Zoe, you’ve been my life-long friend on SentiBook; today the news feed reports most social network friends don’t exits, are you real?* (22 words, 133 characters)
 - Our lives are becoming increasing virtualised through, for example, friendships via social networks with people we might never have met physically. As we approach the singularity AI will improve the ability of machines to mimic real people, enhancing, the susceptibility of people to form relationships with intelligent agents masquerading as people, either openly or surreptitiously. Such topics have been popularised by films such as “Harvey” and “Her” plus children’s toys such as the as *Tamagotchi* [25].

3.2 Transhumanism

In simplistic terms, Transhumanism refers to the use of science to artificially augment human intellectual and physical capacities in some massive way. This could happen, say, through genetic engineering or add-on/replacement artificial parts. There might be various motivations for doing this such as medical needs (repairing malfunctioning bodies), extending life or enhancing human capability. The hope is that human beings might eventually transform themselves into beings with greatly expanded abilities that are significantly different to our current condition, justifying a new label such as “posthuman” or Humanity+ (H+). As always SciFi has been quick to focus on some of the extremities of these visions such as the famed Daleks or Cybermen from Dr Who. In another sense, transhumanism (and whole brain simulation) can be seen as a quest for immortality that can be traced back to the earliest written history. For example, the first emperor of a unified China, Qin Shi Huang (246 B.C. to 210 B.C) spent the latter part of his life seeking the ‘*elixir of life*’. Ironically, although he never discovered a means to extend his life, he did achieve a type of immortality through his effects on China’s political and social system, plus his

renowned terracotta army! The following are 3 examples of micro-SFPs that adopt a transhumanism theme.

1. Smart Friends – *So, old friend, you finally replaced your wet-brain with a FreeWill3 quantum unit; yeh, & I'm replacing old friends with smarter ones!* (22 words, 134 characters)

– This micro-SFP introduces the idea that free-will is an important characteristic of people and that it might need a different type of computing. For instance physicists such as Eugene Wigner, have argued there may be quantum processes in the brain, which might be linked to the elusive understanding of consciousness and free-will, thus this micro-SFP speculates on this by including a FreeWill3 quantum unit [26]. Whatever it's clear that in terms of creating Cyborgs, the maintenance of a conscious self, as part of any brain replacement would be a momentous achievement. The story also raises the issue of whether augmenting the body and mind may lead to less stable social relationships

2. Clone World – *Tom, this morning mend the cooker, take the kids to playland & go to work. Yes, dear we will do that!* (21 words, 101 characters)

– This micro-SFP raises the intriguing possibility that, when it becomes possible replace all the parts in a human, it will be possible to clone entire people (or cyborgs). In this story there are at least 3 clones of John (the three simultaneous jobs he is doing), hence he can complete at least three times the amount of work (three people in the same god!). Where would this stop, would there be a pressure on individuals to create ever more clones of themselves? How would those clones be managed and how (and would) their experiences to integrated to maintain a single super-person and experience. The social as well as technical ramifications are intriguing.

3. Upgrade - *Max read the side-effects warning on the mental-arithmetic upgrade nanobot-pills; "some users report reduced emotional behaviour"* (16 words, 129 characters)

We are all finely balanced systems with a risk that if change one part of our physical or mental make-up, it will have side-effects on other aspects of our being. As cosmetic surgery has proved to-date, once it becomes possible to enhance our bodies by artificial means, there will be a significant demand for such services. Who wouldn't want to have better memory, improved sensory perception, more knowledge and improved analytical ability? However, how will such changes affect our lives and wider society? How will such augmentation be supplied and regulated. This micro-fiction seeks to prototype the idea that this might be done as simply as taking nanobot pills which could alter our brain characteristics in both performance and character [27].

3.3 The Intelligence Explosion

The intelligence explosion describes a cumulative cycle where ever smarter tools (perhaps robots) make even smarter tools (perhaps other robots) resulting in an intelligence explosion (a rapid acceleration of machine intelligence) [28]. In control theory this would be equivalent to a closed-loop system with positive feedback which,

when implemented as an audio system (eg microphone, amplifier and speakers) manifests itself as a sudden intense amplification of sounds, akin to a sound explosion (howls and whistles that you may have heard at rock or pop concerts!). Proponents of the intelligence explosion theory argue that this would be a relatively sudden transition (perhaps a small number of robot development life cycles over just a few years) that would critically alter the balance of man versus machine. Most so-called explosions are the result of self-fueled, but resource-constrained, processes that characterize the nature of the explosion (period, intensity etc). Most calculations to-date make assumptions that the basic ingredients of human intelligence are already known and it's a matter of development, rather than fundamental discovery, which allows extrapolations of current technological progress to be used as estimates of such an intelligence explosion. Should there be some missing key mechanisms involved in the fabrication of human-like intelligence, then such calculations become more uncertain but not impossible. A general awareness of the possibility of such an intelligent explosion is gradually leaking into the public domain through luminaries, such as the renowned UK theoretical physicist Stephen Hawking's, speaking out on the dangers of sleep walking into an era where human intelligence and superiority is overtaken by machines [29]. The following micro-SFPs explore this issue from various perspectives.

1. **Viral Intelligence** – *Jane's sleepy eyes said it all, another smart home with a viral-intelligence infection, call the singularity exorcists!* (17 words, 119 characters)

- This micro-SFP picks up on a number of ideas. First that smart homes are susceptible to viruses, second that those infections might concern the controlling soft-agents and third that that soft-intelligence (agents) might migrate, grow and mutate; continuously evolving, competing and engaging in a remorseless struggle for existence as it moves around networks of intelligent environments, a problem that might increase as these intelligences pass the singularity and take on a form of evolving sentient ghost-like presences (possibly displaying combinations of benevolent, mischievous or malicious behaviour as found in people). The key message from this micro-SFP is that viruses are already problems for computer systems, but may get considerably worse when they become super-intelligent viral agents!

2. **Collective Consciousness** – *Silently Zac prayed for inspiration; thanks to his SentiNet brain implant from the 7th Day Evangelists his prayers were soon answered.* (21 words, 134 characters)

- This micro-SFP raises the possibility for brain interfaces or implants becoming commonplace commodities. It also alludes to a higher form of post-internet sentient network comprising groups (political, hobbyist, religious, commercial etc) of natural (people) and artificial agents connected to create a type of crowd sourced super-intelligence. Connected consciousness can be traced to ideas of shared values or beliefs espoused by French social theorist Émile Durkheim (1858–1917) and subconscious communication via natural (but as yet unknown) means [30]. This micro-SFP differs to these as it speculates about whether accelerating technology development might eventually facilitate an artificial form of connected consciousness that is analogous to telepathy.

3. **Upgrade** – *Sentinet is down again! Be warned wise reader, the Singularity will be preceded by an unprecedented torrent of upgrades!* (19 words, 121 characters)

- This micro-SFP makes a literal interpretation of the intelligence explosion; seeing it as a rapid cycle of improvements (upgrades) signalling the onset of a massive intelligence explosion. In doing this it questions, implicitly, how will the singularity happen, what might be the signs, could it spontaneously emerge, will it happen on an isolated system, can it be contained, or would it escape like a virus into the wider world? Popular fiction imagines it as involving humanoid-like robots but it might equally (or more likely) happen on systems with powerful computing, vast knowledge bases and a real need for AI (as hinted at by the use of the term ‘*Sentinet*’). In our current environment, advanced search engines, such as Google are likely candidates [31] as are, of course, the military who will perceive super-intelligence as a potential strategic weapon, akin to nuclear technology, so they will likely have a hidden hand in its development. One can only speculate about these issues and, for all our sakes, think them through from the relative safety and comfort of our pre-singularity world.

4. Conclusion

This article has sought to introduce the micro-SFP as a quick and simple tool to capture and communicate ideas about the future. In doing this it described one topical area of radical thinking, *The Technological Singularity*, a topic that provides rich pickings for product innovation. The article described the micro-SFP methodology, illustrating the concepts based on nine examples of micro-SFPs relating to areas *whole brain emulation*, *transhumanism* and the *intelligence explosion*. Such short micro-fictions are challenging to write as there are not many words available to convey a plot or describe the technology. As mentioned in the introduction, the number of words is not fixed and varies between writing groups. In the case of this article, it has focused on micro-fictions that are compatible with Twitter or phone texts, which led to the limitation of 140 characters or around 25 words. Micro-fictions have the merit of focusing the writers mind on the most essential elements. However, from a product prototyping perspective (rather than a story) it is difficult to say what the ideal length for such a micro-fiction should be although, based on the experience in writing micro-SFPs for this article, it may be closer to 100 words as that is equivalent to the aggregation of the micro-SFP (25 words) and the explanations (a further ~80 words) used in the examples above. Of course, the micro-SFP examples were not presented as instances of good literature, nor as innovative ideas, rather they were simply provided to illustrate the concepts underpinning micro-SFPs and to provoke discussion about their usefulness in supporting product innovation activities. In that respect I hope this article proves useful and interesting.

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References

- [1] Amnon H. Eden, James H Moor, Johnny H Soraker, “*Singularity Hypotheses: A Scientific and Philosophical Assessment*” (The Frontiers Collection), Springer, April 2013, 452 pages ISBN-13: 978-3642325595
- [2] Richard Thornton, (1847), *The Expounder of Primitive Christianity* 4, Ann Arbor, Michigan, p281
- [3] Alan Turing, *Intelligent Machinery, A Heretical Theory*, 1951, reprinted Philosophia Mathematica (1996) 4(3): 256–260
- [4] Stanislaw Ulam, (May 1958). *Tribute to John von Neumann*. 64, #3, part 2. Bulletin of the American Mathematical Society. p5
- [5] Irving John Good, (1965), *The scientist speculates: An anthology of partly-baked ideas*, Capricorn Books
- [6] Vernor Vinge, "The Coming Technological Singularity: How to Survive in the Post-Human Era", originally in *Vision-21: Interdisciplinary Science and Engineering in the Era of Cyberspace*, G. A. Landis, ed., NASA Publication CP-10129, pp. 11–22, 1993
- [7] Vernor Vinge., “*The Collected Stories of Vernor Vinge*”, Souvenir Press Ltd (27 Mar 2008), 0285638211
- [8] Ray Kurzweil, “*The Singularity is Near*”, Penguin Group, 2005
- [9] Stuart Armstrong, "How We're Predicting AI", (presentation) Singularity summit 2012
- [10] Brian David Johnson, “*Science Fiction Prototyping: Designing the Future with Science Fiction*”, Morgan & Claypool Publishers; 1 edition (April 20, 2011), ISBN-13: 978-1608456550
- [11] Brian David Johnson, “*Fake Plastic Love*”, 172 pages, Pub iUniverse, Inc. (July 10, 2007), ISBN-13: 978-0595430611
- [12] Vic Callaghan, Paul Chernett, David Lyons, “*The Brooker Laboratory for Intelligent Embedded Systems*“, in *Improving the Quality of Teaching and Learning in Computing*, SEDA, July 95, pp11-25
- [13] Vic Callaghan, Graham Clarke, Jeannette Chin, “*Some Socio-Technical Aspects Of Intelligent Buildings and Pervasive Computing Research*“. In *Intelligent Buildings International Journal*, Earthscan Journals, Vol 1 No 1, Jan 2009, ISSN 1750-8975.
- [14] Brian David Johnson, “*An Introduction to SF Prototyping*”, Creative Science 2014 (CS'10) Kuala Lumpur, Malaysia. 19th of July 2010
- [15] Ernest Hemingway micro-fiction
http://en.wikipedia.org/wiki/For_sale:_baby_shoes,_never_worn
- [16] Shumei Zhang, Vic Callaghan, “*Using Science-fiction Prototyping as a Means to Motivate Learning of STEM Topics and Foreign Languages*”, Intelligent Environments 2014, Shanghai China 2-3 July 2014
- [17] Wired, “*Very Short Stories* (over fifty 6-word stories), Issue14.11 - November 2006.
<http://www.wired.com/wired/archive/14.11/sixwords.html> (accessed 13.3.14)
- [18] Chris Worth, R.P. Bird, “*Espresso Stories*” invites, reviews and hosts Micro-Fiction of 25 words or less. This site has hundreds of micro-fictions organised by genre and author, <http://espressostories.com/>. In addition, this site has a useful set of writing guidelines, see; http://espressostories.com/story_writing_tips.php (accessed 13.3.14)
- [19] Creative Science micro-SFPs <http://www.creative-science.org/activities/microsfp/>
- [20] Futures (Special issues Exploring Future Business Visions Using Creative Fictional Prototypes), Volume 50, June 2013.
<http://www.sciencedirect.com/science/journal/00163287/50>
- [21] Nick Bostrom, 2003, “*Are You Living in a Computer Simulation?*”, *Philosophical Quarterly* (2003), Vol. 53, No. 211, pp. 243–255
- [22] Vic Callaghan, “*The Dream Machine*”, *Creative Science 2013 CS'13*, King’s College London, 29th November 2013
- [23] The Thirteenth Floor - <http://www.imdb.com/title/tt0139809/>

- [24] Graham Clarke and Malcolm Lear, “*We all wear dark glasses now*”, 1st International Workshop, Creative Science 2014 (CS'10), Kuala Lumpur, Malaysia, 19th of July 2010
- [25] Tamagotchi handheld digital pet, <http://en.wikipedia.org/wiki/Tamagotchi>
- [26] The Quantum Mind http://en.wikipedia.org/wiki/Quantum_mind
- [27] Vic Callaghan, “*The Maker Fables*”, in ‘The Outer Limits’ a hosted in the Cloud of Things (CoT'13), Athens, Greece, 16-17 July 2013
- [28] David Chalmers “The Singularity: A Philosophical Analysis”, in the “*Singularity Hypotheses: A Scientific and Philosophical Assessment*” (The Frontiers Collection), Springer, April 2013, 452 pages ISBN-13: 978-3642325595
- [29] Stephen Hawking, Max Tegmark, Stuart Russell, Frank Wilczek, “*Transcending Complacency on Superintelligent Machines*”, Huffington Post, 19th April 2014
http://www.huffingtonpost.com/stephen-hawking/artificial-intelligence_b_5174265.html
- [30] Global Consciousness Project http://en.wikipedia.org/wiki/Global_Consciousness_Project
- [31] Google and the World Brain, <http://www.imdb.com/title/tt2551516/>