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The Strategic Prototype "Crime-sourcing" and the Science/Science Fiction behind it

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Abstract.

The function of science fiction prototyping (SFP) is to communicate complex science ideas and their projections to a lay audience, provoking thought and informed discussion on the science. Fictional prototyping is a recent spin-off of science fiction, directly inspired by 'hard' science fiction writing and more recently many of the imagined worlds of writers like Bruce Sterling, William Gibson, J.G. Ballard and others. Prototypes set out to do many of the same things as SF does, but in a more concrete way, by introducing real physical objects or real sets of rules and scenarios which require the participation (direct or indirect, voluntary or involuntary) of users. Crowdsourcing systems have the ability to gather large amount of data, resources and even funds. Additionally, crowdsourcing enables criminal investigators to collect data from populations and demographics that they may not previously have had access to. "Crime-sourcing" is a prototype designed to explore futuristic crowdsourcing ideas. Its purpose is to provide a fictional scenario that speculates how crowdsourcing could be blended with future technology to develop a "crime-to-conviction" model. This scenario takes the cyber-space concept of crowd-sourcing and then transfers it to a hybrid cyber/physical business model context. The story aligns itself with Zuckerman's doctrine that while there is human tendency to "flock together" in crowds, most of our social ties online or off, are only with a small set of people with whom we have much in common. The contribution of this paper to crowdsourcing theory and the challenges that need to be overcome if prototyping is to become an established foresight methodology are considered in the conclusion.

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Keywords

Crowdsourcing, Technological Forecasting, Social Change, Crime-Sourcing, Business models, Big Data.

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1. Introduction

Predicting distant futures is always problematic as unforeseen disruptions can come along and dramatically change the technological and innovation landscape. Linear, rational forecasting techniques for instance, failed to identify the dramatic rise of cell phones or social media [8]. Fictional prototyping seeks to complement such techniques by exploring a series of alternative futures through the techniques of fiction and drama. The technique prototypes objects and devices being currently developed in the "real world" to see how they might be utilised or how people might respond to new designs, tools or scenarios [1][2].

Fictional prototyping attempts to reveal something about the future, however the users of any prototype or piece of speculative design are the users of today, not tomorrow, so the developer's assumptions and conventions are those of the present [1]. This is a difficult challenge, and one that even the greatest SF writers have struggled with. How can you imagine characters whose attitudes and emotions are being shaped in an entirely different social and technological environment?

In *A Scanner Darkly*, Philip K Dick describes a future world in which Los Angeles and its wider conurbation have expanded to take up much of California, in which police agents are able to use special camouflage suits to disguise their identities, and in which "mega corporations" create new and highly toxic drugs. In many ways it's a plausible scenario. But the characters in *A Scanner Darkly*, through their speech, their attitudes and their behaviour, are drawn from a very recognisable 1960s counter-culture. The book is an often cited masterpiece for all sorts of reasons, one of which is the very accuracy with which the author

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depicts that particular community [12]. But what even Dick can't do is give us characters from the future. Instead what he creates is a parallel universe in which characters that we instantly recognise and empathise with are pitched into a scenario and a location that is unfamiliar.

The focus of our prototype 'Crime-sourcing' is *Murder Hunt* a crowdsourcing site that aims to provide clear information about homicides and the tools necessary to record, report and then go about capturing the murderer. It is an imaginative prototype based upon facts with the purpose of discovering a new innovative path and investigates possibilities that we would not have imagined if we hadn't presented them in a fictional setting [2]. The purpose of this paper therefore is to 'test' the future, to see what future technologies or crowdsourcing systems might work, and how they might be received and what their impact might be.

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In the next section we review the distinction between 'hard' and 'soft' SF, before critically interrogating its association with fictional prototyping. Section three evaluates the procedural challenges of the prototyping methodology. In Section four we present the creative prototype 'Crime-sourcing'. Finally, in the conclusion we analyse both the contribution of this technique to crowdsourcing theory and the implications for establishing prototyping as a forecasting methodology.

2. Literature Review: Establishing links between SF and fictional prototyping

Figure 1 presents the science fiction constructs underpinning prototype development. In the late 1960's an entire sub-genre of science fiction sprang up around writers that aligned themselves closely with the "hard sciences" (e.g. computer science, astronomy, physics,

chemistry). 'Hard' SF writers [17][18][19][20] ground their work in the cutting edge of science and technology (albeit with varying degrees of artistic license). American science

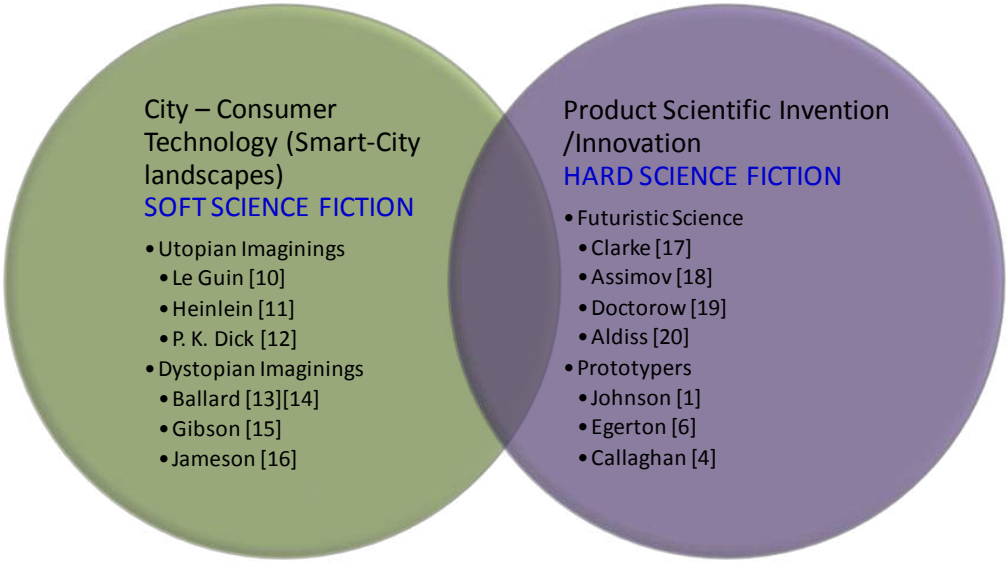

Figure 1 Science fiction literature constructs underpinning prototype development

fiction author Wysocki [9] defines this as follows: "Hard SF is the form of imaginative[1] literature that uses either established or carefully extrapolated science as its backbone." Many critics [7] see hard SF as the only true science fiction because it is based on real science as opposed to "soft SF", which is based on the 'soft' sciences, and in particular, the social sciences (anthropology, sociology, psychology, political science) [16]. For instance, Ursula Le Guin's work often depicts futuristic or imaginary alternative worlds in politics, natural environment, gender, religion, sexuality and ethnography with no direct link to scientific speculation [29][30].

Fictional prototyping is a recent spin-off of the 'hard' science fiction genre but which has more recently evolved to incorporate the imagined 'soft' science worlds of writers like Bruce

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[1] p. 9.

Sterling, William Gibson, J.G. Ballard and others. Prototypes set out to do many of the same things as SF does, but in a more concrete way, by introducing real physical objects or real sets of rules and scenarios which require the participation (direct or indirect, voluntary or involuntary) of users, beyond just their emotional and intellectual engagement.

In this way fictional prototyping can 'test' objects or tools or storylines. Science Fiction has (in general) been a fixed text until very recently, and though while readers have enjoyed many different readings and interpretations, the author has not been able to adapt or react to their responses. Fictional prototyping further allows the inventor or storytellers, to adapt scenario's as they evolve and as the users or participants give their reactions. However the design of a prototype is challenging as they require the developer to be both a scientific and technological expert and also to be able to write compelling fiction.

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3. Emerging methodology of Science fiction prototyping

3.1 Theoretical underpinning

Experimentation as a form of problem-solving is fundamental to business model innovation [3][5][12], it consists of trial and error directed by a critical amount of insight as to the direction in which a solution might lie. According to Leonard-Barton [32] experimentation generates new kinds of organizational capabilities. The fictional prototype uses imaginative narratives based explicitly on science fact as a design tool in the development of future technology trajectories [5]. This emerging methodology largely focuses on the social, economic and ethical influences of future technology. Prototypes can be taken as indicators of design paths in the on-going search process of an industry [33].

3.2 Procedural complexity

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This diagram below presents some of the invisible entities that surround the prototyping framework contributing to its procedural complexity (refer to Figure 2).

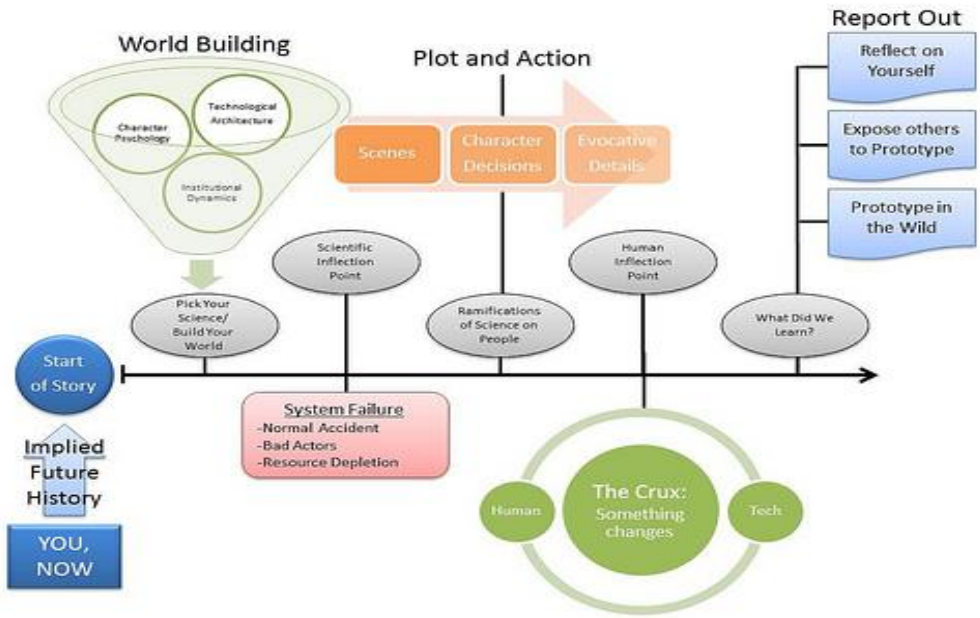

Figure 2 The procedural complexity of science fiction prototyping
Adapted from Emerge [34, p. 1].

People are narrative thinkers; they naturally organize their world into stories, and understand when a story makes sense, and when it does not [1]. By combining realistic characters and social milieus with novel technology, science fiction can engage multiple ways of thinking, and draw out underlying values and sites of conflict and confusion. However the envisioning process is complex and depends on the information you have access to: what you know about science and technology, your own life experiences and beliefs, and any related materials provided by the SF community. Pitching and dialog are definitely learned skills, and

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different people have very different levels of aptitude at them. For instance, it is a difficult technical skill to express and write a concise short story [4][6].

The ability of the developer ultimately relies on tacit knowledge about science, technology, people, institutions, narrative structures, the creative process, and proper presenting and critiquing skills. The problem with relying on tactic knowledge for foresight is that your visions are going to be infected with unexamined biases, and may confirm what you want to know rather than challenge and transform your vision of the future [2]. The main check against such bias is the scientific expertise of the other participants (for instance, reviewers, colleagues, co-authors and science fiction writers) involved in the prototype development process who can check the validity of the original scientific principles under examination.

4. The "Crime-sourcing" Prototype

4.1 The Science behind the SFP "Crime-sourcing"

Jeff Howe, coined the term 'crowdsourcing', in 2005, after conversations about how businesses were using the Internet to outsource work to individuals. Howe and Robinson referred to the phenomenon as like "outsourcing to the crowd," which quickly led to the term 'crowdsourcing.' Howe first published a definition for the term 'crowdsourcing' in a companion blog post to his June 2006 *Wired* magazine article, *The Rise of Crowdsourcing*, which came out in print just days later:

> *Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but it is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential labourers* [21].

There are a number of motivations for businesses and non-profit organizations to use crowdsourcing to accomplish tasks, find solutions for problems, gather information or even raise finance [35]. These include the ability to offload peak demand, access cheap labour and information, generate better results, access a wider array of talent than might be present in one organization, and undertake problems that would have been too difficult to solve internally. Crowdsourcing allows businesses to submit problems on which contributors can work, such as problems in science, manufacturing, biotech, and medicine, with monetary rewards for successful solutions. Although it can be difficult to crowdsource complicated tasks, simple work tasks can be crowd-sourced cheaply and effectively [21].

Researchers have used crowdsourcing systems, in particular Mechanical Turk, to aid with their research projects by crowdsourcing: data collection, parsing, and evaluation [35]. Notable examples include using the crowd to create speech and language databases, and using the crowd to conduct user studies. Crowdsourcing systems provide these researchers with the ability to gather large amount of data. Additionally, through using crowdsourcing, researchers can collect data from populations and demographics they may not have had access to locally, but which can then improve the validity and value of their work.

The increasing application by firms of crowdsourcing is changing the traditional conception of "business as usual" in a wide variety of industries. In a noted example, Don Tapscott, in his book *Wikinomics* [22], described how one Canadian gold mining company facing a looming shutdown desperately turned to the general public to help solve a critical business problem. The firm, Goldcorp, was so frustrated with the inability of its own geologists to locate any gold that it did something unheard of at the time: it offered $500,000 to anyone who could find and map the location of the company's own gold in its own mines.

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We live in an age of connection, one that is accelerated by the Internet. This increasingly ubiquitous, immensely powerful technology often leads us to assume that as the number of people online grows, it inevitably leads to a smaller, more cosmopolitan world. Despite the rapidly growing body of work on crowdsourcing, there is still little research on the nature and strength of social relational ties between crowd members. However some initial exploratory research by MIT Media Lab's Ethan Zuckerman (in his book *Rewire*) suggests that:

> *Although we have a human tendency to 'flock together' in crowds, most of our interactions, online or off, are really only with a small set of people with whom we have most in common* [36].

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4.2 Crowdsourcing applied to crime solving

While crowd-sourcing has allowed organized crime groups to commit more crimes with less risk, law enforcement officials are now leveraging the power of crowdsourcing to fight crime as well [31]. The New York Police Departmemt (NYPD) has already launched a social media unit to track criminals on Facebook and Twitter. More recently, in 2011 as the streets of the UK burned in the aftermath of violent protests, citizens of London banded together online to identify looters [23].

In one of the most impressive uses of "investigation-sourcing" to date, the Canadian public came together to identify the thousands of protesters who caused millions of dollars of damage as a result of the Vancouver Canucks losing the NHL championship in June 2011. Using a variety of image processing techniques, the firm Gigapixel was able to assemble 216 publicly submitted photographs and assemble them into one seamless high-resolution image. The phenomenal resolution of the resultant picture allowed the faces of tens of thousands of riot participants to be viewed in high resolution [24]. The identification of more than 10,000 participants by name was completed by tagging individuals in Facebook, breaking a record

for the number of tags in a given image to date. Many of those identified in the photos have now been successfully arrested and prosecuted by Canadian authorities.

The use of crowdsourcing and citizen science is also an issue of national importance with regards to the management of 'big data'. Herodotou *et al.,* [25] highlights:

> *… timely and cost-effective analytics over 'Big Data' has emerged as a key ingredient for success in many businesses, scientific and engineering disciplines, and government endeavours. Web search engines and social networks capture and analyze every user action on their sites to improve site design, spam and fraud detection, and advertising opportunities.*[1]

4.3 SFP: Crime-sourcing

The primary focus of this story is to extend the cyberspace 'crowdsourcing' concept to encompass future technology dimensions in a fictional setting. Underpinning the story is the concept of a high volume, big data-driven "crime-to-conviction" model. In the model participants input large volumes of micro-data directly into an intelligence feed which then guides the progress of a half human/machine ('heptapod') tracking the suspect. When the crowds detect the presence of a murder suspect in the 'border' transitional zone of San Diego a 'Heptapod'[2] is sent to investigate and achieve closure within 24 hours.

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Crete 2030: Ambushed

Cilia, the angelic face of the village of Vilandredou near to the seaport town of Rethymnon filled his soul. Nikos squinted repeatedly in the relentless sun as he sauntered aimlessly along the cracked and chipped eroded old road in empathy with the rugged surrounding terrain and cutting vistas.

[1] Ibid., p. 1.

[2] The heptapods are a fictional human/machine 'hybrid' race which first featured in Ted Chiang's short story *Story of Your Life* [26]

The dazzling glare of a blade flashed before his eyes. As the knife punctured him he felt his chest implode inwards. Darkness turned into white light. He fell to his knees. Life poured out of him. But the angelic image of Cilia remained with him.

* * *

San Diego 2050

Jacque Levafre had arrived in the smart city zone of San Diego four hours ago. Levafre was the lead player of *Murder Hunt* a digital driven crowd of elite investigators. Lefavre climbed slowly up the steep hillside scrambling amongst the rocks, dodging thorn bushes, lizards and the occasional snake, in the towering shadows of the magnificent redwoods.

When he finally reached the old ruins of the Presido, screams and shouts of the gathered crowd disturbed the tranquillity of the historic Californian setting. They were chanting the name of 'Carol' 'Carol.'

For Jacque, final conviction was demanded within 24 hours by the crowd. He knew the crowd wouldn't renew his credit and they would replace him with another player if the hunt ran into extra time. Every image had been recorded by the optic portals of his data transmitting sunglasses.

* * *

Chi'ing - one month earlier

Jacque felt the vibration of his 'holo-receiver' in the inside pocket of his long black leather jacket. The image it projected was that of a lean, tall man. As the image became clearer the rugged but still handsome features of the sun beaten face startled him. What caught his eye was the similarity to his father. But then he noted subtle differences. This man had a more

pointed nose and smaller eyes. His father was always impeccably dressed. While this man wore a dusty windbreaker and a battered, wide brimmed hat that concealed part of his face.

'Jacque, its Chi'ing.'

Chi'ing had risen quickly from a junior operative in chameleon detection to now being the Chief investigator of *Murder Hunt*.

'An old lady refugee from Vilandredou, filed some holographic imagery data into your file this morning. AI established a full bio-DNA profile match with Carol X! Sensors detected her in the gaslight district. Close the report on her.'

After a slight hesitation he continued, 'stop messing around Jacque, close the case, that's an order.'

Jacque nodded with a wry smile. Known for his ruthless super-efficiency Jacque had been uncharacteristic and hesitant on closing this "crime-to-conviction" cycle. He had fourteen hours before he'd be replaced. Chiing would also be worrying about the lead time averages.

The capture of Carol X would put the agency right at the top of the rankings of the charitable convictions index. After the death of her father the notorious Stelios, the killer of Nikos, Carol was believed to head up the global underworld syndicate, the Camorra. But the poor loved her for the resources she had given them, including: the hospitals, medical care and the dental treatment. The city-set had long cast the poor to one side. In the darkness that surrounded him, he could smell the wind carrying the earth's resurgence and he looked across a sky with stars so huge and bright he felt he was home in Crete.

* * *

Seventeen hours had passed when Carol X was intercepted by Jacque on her regular 7 am walk through the dense redwood forest next to the savage enclave of Trailer City. It would only be a matter of time he thought until closure. His glacial thoughts were on crime closure. But as he walked with Carol he began to feel his stomach turn and he felt embarrassed. He felt different to all his previous cases. He had fought against hardened killing machines, murderers and enforcers/hit men, the toughest of the tough but he had never failed to reach closure. This was harder. Her beauty and kindness to the poor had transfixed him. Physically this was the weakest case of the lot, but psychologically the hardest for him to implement. Then he thought of his father and his human heart froze a little. With an awe and nervousness unlike any feeling he had ever experienced before, he was struggling to control his respect for her. They continued to talk of her work in the war project zones around San Diego, and her colony for the lepers escaping the outbreak of leprosy in Mexico.

They stared at each other. 'I researched your crowd profile before you came to interview me. You're human mother is from Crete?'

'Yes, she's from Crete,' replied Jacque.

'Have you ever visited the island?'

'No, never,' said Jacque curious as to where the conversation was heading.

'Jacque lets end this in Vilandredou,' she said closing the conversation and held out both her arms towards him. The laser cuffs gripping them tightly.

* * *

The high speed train arrived in Vilandredou just before noon. There was a big crowd waiting in harbour square. Jacque had turned off his tracker in San Diego. The first time he'd done so since beginning his employment at Murder Hunt. As the train stopped he climbed down the

steps onto the single station platform. A piercing glimpse of white light flashed straight into his eyes, temporarily blinding him. He could hear the chimes of the village square clock, one, two, three …. ten, eleven.. He traced the source of the light to balcony of the once regal Albert Premier hotel. There was a mysterious old lady pointing towards him. Jacque felt weak and tired, he rubbed his eyes. He turned towards Carol momentarily smiling. He released her laser-cuffs before looking back towards the balcony. There he saw the angelic face of Cilia.

5. Conclusion and implications for future research

This prototype extends crowd-sourcing theory to a futuristic "crime-to-conviction" model. We have contributed to theory by suggesting that there is a need to explore more closely the emotional and relationship nature, of the individual ties linking crowds together. For instance, the utility for the crowd at an aggregated level in this case is the prosecution of criminals. But the model's sustainability is being driven by the time efficiency of crime detection. The prototype has been designed to speculate on the social and economic consequences of taking cyber-space concepts on the internet and transferring them into real-life actions through future technology.

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Moving away from the science and economics we have tried to introduce an emotional element in the story. This was largely inspired by the controversial and exploratory doctrine of MIT's Ethan Zuckerman which suggests that even though people flock together in large connected crowds they really only have two or three strong emotional ties. The social connection between Jacque and Carol was presented as being infinitely stronger than his professional ties with the crowd. As Jacque is partly a machine, we also drew inspiration from the idea of singularity and the notion of machines being at an intellectual level that they are able to think and make intelligent decisions as if they were humans [27][28].

The appeal of crowdsourcing for models of crime searching is that it is an open system and it allows everyone to have a voice and feel that they can make a form of an 'open' contribution to the tracking and arrest of murderers. For instance, the success of Homicide Watch in the US provides some evidence for ordinary people wishing to participate with technology, if they see how that technology can lead to social benefits for themselves and the families of victims.

This emerging methodology seeks to break new ground for technological forecasters in our understanding of the rich and varied multi-disciplinary dimensions of innovation [32] [33]. It does not have the largely implicit biases toward certain kinds of "value knowledge" and "rational outcomes" of more traditional foresight methods which have failed to deal with major uncertainties, for instance the rise of cell phones, tablets and social media in politics.

Science fiction prototyping is definitely useful, but there are still many questions which need answering through further research before it becomes fully trusted as a foresight methodology. Some questions are procedural: What is the best preparation before going into the prototyping process? How should information and questions be framed so that non-practitioners find it productive? How can you train people to pitch and critique ideas more effectively? Is there a way to develop the prototype that is faster than writing a whole story around it? How can the constructive process of dialog continue throughout the development cycle? How can individual communicate a prototype to a group in an impactful way?

Other questions are related to the core concepts of science-fiction prototyping, and are harder to resolve: What is the proper way to develop the technology through the course of the story, is it a character, a prop, or something else? How does an author recognize their biases and

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blind spots? How can science-fiction prototyping be used to prompt reflexive deliberation on the future? What does the dialog involved in prototyping imply for the authorship of the work, and the origins of its ideas? Does one need to make science fiction prototypes to find them useful, or is consumption of the right kind of science-fiction adequate for foresight?

The construction of prototypes is both a complex and challenging activity. This is clearly an emerging methodology which is not yet established. But potentially it allows the researcher to move out of the lab into the wild. Further it provides opportunities to facilitate greater user involvement (younger generations) and civic participation in the development of future prototypes.

Acknowledgement

We are thankful to the reviewers for their comments and insights helping us to improve this paper. Motivated by their comments, in the future work we plan to extend the crime-sourcing work with dimensions including social psychological investigations of the ‘crowd’ and its relationship with the individuals.

References

[1] Johnson, B. D. (2011) *Science Fiction Prototyping: Designing the Future with SF. Synthesis lecture on Computer Science,* Morgan and Claypool Publishers, San Rafael, CA.

[2] Johnson, B. D. (2010) *Screen Future: the Future of Entertainment, Computers and the Devices We Love,* Intel Press, Santa Clara, CA.

[3] Teece, D. (2010) "Business Models, Business Strategy and Innovation", *Long Range Planning,* Vol 43, No 2/3, pp. 172-194.

[4] Wu, H-Y. And Callaghan, V. (2011) "The Spiritual Machine", *Workshop Proceedings of the 7th International Conference on Intelligent Environments*, J. C. Augusto (Ed), IOS Press, Amsterdam, pp. 155-166.

[5] McGrath, R. (2010) "Business Models: a Discovery Driven Approach", Long Range Planning, Vol 43, No 2/3, pp. 247-261.

[6] Egerton, S., Davies, M., Johnson, B. And Callaghan, V. (2011) "Jimmy: Searching for Free-Will (A Competition)", *Workshop Proceedings of the 7th International Conference on Intelligent Environments*, J. C. Augusto (Ed), IOS Press, Amsterdam, pp. 128-154.

[7] Paneck, R. (2004) *The Invisible Century*, Penguin, New York.

[8] McCullagh, P. (2011) "Internet of 'Mysterious' Things", *Workshop Proceedings of the 7th International Conference on Intelligent Environments*, J. C. Augusto (Ed), IOS Press, Amsterdam, pp. 255-266.

[9] Wysocki, E. (2012) *The Great Heinlein Mystery: Science Fiction, Innovation and Naval Technology,* Createspace, Seattle.

[10] Le Guin, U. (1974) *The Dispossessed*, Harper and Row, New York.

[11] Heinlein, R. (1961) *Stranger in a Strange Land*, Putman Publishing Co, New York.

[12] Dick, P. K. (1997) *The Shifting Realities of Philip K. Dick. Selected Literature and Philosophical Writings,* (Ed) Lawrence Sutin, First Vintage Books, New York.

[13] Ballard, J. G. (1998) *Cocaine Nights*, Counter Point, Berkley, CA.

[14] Ballard, J. G. (2008) *Kingdom Come*, Fourth Estate, London.

[15] Gibson, W. (1984) *Neuromancer*, Ace Books, New York.

[16] Jameson, F. (2005) *Archaeologies of the Future: the Desire Called Utopia and Other Science Fictions*, Verso, New York.

[17] Clarke, A. C. (1973) *Rendezvous with Rama*, Gollancz, London.

[18] Asimov, I. (1950) *I, Robot,* Gnome Press, New York.

[19] Doctorow, C. (2007) *Overclocked: Stories of the Future Present*, Thunder's Mouth Press, New York.

[20] Aldiss, B. (2007) *A Science Fiction Omnibus*, Penguin, London.

[21] Howe, J. (2006) The rise of crowdsourcing**,** *Wired,* http://www.wired.com/archive**,** accessed 21 May 2012**.**

[22] Tapscott, D and Williams, A. (2006) *Wikinomics: How Mass Collaboration Changes Everything*. Atlantic Books, New York.

[23] Britto, J. (2011) After riots, London crowdsources clean-up, identifying looters, *Techland.time.com*, http://techland.time.com/2011/08/09/after-riots-london-crowdsources-cleanup-identifying-looters/, accessed: 9 August 2012.

[24] Hager, M. (2011) Anatomy of a riot, http://www.vancouversun.com/archive, accessed: 7 June 2012.

[25] Herodotou, H., Lim, H., Luo, L., Borisov, N., Dong, L., Cetin, F. B., And Babu, S. (2011) *Starfish: A Self-tuning System for Big Data Analytics*. In Proceedings of the Fifth Biennial Conference on Innovative Data Systems Research (CIDR), January 2011.

[26] Chiang, T (1998) *Story of Your Life,* Starlight 2, New York.
[27] Pearl, J. (2012) Giving computers free will. http://www.forbes.com/2009/06/18/computers-free-will-opinions/archive,accessed: 11 November 2012.
[28] Rand, A. (1943) *The Fountainhead,* Bobbs Merrill, *New York.*
[29] Sellars, S. and O'Hara, D. (Eds) (2012), *Extreme Metaphors: Interviews with J.G. Ballard 1967–2008*, London: Fourth Estate, pp. 367-8. .
[30] Auge, M. (1995) *Non-places: Introduction to an Anthropology of Supermodernity,* trans. J. Howe, Verso, London and New York, pp. 30, 26.
[31] Goodman, M. (2011) From crowdsourcing to crime-solving: the rise of distributed criminality, O'Reilly Radar, http://radar.oreilly.com/2011/09/crime-sourcing.html
[32] Leonard-Barton, D. (1998) *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*. Harvard Business School Press, Boston, MA.
[33] Thomke, S.H. (1997) "Managing Experimentation in the Design of New Products". *Management Science* 44 (6). pp. 743–762.
[34] Emerge (2013) SFP: A preliminary assessment. http://wealoneonearth.blogspot.co.uk/2012/03/science-fiction-prototyping-preliminary.html, accessed: 21 May 2013.
[35] Cosper, A. (2013) *Reimaging the Tired, Old Business of Financing*, Entrepreneur, June 2013, pp. 16-18.
[36] Zuckerman, E. (2013) *Rewire: Digital Cosmopolitans in the Age of Connection*, W. W. Norton and Co., New York.

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Biographies

Dr Gary Graham is based at Leeds University Business School and is a founding member of the Centre for Operations and Supply Chain Research. His work to date focuses on the impact of the internet and digital technologies on supply chains, logistics and distribution operations. He has authored two books, thirty research papers and worked on ESRC/EPSRC, British Academy, the Foreign and Commonwealth Office and EU research grants investigating the economic and social consequences of disruptive innovation on the music and news media sectors. In 2005, he was awarded by Emerald Publishers an Outstanding Guest Editor award. Graham was a Visiting International Research Scholar in the School of Journalism and Mass Communication at the University of North Carolina at Chapel Hill (October 2008) and the School of Engineering at the University of California – Silicon Valley (February, 2009). Graham is co-chairing a strategy sub-themed steam of papers on fictional prototypes at the forthcoming British Academy of Management (BAM) 2013 conference, a PDW on the Futures SI in August at the American Academy of Management 2013 conference and is organizing a BAM and EPSRC NEMODE funded workshop on strategic prototyping in London on February 6.

Prof. Rashid Mehmood is the Professor of Networked Information Systems at the College of Computer Science, King Khalid University.

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a Research Fellow within the School of Computing and Engineering at the University of Huddersfield. Earlier, he has worked as a lecturer in Computing and Communications at Swansea University where he led a research group developing state of the art technologies in telecom, healthcare and transportation through cross disciplinary research and international collaborations. He has also worked as a Postdoctoral Researcher at the Computer Laboratory, University of Cambridge. His qualifications include a PhD in Computer Science (University of Birmingham), an MSc in Computations (University of Oxford), an MBA with majors in Marketing and Management, and a B.Eng. in Electronics and Communications. Dr Mehmood has over 15 years of research experience in Computational Modelling and Simulation Systems coupled with his expertise in High Performance Computing. His broad research aim is to develop Multi-Disciplinary Science and Technology to enable better Quality of Life and Digital Economy with a focus on Real-time Intelligence and Dynamic System Management. He has chaired several international conferences and workshops in his areas of expertise. He has led and contributed to several academia-industry collaborative projects funded by EPSRC, regional funds and Technology Strategy Board. He is a member of ACM, OSA, Senior Member IEEE and past Vice-Chairman of IET Wales SW Network.