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3D, SF and the future

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ABSTRACT

This article assesses the use of 'science fiction' (SF) in visioning or prototyping the potential economic and social consequences of so-called 3D printing. What is becoming clear to many commentators as well as science fiction writers is how rapid prototyping, or 3D printing more generally, could permit many final objects to be made near to or even by consumers on just-in-time 'printing' machines. This revolution in making would have many implications for the economy-and-society in the future by seriously augmenting, or possibly replacing, current systems of manufactured production, long-distance transportation and consumption. These 3D technologies have featured in SF works, including Neal Stephenson's *The Diamond Age*, Ian McDonald's *Brasyl*, Charles Stross's *Rule 34* and Cory Doctorow's *Makers*. The article reports on current research seeking to understand the implications of what may be a major new sociotechnical system in the making. Some creative uses of SF are presented in a professional workshop setting. As well the article documents the use of SF as a methodological prototype in forecasting alternative scenarios of the future. SF prototyping could be a powerful tool in the social science repertoire when put into action in forecasting possible technology and business futures.

1. Introduction: prototyping the future

Corporate futurist Brian David Johnson presents 'science fiction (SF) prototyping' as an unorthodox, yet core, method in futures work for the computer processor corporation, Intel. As he points out, thinking about the future trajectories of current technological innovations is the bread and butter of these companies where final products appear many years after patents have been submitted and exhaustive testing and prototyping conducted [1, p. 31]. He presents SF prototyping as more than just an experimental indulgence—a guilty pleasure of sci-fi fans like himself—but instead as an emergent tool of the trade in professional forecasting. He describes a 'prototype' in this context as "a story or a fictional depiction of a product" [1, p. 12]. SF in this reading is not just a resource to draw upon for possible imaginings of future worlds, but also a technique in itself, allowing the generation of scenarios through the development of characters, plots and narrative stories. Johnson is quick to emphasize that these "stories are not about technology, megatrends or predictions" but rather how the "future is about people" [1, p. 5].

This idea of bringing 'people' into professional forecasting scenarios chimes well with recent social science experiments in futures work. For instance, the 'Sixth International Conference on Intelligent Environments' held a session on 'Science Fiction Prototyping for Research Innovation' [2]. For social scientists the usefulness of SF prototyping is not only to fantasize about (or fetishize) speculative technologies, a role fulfilled eagerly by the media, but also to encourage vatic insights into the

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possible unintended consequences and social practices emerging from people's varied engagements with 'technology' and involvement in innovation. This helps to bring people's social practices into various forms of thinking and planning about the future, from policymaking to marketing [3].

The term 'prototyping' is significant here in both social science methodology and the specific topic of this paper. The focus of the research examined is 'rapid prototyping'. This is to be found in many settings whereby objects need to be previewed and modelled physically, before being produced on a mass scale in a workshop or factory [4]. Prototyping and modelling remain the main forms of investment and growth for 3D printing, although this is changing with investors and technologists growing increasingly excited about the wider possibilities of 3D technologies as discussed below [5].

Rapid prototyping derives from a range of 'printer' technologies allowing the local production of objects, much in the same way as 2D printers allow the generation of paper documents in offices and homes often distant from where the text has been 'designed'. Rapid prototyping can be seen as a tentative stage in a wider adoption and engagement with 3D printing throughout contemporary societies and this is how it has been represented in many SF accounts. SF is then 'ahead of the game' in envisioning this radical future for rapid prototyping.

The debate about how SF and futures should work together has a long heritage, particularly in this journal, and has been recognized as useful in foreseeing the social consequences of technology [6]. Indeed, it has long been argued that futurists "should note the agreement between artistic vision and scientific research" [7, p. 42]. The use of vignettes as powerful devices has been recommended as a strategy for futures work [8]. This is fortified by recent examples of this technique in business visioning [9]. "What both science fiction and the futures workshop have in common is some kind of immersion of the reader or participant in imagined future worlds" [10, p. 888] to better "value and embed the depth and meaning of people's experiences into the systems and processes of ongoing city planning, development, and policy making" [11, p. 427].

The important role of SF in futures work is not only found on the fringes of debate. Fictional stories have featured with good effect in the UK Government's Foresight reports. One of the authors was involved in a novel approach to assessing the possible futures of transport and mobility in one of these exercises [12]. In the report *Intelligent Infrastructure Futures—Towards 2055* four scenarios of different worlds were explored and in each a fictional vignette was deployed. This was called 'An Urgent Delivery' whereby the character 'Mike' attempts to deliver a package in the radically different worlds imagined within each scenario: "His client was expecting 24/7 service, but the world of bits and world of atoms are different, Mike mused" [13, p. 25].

This use of creative fiction in policy and planning contexts, in order to imagine the social aspects of future worlds, has subsequently appeared in other related academic scenarios work we have been involved in relating to future transport systems, climate change and oil depletion [14].

In this paper we describe similar experiments relating to the current state of play of rapid prototyping and its possible future impacts upon the movements of objects and people. We link the development of rapid prototyping and more generally 3D printing to fictional futures and highlight the possible ways these visions might interestingly inform forecasting and scenarios building. We then highlight the invaluable role creative SF prototyping played in examining scenarios and collaborating with experts within engineering, design, consultancy and policymaking.[1] Finally, we detail the fictional 'stories' we experimented with and conclude with a discussion of the possible methodological benefits this approach yields for social science.

SF is now recognized as both a valuable asset for thinking about the future in general terms and a possible method for specific inquiries into how people engage with technologies and the degree to which business shapes people. Fictional devices enhanced this research into 3D printing and its potentially large-scale consequences.

2. Rapid prototyping and 3D printing

There are now various machines enabling the printing of many such 3D shapes, the main differences being in how the layers of the print are built up as they are deposited one on top of the other as the printer releases material from a container or cartridge. There are both low-end consumer level printers available for less than a thousand pounds sterling and high-end industrial printers costing millions. As materials are stratified so a 3D object is produced. Each layer is in effect a digital slice generated through a given computer-aided design. Every next layer is added until the object is fully printed or 'manufactured' with an extruder (fused-filament), chemical agent (binder) or a laser (sintering/melting) changing the state of the material. This process is technically known as 'additive' manufacturing, by contrast with most previous 'subtractive' manufacturing processes that involve cutting, drilling or bashing wood or metal or other materials.

Such 3D printing was initially developed during the 1980s and 1990s to produce prototypes of an object before tooling up in a workshop or factory to produce thousands or more copies of the 'real' object. Manufacturing individual prototypes is very expensive but 3D printing is much cheaper. As 3D printing developed, so it was realized that a much wider range of shapes and materials could be produced in quantity and not just the prototypes of 'real' objects. Something like one-fifth of additive manufacturing is now of final products, rather than prototypes, and this figure is rapidly increasing. Some are

[1] This analysis and the science fiction vignettes are drawn from an ESRC-funded research project and workshop on Technologies and Travel, grant number ES/J007455/1.