Worldcon 75 Academic Track
Session 13: Learning from SF

Saturday 10:00-11:30
Room 209

Chair: **Päivi Väätänen**

Abstract 1:
Nick Falkner (University of Adelaide, Australia):
Design Fiction for Education: Driving Reinterpretation of Educational Challenges in the Present through the Construction of Working Futures in Speculative Fiction
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Design fiction, a term coined by Julian Bleecker of Near Future Laboratory and popularised by Bruce Sterling, is "the deliberate use of diegetic prototypes to suspend disbelief about change." To identify areas of change, we must be able to correctly perceive those elements that require change and, after Shklovsky, we must fight habitualisation and defamiliarise elements that we would otherwise overlook.

The representation of education is an important part of world building and story telling, yet many examples of education are habitualised stereotype: bored students, 19th century classroom or recitative teaching machine, all combining to provide a backdrop that is glanced over. There are examples in fiction of innovative educational practices that mirror the best 21st century pedagogical practice but these are not commonplace. While few people will pick up and read papers on pedagogy, speculative fiction can provide elements for readers that will influence the community to accept the new directions in education that are often challenged by parents, students, and teachers as not being "real education". What we often call "real education" is merely the comfortable habitual framework of tradition and educational researchers are well aware that tradition is not necessarily a guide to the best educational practices.

Computer scientists and engineers are increasingly required to consider defamiliarisation as a tool for constructing new and innovative devices and software (after Genevieve Bell et al's "Making by Making Strange", ACM Transactions on Computer-Human Interaction, 2005). Computer science education researchers operate in a similar space, with a domain of face-to-face and on-line educational systems that can benefit learners across the globe in developing computational thinking and algorithmic skills.

In this paper, I will argue the importance of defamiliarising perceptions of education as part of a design fiction approach that envisions a world where we have successfully conquered the challenges of providing ubiquitous high-quality education. The design fiction approach will be presented, with examples from existing speculative fiction, academia and industry, to illustrate how the consideration of a future possibility can be used, in conjunction with dehabitualising educational elements in narrative, to encourage a reconsideration of the nature of education by the reader. The paper will conclude with a discussion of a successful education model as being one where there is a need for constant freshness. By always examining elements of education as if we are seeing them with new eyes, we are more likely to achieve our educational goals.

Associate Professor **Nick Falkner** has a PhD in Computer Science and is a widely published and award-winning educator and researcher, specialising in innovative and creative learning design. His short piece on design fiction to inspire the support of modern educational techniques, "Future-proofing the Near Future: Design Fiction For Global Education", was accepted by Analog for publication in 2017. Nick is currently employed at the University of Adelaide and is a member of the Computer Science Education Research group. He also conducts research into block-chain cryptography for novel applications, network design, and the security of critical infrastructure.

Abstract 2:
Jerry Määttä co-authored with Daniel Pargman (Uppsala University, Sweden):
Estranging Energy: Teaching Abstract Concepts through Making Strange
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Few people intuitively grasp the energy needs of our everyday technology (smartphones, computers, cars), or indeed our bodies (the daily caloric intake), and it is often equally hard to understand the concomitant but invisible carbon emissions that are the result of our modern, high-energy technological lifestyle.

      The aim of this paper is to examine and discuss one possible way of alleviating these difficulties, namely through the use of images, metaphors, and *estrangement*, enabling especially students to defamiliarise abstract concepts such as energy by forcing them to conceive these terms as concrete, tangible, and manipulable. Apart from discussing estrangement as a concept and some of the numerous interpretations and developments of Viktor Shklovsky's *ostranenie* (not least Bertolt Brecht's *Verfremdung* and Darko Suvin's *cognitive estrangement*), this paper analyses a few examples where science fictional estrangement can be used in teaching abstract concepts – in this case pertaining to energy and sustainability.

      For instance, one way of defamiliarising students to the abstract concept of energy is through the term or unit 'energy slave', standing for the potential energy output of one well-fed and fully functional human being: 75 watts during an 8-hour day, for a total of 600 Wh (0.6 kWh) per day (Nikiforuk 2014; Avallone et al. 2007). The 'energy slave' unit is thus comparable to the 'horsepower' unit – where one horsepower corresponds to about 10 energy slaves – but also to fossil fuels, where a barrel of oil (159 litres) is "roughly equivalent to 25 000 hours of human labour" (McKibben 2011).

      While the invocation of the term 'energy slave' might be perceived as inappropriate in some contexts (e.g. in a society that still grapples with the consequences of actual historical slavery), we use it here due to the saying that, according to the ancient Greek philosopher Protagoras, "man is the measure of all things". The term 'energy slave' brings a tangible, skin-in-the-game aspect to the act of imagining or estranging energy, and through mental exercises such as this, it becomes much easier to both make sense of and get a feeling for various calculations about everyday energy consumption as well as our dependency on fossil fuels.

      Apart from the fact that thought experiments on sustainability often read much like science fiction in themselves (going back at least as far as the metaphor of "Spaceship Earth"; see Höhler 2015), this paper examines how concepts that are often used within literary scholarship, and particularly within science fiction studies, can shed light on pedagogical challenges and didactic practices within the field of teaching energy and sustainability. Besides the concept of 'energy slaves', this paper also explores the didactic employment of

images, metaphors, and estrangement from works ranging from Jonathan Swift's proto sf *Gulliver's Travels* (1726) to Paolo Bacigalupi's *The Windup Girl* (2009).

Jerry Määttä is an Associate Professor at the Department of Literature at Uppsala University, Sweden. He has published on science fiction, sociology of literature, the Swedish book market, popular fiction, audio books, literary prizes and awards, and has recently finished a project on British and American apocalyptic and post-apocalyptic narratives in film and literature since ca. 1950.

Daniel Pargman is an Associate Professor at the Department of Media Technology and Interaction Design (MID) at KTH Royal Institute of Technology, Sweden. He is interested in energy research and social science, teaching sustainability and computing within limits. He blogs at danielpargman.blogspot.com.

Abstract 3:
Kanta Dihal (St Anne's College, University of Oxford, UK):
Stranger than Fiction: Quantum Physics as a Defamiliarizing Technique in Science Fiction
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As quantum physics began to be known beyond the scientific sphere, writers soon recognised its potential to provide both new material for narratives and new ways to apply existing narrative tropes. Using quantum physics influenced their storylines, providing a scientific underpinning to events which only a few decades earlier would have sounded fantastical: science fiction was the first genre to embrace the concepts of quantum mechanics explicitly in narratives, despite the difficulty of the science and the proliferation of mutually exclusive interpretations.

In this paper, I investigate the way in which quantum physics is used in twentieth- and twenty-first-century science fiction literature, from a literary studies perspective, building on studies such as those of Strehle (1992) and Front (2015). The use of quantum physics in fiction has led to a proliferation of works that explore its concepts to find novel ways of creating a narrative. What does it allow writers to do that wouldn't be possible without referring to this science? What effect does this have on real-world perceptions of science, and of what quantum mechanics is? Can science fiction be used to teach quantum physics through estrangement, through looking at it in a way that regular textbooks are unable to do?

Quantum physics is still not fully understood, and these many different interpretations abound. The consensus among physicists leans towards the Copenhagen interpretation, which is used in Greg Egan's *Quarantine* (1992) and David Walton's *Superposition* and *Supersymmetry* (both 2015). However, despite being almost three decades younger, the many-worlds interpretation (Everett 1957) is more frequently used in science fiction: for instance, in Frederik Pohl's *The Coming of the Quantum Cats* (1986), Gregory Benford's *Timescape* (1980), and Iain Pears's *Arcadia* (2015). In fact, authors such as Jorge Luis Borges ('The Garden of Forking Paths,' 1941) and Andre Norton (*The Crossroads of Time*, 1956) even anticipated the most important concept now associated with Everett's interpretation: that of branching timelines of alternative outcomes of events. One reason seems to be the narrative potential of the many-worlds interpretation, as Marie-Laure Ryan (2006) has argued: it strengthens the realistic illusions of science fiction through giving a scientific grounding to tropes that have been popular throughout literary history, such as alternative histories and travel to parallel worlds. Here, quantum physics seems to have a

familiarizing rather than a defamiliarizing effect: the seemingly fantastical event is given weight through a grounding in real-world science.

I will therefore argue that the introduction of quantum physics in science fiction created two kinds of estrangement: it made the familiar strange again, by providing a scientific underpinning to existing fantastical story tropes, and it made the strange comprehensible, by explaining complicated scientific phenomena through allowing human characters to encounter them and having the story influenced by them.

Kanta Dihal is a third-year doctoral researcher in literature and science at St Anne's College, University of Oxford. Her thesis, titled *Reader Engagement in the Presentation of Quantum Mechanics in Popularizations of Science and Science Fiction*, is supervised by Professor Sally Shuttleworth and Dr Michael Whitworth. She is also the Executive Editor and popular science reviewer of *The Oxonian Review*, and Section Head of Literature at *The Oxford Culture Review*.