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Worldbuilding in Science Fiction, Foresight and Design

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Abstract

Science fiction is experiencing a renaissance as the rate of change and uncertainty about the future increases. Organizations, innovators, and changemakers alike are turning to the genre to navigate the future and design for the present, often unaware that generating and using images of the future for strategic purposes is a cornerstone of foresight practice. A fundamental concept in science fiction that is fueling the use of the genre as a strategic tool is worldbuilding. This paper explores how worldbuilding is currently leveraged, how it relates to design and foresight, and how it might further enrich both disciplines. It will propose that design and foresight may benefit from the worldbuilding processes of science fiction authors to design for coherence, user-test worlds, and help society develop a superstructure of culture in order to imagine and create new visions of the future.

Introduction

Stories are powerful. A story "can be a way for humans to feel that we have control over the world. They allow people to see patterns where there is chaos, meaning where there is randomness. Humans are inclined to see narratives where there are none because they can afford meaning to our lives — a form of existential problem-solving" (Delistraty, 2014). Creating fiction — our ability to envision possibilities outside of our immediate reality — has served as an evolutionary advantage for our species. Historian Yuval Noah Harari argues that it is our propensity to create and perpetuate mass mythologies that defines humanity and our dominion over reality (Harari, 2015).

Often, stories have the power to change us on a fundamental level because our brains process moral lessons coded in narratives differently. Researchers have found that "narratives that appeal to 'protected values', including core personal, national, or religious values, may be particularly effective at influencing receivers. Protected values resist compromise and are tied with identity, affective value, moral decision-making, and other aspects of social cognition" (Kaplan et al., 2017, p.1). When we encounter moral lessons in the form of a narrative, our brains show increased activity, and we engage more deeply than we would otherwise.

From Mary Shelley to Robert A. Heinlein to William Gibson, science fiction has provided the world with stories about the future. Science fiction is, in the broadest sense, fiction that follows science. It depicts "plausible

futures — envisioning where contemporary social trends and recent breakthroughs in science and technology might lead us" (Gunn, 2014). It is a sociology of the future (Toffler, 1970, p.208). A vast and varied genre, science fiction is a subset of speculative fiction — a super-category that embraces alternative realities (Oziewicz, 2017).[1]

Science fiction is experiencing a renaissance as the rate of change accelerates, and we grow more uncertain about the future. Organizations, innovators, leaders, and changemakers are turning to the genre to navigate the future and design for the present, perhaps unaware that generating and using images of the future for strategic purposes is a cornerstone of foresight practice. In particular, the concept of worldbuilding in science fiction may offer new insights at the intersection of foresight and design that may strengthen the growing bond between them. This paper will explore how science fiction is currently impacting real-world design, how worldbuilding overlaps with foresight and design, and how worldbuilding in science fiction might further enrich both practices.

The Application of Science Fiction

Science fiction holds significant influence over technological innovation and scientific research. For instance, Jules Verne inspired the U.S. Navy's first submarines and the modern helicopter (Tavakoli-Far, 2013). It was Arthur C. Clarke who first proposed using satellites for global communications in 1945 (Tweney, 2011). Everything from the desire to visit "Mars to flying cars to digital drugs, robot friends to teleportation, GPS to mobile communicators, smart food to mitochondrial reproduction techniques," has roots in science fiction (Bassett, Steinmueller, & Voss, 2013). The multitude of examples demonstrate that "science fiction and science 'fact' — science and technology innovation, policy, public knowledge, investment — are not two separate realities but are two entangled and overlapping fields" (p.1).

However, science fiction is more than a technophilic wellspring. Good science fiction presents "a fully realized, multidimensional vision, including not only the technological and scientific, but the psychological, cultural, moral, social, and environmental dimensions of future human existence. The real future will be an interactive synthesis of all these dimensions" (Lombardo, 2018, p.3).

During the American Civil Rights movements, Martin Luther King Jr. encouraged Nichelle Nichols to remain in her role as Lieutenant Uhura on Star Trek though she had considered leaving. To King, Star Trek and Nichols represented a brighter world with a more progressive social system — a vision of the future for the Civil Rights Movement, in which a black woman was judged solely on the content of her character. Later, Nichols was instrumental in reforming NASA's hiring policy, and the recruitment of Sally Ride and Guion Bluford, NASA's first female and first black American astronauts respectively (Klus, 2017).

Recently, organizers and activists wrote an anthology of "visionary science fiction and speculative fiction", titled *Octavia's Brood: Science Fiction Stories from Social Justice Movements*. Paying homage to author Octavia Butler, they aspire to create "'visionary fiction' and movements for social change through short stories". They believe science fiction "pulls from real life experience, inequalities and movement building to create innovative ways of understanding the world around us, paint[s] visions of new worlds that could be, and teach[es] us new ways of interacting with one another" (Brown & Imarisha, 2015).

In this context, science fiction empowers marginalized voices, fosters equal representation, and challenges entrenched orthodoxies and concepts of 'the other'. The work of minorities and women has gained prominence and recognition in recent years, helping diversify the value systems depicted (owing partly to democratic reform at The Hugo Awards) (Liptak, 2017). As marginalized voices bring alternative perspectives to the genre, the perception of science fiction may shift from a plot-driven, artifact-centric genre to a socially conscious, value-centric one.

The idea that science fiction can inform the design of a better tomorrow is becoming a movement. Recent initiatives such as *Project Hieroglyph* and The Verge's *Better Worlds* both offered positive images of the future to inspire a better world (Konstantinou, 2019). They encapsulate the same spirit as Ray Bradbury's *The Toynbee Convector* which posits that if someone shows us a brighter future and maps the path to it, we will all rush towards that outcome (Bradbury, 1984). Since positive images of the future are "one of the main instruments of culture, providing both a vision of civilization and the tools for realizing it", the inclination to use science fiction in this manner should come as no surprise (Polak, 1973, p.13).

In stark contrast, Russia uses science fiction as a political weapon of war. Vladislav Surkov — a "political technologist" and "Putin's grey cardinal" — allegedly writes science fiction under the pseudonym Natan Dubovitsky (Pomerantsev, 2014). Commentators pore over his dystopian visions of a non-linear war in order to understand the Kremlin's vision for Russia (Komska, 2014). Surkov combined his background in public relations with his love of theatre and science fiction into a "strategy of power based on keeping any opposition ... constantly confused, a ceaseless shape-shifting that is unstoppable because it's indefinable" (Pomerantsev, 2011).

These examples demonstrate that science fiction offers an opportunity to imagine and prototype complex socio-economic and political systems of the future, and the reinforcing relationship people have with those systems (for better or worse). The genre will likely gain popularity as more real-world uses emerge.

An Entangled Relationship

At present, "the divide between science fiction and futures studies is neither necessary nor desirable. There is a long history of crossover between the two, with each positively influencing the other" (von Stackelberg & McDowell, 2015, p.29). It was author H.G. Wells who first called for professors of foresight in 1932 (Wells in Slaughter, 1989, pp.3-4). Thirty-one years later, Arthur C. Clarke stated that "a critical . . . reading of science fiction is essential training for anyone wishing to look more than ten years ahead" (Clarke, 1963). Both Wells and Clarke, "frequently and successfully crossed back and forth from science fiction and futures studies" (von Stackelberg & McDowell, 2015, p.29).

Similarly, design and foresight reinforce each other. Whether we are designing products, policies, or services, time passes during the process, from the moment we identify a problem to the moment we implement a solution. In that sense, all design is for the future.
In *The Futures of Everyday Life*, Stuart Candy states that,

> *Futures can lend design a richer temporal context and big-picture meaning-making… Design lends futures solidity, communicative as well as exploratory effectiveness…a direct interface to materiality, a place to begin pursuit of preferred futures in the concrete. Together, they provide the tools of a more complex and yet more intuitive exploration of possibilities, with the 'theory objects' of futures — which scenarios have always been — now assuming irresistibly tangible forms (2010, p.207).*

In science fiction, the overlap between foresight and design distils into a single concept deemed "the lifeblood of storytelling": worldbuilding (Anders, 2013).

Worldbuilding

Worldbuilding is the process of constructing a complete and plausible imaginary world that serves as a context for a story. It is "the creation of imaginary worlds with coherent geographic, social, cultural, and other features" (von Stackelberg & McDowell, 2015, p.32). Worlds "provide

detailed contextual rule sets that develop a larger reality that extends beyond a single story, while potentially providing a deeper understanding of the underlying systems that drive these worlds" (pp. 25-26). All stories require some worldbuilding, whether the story takes place in Rome in 500 B.C., or modern-day Tokyo, or in a galaxy far, far away.

Worldbuilding in science fiction can forge a stronger relationship between foresight and design because it is a form of social constructivism and systemic design. Similar to how our socio-ecological systems are emergent, co-evolved and "interlinked in never-ending adaptive cycles of growth, accumulation, [and] restructuring," science fiction worlds instil a sense of completeness (Holling, 2001, p. 392). For example, Kim Stanley Robinson's *Mars* trilogy begins with "humanity's efforts to colonize our cosmic neighbor in Red Mars, and closes two centuries later in Blue Mars" having fully explored his "musings on science, politics, economics and religion" over hundreds of pages (Walter, 2016).

Heinlein's *The Moon Is a Harsh Mistress*, Ursula Le Guin's *Hainish* series, and Samuel Delany's *Nova* are other examples of both science fiction and systems fiction because they attempt to portray how an entire society works rather than a fragment of it (Walter, 2016). Subgenres of science fiction such as climate fiction — which "explores the potential, drastic consequences of climate change" or alternative climates — also leverage systems-thinking[2] (Ullrich, 2015).

Worldbuilding is also an understudied act of intentional design. Raven and Elahi state that "little or no literature exists which applies the strategies and logics of narrative as understood by writers, cineastes and cultural scholars to the methods deployed by futures scholars and practitioners in the creation of their final outputs" (2015 p.49). Moreover, because narratives are processed differently than other forms of information, leveraging storytelling and worldbuilding may allow us to challenge societal values without antagonizing protected values.

Worldbuilding, Foresight, and Design

The concept of worldbuilding is embedded within foresight and design practices, albeit to a different extent than it is in science fiction. Notable examples at this intersection include scenario generation, science fiction prototyping, experiential futures, and transition design.

Scenario generation

Scenario generation has its roots in storytelling. The "RAND Corporation borrowed the Hollywood term scenario, referring to a movie script, to describe their work with military planners developing contingency plans" (Hammoud & Nash, 2014, p.2). Scenarios are a set of alternative futures that "describe a world to come, making a systematic set of assumptions about the drivers shaping that world. They may be brief and descriptive, or they may include story-like narratives that represent the point of view of personas in the future" (Institute for the Future, 2017). Foresight practitioners use several inductive and deductive methods to create scenarios including Generic Images of the Future, 2x2 Matrix, and Branch Analysis Method, amongst others (Bishop, Hines, & Collins, 2007).

Though scenarios are prototypes of the future designed for a variety of purposes, "their primary purpose is to guide exploration of possible future states" (Schultz & Curry, 2009, p.36). Scenarios are akin to worldbuilding because they describe future states. However, a "critique of existing scenario output is that too much of it consists of 'snapshot' scenarios, which merely describe the future conditions without explaining how they evolved" (Schultz & Curry, 2009, p.37; List, 2004). Compared to novels and films, they lack breadth and depth.

Science fiction prototyping

Science fiction prototyping (SFP) is the systematic process of pulling science into narratives in order to generate technological prototypes and understand their human impact (Johnson, 2011). This method strategically mimics science fiction while leveraging the iterative, prototyping approach of design-thinking. SFP also leverages the interplay between worldbuilding and storytelling through the use of narrative, which scenarios sometimes lack.

Technology in science fiction is an aspect of worldbuilding because an artifact can exist across multiple stories (e.g. lightsabers are used in all *Star Wars* films). Since SFP aims to generate and understand the use of an artifact, it may fail to depict the broader system and the nuances and implications of those systems. It reinforces the idea that science fiction is most useful for product design and tech innovation, and ignores its potential for systemic design and future state prototyping.

Experiential futures

Experiential futures are "situations and stuff from the future to catalyse insight and change" (Candy, 2015). Both it and SFP are closely related to speculative design. Speculative design places "new technological developments within imaginary but believable everyday situations that would allow us to debate the implications of different technological futures before they happen" (Dunne & Raby, n.d.). Speculative designs can be as simple as an unergonomic chair or "as substantial as a public transport infrastructure...At either end of the scale, the aim... is always to improve the future" (Kolehmainen, 2016).

Similar to SFP, the 'stuff' in experiential futures reflect worldbuilding, while the 'situations' are a blend of worldbuilding and storytelling, using story elements such as characterization and plot. Though it is more concrete than a scenario, experiential futures often depict instances within a broader world rather than a robust world. The method has one distinct advantage over science fiction: an experiential future brings a future into the real world, making it an immediate, firsthand encounter. Advancements in virtual and augmented reality may blur the lines between experiential futures and science fiction.

Transition design

An emerging area of design that leverages science fiction, foresight, and systems thinking is transition design. It argues that we must go beyond social innovation, which "challenges existing socio-economic and political paradigms" and often lacks a long-term, systemic view (Irwin, Kossoff, Tonkinwise, & Scupelli, 2015, p.8). Instead, transition design calls for "radically new ideas and compelling visions of sustainable futures" that leverage "future-based narratives that come from the field of science fiction, narrative and storytelling, future-casting/futuring and speculative and critical design" (p.3). Similar to *Octavia's Brood* and *Project Hieroglyph*, transition design aims to use science fiction to imagine brighter worlds and the pathways there.

Recent research in transition design yielded a worldbuilding model inspired by the work of science fiction authors, called *Seven Foundations* (Zaidi, 2017). It draws upon elements of foresight, design, and systems-thinking to provide a framework for creating new visions of the future using a first-principles approach. Both the model and the field of transition design are relatively new additions to the foresight and design landscape and warrant further exploration.

Worldbuilding in Science Fiction

In science fiction, worldbuilding is expansive and elaborate, and the outcome is often a high fidelity product such as a novel or film. Unlike foresight and design, which are strategic practices

subject to real-world constraints (e.g. client objectives) and resources (e.g. time and money), the worlds of science fiction are a creative endeavor. A world may be constructed iteratively over years, or collaboratively assembled with robust support structures (e.g. films supported by studios). The result is richer and bigger worlds.

Science fiction gives us a world and story at once, depicting the broader context and implications of that context through plot and characters. It is this interplay between worldbuilding and storytelling that makes science fiction compelling as a strategic tool. According to Lombardo, "a good story about a possible future, with its drama, sensory detail, and nuances, is psychologically more compelling and realistic than an abstract futurist scenario or statistical prediction. Further, science fiction also personally draws us into a rich vicarious experience of the future through vivid and memorable characterizations" (2018, p.2).

Worldbuilding acts as a backdrop for emotionally resonant human experiences as well as the mundane, everyday life. When science fiction creators introduce us to new products, they depict the gestures and interactions required to use them, and moments when those products fail. When introduced to a new system, we see an alternative political reality, what it means to live within that reality, and possibly how to challenge that alternative status quo. The inner worlds and outer behaviours of characters provide filters for storyworlds. A scenario may introduce an artificially intelligent companion; science fiction depicts what it means to fall in love with it.

Though foresight scenarios may include 'a day in the life' vignettes, it is rare to see elaborate storytelling with a cast of characters. Neither do we see conversations between characters that explore the implications of the scenarios they occupy. Characters that reflect, interact with each other and the world, and engage in dialogue provide an accessible entry point into a world, along with multiple personas to navigate it. Situational experiential futures do capture some interplay between world and story. However, they are typically not documented and disseminated like science fiction is, limiting their real-world impact and opportunities for inspiration and deconstruction. Often, the conversation ends when the experience ends.

The worlds of science fiction also contain prototypes for complete and coherent systemic states, technologies, relationships, and values. The systemic nature of storyworlds allows us to repeatedly mine a world for new ideas and insights, with different stakeholders deriving different value. For instance, an entrepreneur may look to *Blade Runner* for product innovation, a transportation specialist for city planning, or a lawyer for human rights implications. Robust worlds provide endless strategic possibilities because they are difficult to exhaust.

Borrowing from Science Fiction

More recently, foresight practitioners and designers are leveraging worldbuilding in new ways. For instance, *The Thing From the Future*, created by Stuart Candy and Jeff Watson, is a game that prompts "thought-provoking descriptions of hypothetical objects from different near, medium, and long-term futures" (Situation Lab, n.d.). The game may "yield close to 40,000 unique permutations in the redux edition (and over 3.7 million in the more complex, multivariate earlier version)" (Candy, 2018, p.238). Each permutation provides a scaffold for worldbuilding.

Alex McDowell, Director of the World Building Media Lab at the University of Southern California, uses worldbuilding and storytelling techniques both on and off screen. Recently, McDowell used worldbuilding techniques during a housing and sustainability development project on behalf of a Saudi Arabian foundation. The project looked "ten years into the future of a specific Bedouin tribe, a nomadic tribe who had been settled and fallen into abject poverty, with failing crops and decaying shelter" (McDowell, 2019, p. 109). This approach allowed members of the community to imagine alternatives "from sustainable housing to permaculture that establishes new and robust crops, [that] are all being implemented in the real world" (McDowell, 2019, p. 109).

Understanding the process of worldbuilding in science fiction can enrich design and foresight practice. Key concepts from science fiction authors that could influence design and foresight include designing for coherence, user testing worlds, and fostering a superstructure of culture.

Designing for coherence

When science fiction authors like Ursula K. Le Guin create worlds, they ensure those worlds are coherent. Coherence implies that the design of a world has internal logical consistency.
In an open letter titled "Plausibility in Fantasy", Ursula K. Le Guin stated that:

> *While I am composing I have no abstract ideas, purposes, or policies in mind, but am intent only on following the story . . . Then there is detail. The more realistic, exact, 'factual' detail in a fantasy story, the more sensually things and acts are imagined and described, the more plausible the world will be. After all, it is a world made entirely of words. Exact and vivid words make an exact and vivid world (Le Guin, 2005).*

Like Le Guin, when we design products, policies, strategies, etc., we too should aim to achieve coherence, ensuring that our designs and their details fit both with the current and emerging states of our world. For instance, are the products we create today coherent with the emerging realities of climate change? If not, what are the consequences?

User testing worlds

Author N.K. Jemisin also strives for coherent worlds, but takes a different approach:

> *Sometimes I'll write a short story set in that universe to try and solidify my ideas. Not the same plot, not even the same characters; just playing around with the world. I call this a 'proof of concept' story, for lack of a better description — basically I'm testing the worldbuilding to see if it's complete enough to support a novel yet. Often the act of writing the story helps me catch glaring holes in my worldbuilding (Jemisin, 2011).*

Personas and user journeys are staples of design work. In order to build robust worlds that we can mine for strategic purposes, we should test our designs and scenarios with multiple, diverging narratives. This includes understanding how different people (or personas) may approach our designs or scenarios, with consideration for extreme and/or unexpected users. Doing so may provide additional insights on how our designs and proposed future states will impact and influence people while mitigating unintended consequences.

It may also benefit us to explore how personas and user journeys might interact and influence each other. This may require prototyping and iterating conversations between various stakeholders, with the goal of generating diverse alternatives that allow for exploration, rather than a single refined outcome. For instance, what conversations may occur between entrepreneurs and government officials in the context of artificial intelligence in 2040? What happens when we filter those conversations through different emotions?

Fostering a superstructure of culture

Authors William Gibson and Samuel Delaney have suggested that readers develop a "superstructure of culture on top of [an existing cultural construct] that allows them to enjoy" science fiction (Newitz, 2014). In other words, by engaging with alternative future worlds, science fiction readers develop an understanding of the modular, foundational components of a culture. They build their capacity to engage with alternative systems and ways of living.

Before we can design better futures for all, we have to build a societal-wide capacity to envision and design alternatives. This requires cultivating a multiple futures perspective while accounting

for the multiple perspectives that already exist in the present. Science fiction and futures-based narratives may help people develop a superstructure, and serve as a strategic precursor to widespread change. Creating more foresight-based narratives for various ages, and embedding information about complex problems within them, may prove beneficial.

Furthermore, it may be worthwhile to explore the role of narrative designers (individuals who design elements of story in games), and what such a role could play in society. If the Kremlin can employ a political technologist who uses science fiction to create chaos, how might we create roles and capacities that allow society to envision and realize collective preferred futures through storytelling? Could such a role help society foster a superstructure of culture and design for collective good? The concept of a cultural superstructure and the role of a narrative designer may have significant implications for both design and foresight, and warrant further exploration.

Conclusion

The concept of worldbuilding in science fiction marries elements of foresight and design, and offers opportunities to enrich both practices. By understanding the many ways in which science fiction is used throughout society and borrowing from its worldbuilding processes, we may harness new insights on how to design emotionally resonant futures that inspire real-world action. Designing for coherence with emerging future states, user testing multiple, alternative worlds, and fostering a superstructure of culture may help strengthen the existing overlaps between foresight and design.

As researchers and practitioners, we should further explore of the worldbuilding processes of science fiction in order to design new, emotionally resonant visions of the future, and explore our place within those visions. Though the future looks precarious, a better world may be on the horizon if we work towards it.

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Notes

1. Speculative fiction "includes fantasy, science fiction, and horror, but also their derivatives, hybrids, and cognate genres like the gothic, dystopia, weird fiction, post-apocalyptic fiction, ghost stories, superhero tales, alternate history, steampunk, slipstream, magic realism, fractured fairy tales, and more" (Oziewicz, 2017).
2. Based on an analysis of multiple definitions, "systems thinking is a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviors, and devising modifications to them in order to produce desired effects" (Arnold & Wade, 2015).

References

Anders, C. J. (2013, August 2). 7 deadly sins of worldbuilding. *Gizmodo*. Retrieved from http://io9.gizmodo.com/7-deadly-sins-of-worldbuilding-998817537

Bassett, C., Steinmueller, E., & Voss, G. (2013). *Better Made Up: The Mutual Influence of Science fiction and Innovation*. Nesta Working Paper No. 13/07. Retrieved from https://media.

nesta.org.uk/documents/better_made_up_the_mutual_influence_of_science_fiction_and_innovation.pdf

Bishop, P., Hines, A., & Collins, T. (2007). The current state of scenario development: An overview of techniques. *Foresight, 9*(1), 5-25. doi:10.1108/14636680710727516

Bradbury, R. (1984, January). The Toynbee convector. *Playboy*. Retrieved from https://kwarc.info/teaching/TDM/Bradbury.pdf

Brown, A. M., & Imarisha, W. (2015). *Octavia's brood: The project*. Retrieved from http://octaviasbrood.com/index.php?page=the-project

Candy, S. (2010). *The futures of everyday life: Politics and the design of experiential scenarios* (PhD Dissertation). Department of Political Science, University of Hawaii at Manoa. doi:10.13140/RG.2.1.1840.0248

Candy, S. (2015, November 2). La Chose du Futur à Paris [Blog post]. *The Sceptical Futuryst*. Retrieved from https://futuryst.blogspot.com/2015/11/la-chose-du-futur-paris.html

Candy, S. (2018). Gaming futures literacy: The thing from the future. In R. Miller (Ed.), *Transforming the future: Anticipation in the 21st century*. New York: UNESCO / Routledge.

Clarke, A. C. (1963). *Profiles of the future*. New York: Bantam.

Delistraty, C. C. (2014, November 2). The psychological comforts of storytelling. *The Atlantic*. Retrieved from https://www.theatlantic.com/health/archive/2014/11/the-psychological-comforts-of-storytelling/381964/

Dunne, A., & Raby, F. (n.d.). Design for debate. Retrieved from http://www.dunneandraby.co.uk/content/bydandr/36/0

Gunn, E. (2014, May). How America's leading science fiction authors are shaping your future. *Smithsonian Magazine*. Retrieved from http://www.smithsonianmag.com/arts-culture/how-americas-leading-science-fiction-authors-are-shaping-your-future-180951169/

Hammoud, M. S., & Nash, D. P. (2014). What corporations do with foresight. *European Journal of Futures Research, 2*(1). doi:10.1007/s40309-014-0042-9

Harari, Y. N. (2015, June). *Yuval Noah Harari: What explains the rise of humans?* [Video file]. Retrieved from https://www.ted.com/talks/yuval_noah_harari_what_explains_the_rise_of_humans/transcript#t-398029

Holling, C. S. (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems, 4*(5), 390-405. doi:10.1007/s10021-001-0101-5

Institute for the Future. (2017). Scenarios. Retrieved from http://www.iftf.org/what-we-do/foresight-tools/scenarios/

Irwin, T., Kossoff, G., Tonkinwise, C., & Scupelli, P. (2015). *Transition design* (Monograph). Pittsburgh, PA: Carnegie Mellon University School of Design. Retrieved from https://design.cmu.edu/sites/default/files/Transition_Design_Monograph_final.pdf

Jemisin, N. K. (2011, December 14). Carving a new world [Blog Post]. Retrieved from http://nkjemisin.com/2011/12/carving-a-new-world/

Johnson, B. D. (2011). *Science fiction prototyping: Designing the future with science fiction*. San Rafael, CA: Morgan & Claypool.

Kaplan, J. T., Gimbel, S. I., Dehghani, M., Immordino-Yang, M. H., Sagae, K., Wong, J. D. ... Damasio, A. (2017). Processing narratives concerning protected values: A cross-cultural investigation of neural correlates. *Cerebral Cortex, 27*(2), 1428-1438. doi:10.1093/cercor/bhv325

Klus, H. (2017). Imagining the Future: Why Society Needs Science Fiction. The Star Garden. Retrieved from http://www.thestargarden.co.uk/Why-society-needs-science-fiction.html#Ref4

Kolehmainen, I. (2016, April 5). Speculative design: A design niche or a new tool for government innovation? *Nesta*. Retrieved from http://www.nesta.org.uk/blog/speculative-design-design-niche-or-new-tool-government-innovation

Komska, Y. (2014, April 15). Can the Kremlin's bizarre sci-fi stories tell us what Russia really wants? *Pacific Standard*. Retrieved from https://psmag.com/social-justice/can-kremlins-bizarre-sci-fi-stories-tell-us-russia-really-wants-78908

Konstantinou, L. (2019, January 15). Something is broken in our science fiction. *Slate / Future Tense*. Retrieved from https://slate.com/technology/2019/01/hopepunk-cyberpunk-solarpunk-science-fiction-broken.html

Le Guin, U. K. (2005). Plausibility in fantasy. Retrieved from http://www.ursulakleguin.com/PlausibilityinFantasy.html

Liptak, A. (2017, August 11). Women swept nearly every category at the 2017 Hugo Awards. Retrieved from https://www.theverge.com/2017/8/11/16127310/2017-hugo-awards-n-k-jemisin-science-fiction-fantasy-books

List, D. (2004). Multiple pasts, converging presents, and alternative futures. *Futures, 36*, 23-43. doi:10.1016/S0016-3287(03)00140-X

Lombardo, T. (2018). *Science fiction: The evolutionary mythology of the future Vol. 1*. Alresford, UK: Changemakers Books.

McDowell, A. (2019). Storytelling shapes the future. *Journal of Futures Studies*, *23*(3), 105-112. doi:10.6531/JFS.201903_23(3).0001

Newitz, A. (2014, November 10). William Gibson on the Apocalypse, America, and The Peripheral's ending. *io9*. Retrieved from http://io9.gizmodo.com/william-gibson-on-the-apocalypse-america-and-the-peri-1656659382

Oziewicz, M. (2017). Speculative fiction. *Oxford Research Encyclopedias: Literature*. Retrieved from http://oxfordre.com/literature/view/10.1093/acrefore/9780190201098.001.0001/acrefore-9780190201098-e-78 doi:10.1093/acrefore/9780190201098.013.78

Polak, F. (1973). *The image of the future* (E. Boulding, Abr. & Trans.). Amsterdam: Elsevier.

Pomerantsev, P. (2011). Putin's Rasputin. *London Review of Books, 33*(20), 3-6. Retrieved from https://www.lrb.co.uk/v33/n20/peter-pomerantsev/putins-rasputin

Pomerantsev, P. (2014, November 7). The hidden author of Putinism. *The Atlantic*. Retrieved from https://www.theatlantic.com/international/archive/2014/11/hidden-author-putinism-russia-vladislav-surkov/382489/

Raven, P. G., & Elahi, S. (2015). The new narrative: Applying narratology to the shaping of futures outputs. *Futures, 74*, 49-61. doi:10.1016/j.futures.2015.09.003

Schultz, W., & Curry, A. (2009). Roads less travelled: Different methods, different futures. *Journal of Futures Studies, 13*(4), 35-60. Retrieved from https://jfsdigital.org/wp-content/uploads/2014/01/134-AE03.pdf

Situation Lab (n.d.). *The Thing From The Future*. Retrieved from http://situationlab.org/project/the-thing-from-the-future/

Slaughter, R. (1989). *Studying the Future*. Melbourne: Australian Bicentennial Authority / Commission For the Future. Retrieved from https://foresightinternational.com.au/wp-content/uploads/2015/09/Wells_Wanted_Profs_of_Fsight_1932.pdf

Tavakoli-Far, N. (2013, July 23). Jules Verne to Star Trek: Does sci-fi show the future? *BBC News*. Retrieved from http://www.bbc.com/news/business-23169444

Toffler, A. (1970). *Future shock*. New York: Random House.

Tweney, D. (2011, May 25). May 25, 1945: Sci-fi author predicts future by inventing it. *Wired*. Retrieved from http://www.wired.com/2011/05/0525arthur-c-clarke-proposes-geostationary-satellites/

Ullrich, J. K. (2015, August 14). Climate fiction: Can books save the planet? *The Atlantic*. Retrieved from https://www.theatlantic.com/entertainment/archive/2015/08/climate-fiction-margaret-atwood-literature/400112/

von Stackelberg, P., & McDowell, A. (2015). What in the world? Storyworlds, science fiction, and

futures studies. *Journal of Futures Studies*. doi:10.6531/JFS.2015.20(2).A25

Walter, D. (2016, June 24). Systems fiction: A novel way to think about the present. *The Guardian*. Retrieved from https://www.theguardian.com/books/2016/jun/24/systems-fiction-a-novel-way-to-think-about-the-present

Zaidi, L. (2017). *Building brave new worlds: Science fiction and transition design* (MDes thesis). OCAD University. Retrieved from https://www.researchgate.net/publication/321886159