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Research article

Wording Worlds – From Writing Futures to Building Imaginary Worlds

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Abstract

In the context of the assessment of new and emerging technologies, there is the tendency to talk about futures as different worlds. Futures, especially in a non-trivial sense, postulate a break between our world and the potential future world. This break is accompanied by a series of changes that cannot be foreseen, as no empirical knowledge exists about the impacts and the future world that will follow from them. The only knowledge that exists is based on anticipation, extrapolation or speculation and points at worlds that are somehow estranged from our world, while at the same time show similarities. I argue that the worlds talked about in the context of technological futures are imaginary worlds, meaning cognitive constructs building up on the way we perceive our reality combined with culturally shared hopes and fears. Treating future worlds as imaginary worlds allows for an examination of the work that has been done on imaginary worlds in literary and especially SF-studies. Using the framework of understanding and analyzing futures as imaginary worlds can offer a thorough approach of analyzing images of the future and helps us reimagine the future of emerging technologies more holistically.

Keywords: Technofutures; Imaginary Worlds; Imaginaries; Science-Fiction; Worldbuilding; Technoculture

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Научная статья

Миры слов – от описания будущего к построению воображаемых миров

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Аннотация

В контексте оценки новых и появляющихся технологий существует тенденция говорить о будущем как о разных мирах. Будущие миры, особенно в нетривиальном смысле, постулируют разрыв между нашим миром и потенциальным будущим миром. Этот разрыв сопровождается рядом изменений, которые невозможно предвидеть, поскольку не существует эмпирических знаний об этих воздействиях и о том будущем мире, который за ними последует. Единственное существующее знание основано на предвосхищении, экстраполяции или предположениях и указывает на миры, которые в той или иной степени отделены от нашего мира, но в то же время имеют сходство с ним. Я утверждаю, что миры, о которых говорят в контексте технологического будущего, – это воображаемые миры, то есть когнитивные конструкции, формирующиеся на основе того, как мы воспринимаем нашу реальность, в сочетании с разделяемыми культурой надеждами и страхами. Рассмотрение будущих миров как воображаемых миров позволяет изучить работу, проделанную по воображаемым мирам в литературоведении и особенно исследованиях научной фантастики. Использование структуры понимания и анализа будущего как воображаемых миров может предложить глубокий подход к анализу образов будущего и помочь нам более целостно переосмыслить будущее новых технологий.

Ключевые слова: Технобудущее; Воображаемые миры; Воображаемое; Научная фантастика; Миростроительство; Технокультура.

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INTRODUCTION

Through fiction and through poetry new ways of being-in-the-world are opened up in the midst of reality. (Ricoeur, 1975, p. 26)

In the context of the assessment of new and emerging technologies, there is the tendency to talk about futures as *different worlds*. Futures, especially in a non-trivial sense (Nordmann, 2014), postulate a break between our world and the potential future world. This break is accompanied by a series of changes that cannot be foreseen, as no empirical knowledge exists about the impacts and the future world that will follow from them. The only knowledge that exists is based on anticipation, extrapolation or speculation and points at worlds that are somehow estranged from our world, while at the same time show similarities. The question of how we can imagine the difference between both worlds and how both worlds relate to each other is the object of this essay.

I argue that the worlds talked about in the context of technological futures are *Imaginary Worlds*, similar to worlds we encounter in Science or Speculative Fiction (SF). These worlds are cognitive constructs, building up on the way we perceive our reality combined with culturally shared hopes and fears, and mediated mainly through language but also images, sounds or other artefacts.

To explore the relationship between both worlds further, I will reflect on the role of *worlds* in STS, TA and similar fields. Afterwards, I will describe how *world* is understood in literary studies and imagination studies. Lastly, I will turn to SF-studies and the work that has been done on conceptualizing storyworlds, as well as the creative practice of Worldbuilding. The aim of this paper is to combine different perspectives on the concept of *world* to reflect on the cognitive processes that are happening when writing or engaging with futures or when imagining different worlds under the impact of emerging technologies.

FUTURES AS WORLDS

Writing futures is writing about changes. Through writing, we can engage in thought experiments and explore those potential changes in different ways, for example by imagining a potential path of implications starting from our present (i.e., if X happens today, it will lead to Y tomorrow and this will lead to Z the day after). Thinking in implications allows to imagine a world that is different from ours as the implications have changed small or sometimes large parts of the world that we already know.

Since emerging technologies come with the promise of transforming the world, it is important to know about their transformative impacts and the world they might help to create. Alfred Nordmann describes this relation between future, implications and worlds in the following way:

“The future begins when a difference arises that sets the world of the future apart from that of the present. In the discussion of emerging technologies, for example, one usually posits a transformative innovation that introduces a qualitative difference, and



then wants to know what the consequences of the innovation will be in that future world." (Nordmann, 2014, p. 132)

The concept *world* is often used in the context of Technofutures, as for example in STS or in Technology Assessment. Nordmann (2014) states that visions of the future are actually different worlds, inhabited by different technologies and different people and changed through the emerging technology and its several levels of impact. Based on the depiction of these worlds through images of the futures (i.e., talks, presentations, videos, actual images, and other media), we can engage in reflecting on what other impacts might occur and cognitively and collectively explore the world further. Furthermore, we can judge whether we would like to live in such a world or what we should do to prevent it. Understanding futures as worlds takes away the heaviness of framing the future as determinant prediction and instead positions the depicted future as one alternative world. The perspective on the imagined world also allows to weigh the advantages and disadvantages and, in the end, to decide to support this world in its emergence or to prevent it. Technofutures thus become discussable in terms of their implied hopes rather than the probability of their realisation.

However, the worlds implied in images of Technofutures are often rather *thin*, means there is too little substance for deliberately debating those futures (especially in terms of desirability) as they are often mere description of the technology and lack information about their potential impacts or their social embeddedness (Fischer and Mehnert, 2021, p. 28). One reason for this is the lack of knowledge about potential impact, as information about future states are simply not given. Another reason is the lack of perspective, or rather the biases through the perception of the world. As Goodman (1978) points out, we all make different *versions* of worlds by categorizing and weighting the elements we find in our reality differently (p. 7-17). Thus, some relevant elements or categories of one version of the world might be missing in another version. For example, in one version of the world, we might see topics like energy consumption and environmental impact as an important category that is not regarded in another version of the world. These versions of perceiving the world will also inscribe themselves into imagining future worlds and influence decisions of what elements to write into the vision, what to emphasize, what to leave out and so forth. Jameson (1975) calls this “world-reduction” and describes it as “surgical excision of empirical reality in which the multiplicity of what exists is deliberately thinned out” (p. 223).

This moves the building of these worlds into the focus. As Nordmann points out, promoters of a technological vision conjure what they consider a highly desirable future world, while often leaving out or overlooking perspectives by other stakeholders, (e.g., vulnerable groups or marginalized communities). With regards to responsible innovation, we can also ask about “responsible representation” (Nordmann, 2014, p. 93) of these worlds, meaning how we should talk and think about emerging technologies and whether it is responsible to assume that the technology in question will bring about the postulated change in the world, as often the promised change and the social adaption of a technology depends on other factors that lay outside of the realm of technological feasibility (see Bijker, p. 1997).



Reading Technofutures from this perspective, they can be understood as artefacts of a present that do not present an inevitable future, but another world assumably made possible by technology. This world communicates implicit values, interests and assumptions by depicting a normative way of living together. Jasanoff and Kim refer to this part of future worlds as “sociotechnical imaginaries” (Jasanoff and Kim, 2015, p. 19), meaning shared understandings of forms of social life and social order attainable through advances in science and technology. Technofutures link culturally shared hopes and fears with the ideas of new technologies and tell stories about how the technologies are supposed to help make the desirable or avoidable worlds a reality.

In this context, Akrich points out that developers, for example, necessarily hypothesize about the properties of the world in which the technology is to be embedded. Much of the work of innovators, then, is to inscribe their vision of the world into the technology (Akrich, 1994, p. 207). These imagined and invented worlds originate in dreams and ambitions but are substantiated into people, objects, and practices (Jasanoff and Kim, 2015, p. 336), as well as technologies that link the stories, desires and reasons of a society to the material world (Haraway, 1997, p. 64). As visions of technologies provide an insight into utopian or dystopian societies that are to be achieved or prevented by technology, it can be said that the analysis of technology futures tells us more about a culture's desires than about the actual possibilities of a technology. These desires values are revealed through the language used to talk about the new world and the images made to represent this world in contemporary media and popular culture (Sturken et al., 2004, p. 7).

Lastly, Technofutures and the worlds depicted are fictional. This is not meant disrespectfully or as a devaluation; rather, fiction here is understood in a productive way, as described by Elena Esposito and Jens Beckert. Esposito emphasises that it is an inadmissible simplification to reduce the debate on (technological) futures to the opposition of reality and non-reality, because this would neglect the social relevance of fictions (Esposito, 2007, p. 120). Like Esposito, Jens Beckert also underlines the fictional character of technological futures and their social impact (Beckert, 2016). He states that fictional expectations influence the stakeholders related to the development of emerging technologies and helps them to align their actions on the idea, that this technology future is not a fiction but will soon become a reality. Hence, these fictional texts demand from their recipients the willing suspension of disbelief (Coleridge, 1817) and aim at becoming “a fiction that masks its fictionality” (Iser, 1993, p. 13).

I argue that the worlds talked about in the context of technological futures are *imaginary* worlds, meaning cognitive constructs building up on the way we perceive our reality combined with culturally shared hopes and fears. As stated above, Futures postulate a break between our world and the potential future world which is accompanied by a series of changes that cannot be foreseen, as no knowledge exists about this future world to come. The only knowledge that exists point at worlds, that are somehow different from our reality, while at the same time relate to our reality. It raises the question of how these worlds differ from the reality that we know and how they relate to each other. Treating future worlds as imaginary worlds allows for an examination of the work that has been done on imaginary worlds in literary and especially SF-studies.



WORLDS WITHIN WORLDS¹

As stated above, the concept of *world* plays an important role in thinking about the future and about the impact of emerging technologies. But what do we mean when we say, a *different world is imagined here*? One approach to answering this question is to examine the art genre that has mastered the invention of other worlds like no other: science fiction (SF). The central subject of SF is change. It is already in the name that this change is often equated with scientific and technological progress, which explains why the genre is said to be born in the middle of the 19th century, at a time when social change and technological progress could be consciously perceived for the first time in a lifetime (Vint, 2021, p. 16).

Throughout the history of the genre, the meaning of SF has been redefined again and again, often by authors or publishers to distinguish themselves from other authors and to coin their own school of writing.² Although the definitions vary, the different attempts help to understand the relation between SF and the concept of *world*. To embark into the reflection on this concept, we will start with a quote from literary theorist Robert Scholes, who defines SF as a genre that „insists on some radical discontinuity between the world present to us and the world of our experience.” (Scholes, 1975, p. ix)

The two worlds Scholes refers to are object of interest in narratology, literary studies and philosophy (see e.g., possible world theory). In these domains, the *world of our experience* is called *actual world*, *primary world* (Wolf, 2012) or *zero world* (Suvin, 1972, p. 11). This term refers to the contemporary context of the author at the time he or she wrote the story, or as Suvin (1972) puts it: the „empirically verifiable properties around the author” (p. 377). It is marked *zero*, as it is the central reference point of the literature at hand and includes not only the spatial and temporal attributions but also the cultural context that often inscribes itself into the fictional work.

The world *present to us* through the narrative is called the *imaginary world*, *secondary world* (Wolf, 2012) or *storyworld* (von Stackelberg and McDowell, 2015), meaning the place and time in which a narrative is happening, and includes not only the imaginary temporal and spatial setting, but also the technological, social, cultural or other spheres. The literary scholar and critic Marie-Laure Ryan defines an imaginary world as a non-contradictory „connected set of objects and individuals; habitable environment; reasonably intelligible totality for external observers; field of activity for its members” (Ryan, 2001, p. 91).

The relationship between both worlds goes beyond the dichotomy of fictional and real but instead both worlds are interlinked in different ways which will be explained in the following three examples.

¹ This title is taken from J.P. Wolf (2012)

² A famous example for this is Margaret Atwood’s use of the term Speculative Fiction instead of Science Fiction: „What I mean by ‘science fiction’ is those books that descend from H.G. Wells’ The War of the Worlds, which treats of an invasion by tentacled, blood-sucking Martians shot to Earth in metal canisters – things that could possible happen – whereas, for me ‘speculative fiction’ means plots that descend from Jules Verne’s books about submarines and balloon travel and such – things that really could happen but just hadn’t completely happened when the authors wrote the books” (Atwood, 2012, p. 6). For an in-depth discussion on the definition of the genre see Oziewicz (2017).



(1) Deviation & Attachment

Both worlds differ by a degree of deviation which Wolf calls *secondariness*. The level of secondariness „depends on the extent to which a place is detached from the Primary World and different from it” (Wolf, 2012, p. 26). Wolf explains this as a spectrum between a high degree of deviation and a high degree of attachment. He gives the example of Tolstoy’s (1869) *War and Peace*, a novel in which the main action is set in the actual world, to be more precise in Russia during a historical period. This novel would be on the realistic end of the spectrum, as it has a high level of attachment. On the other end he sets L. Frank Baum’s *The Wonderful Wizard of Oz* (1900). Although the story begins and ends in the actual world, the main part takes places in the fantastic land of Oz, which is a world that does not correlate with the actual world at all. Therefore, the novel would be on the opposite side of the spectrum, as it has a high level of deviation. The level of secondariness is a spectrum and different imaginary worlds are placed between both ends, depending on the level of deviation or attachment.

Thomas Pavel (1989) points out that imaginary worlds consist of two characteristics: The first characteristic is a set of elements, meaning objects, places, people and other things that are mentioned. The second characteristics is the relationship of these elements towards each other (Pavel, 1989, p. 47). The closer the elements and their relations of the imaginary world are to the actual world, the higher is the level of attachment (and vice versa). Categorizing imaginary worlds into elements and their relations allows one to determine the level of secondariness between both worlds.

In the context of images of the future, the position on the spectrum of secondariness is somewhere in the middle: The imaginary worlds describe ‘the future’ of the actual world and presents a connection to the actual world through the linearity of time and processes of change. This connection also implies that some elements or relations of the actual world will still exist in the imaginary world, as the future is an „accretive space” (Foster, 2013). The deviation between both worlds comes through the introduction of new elements called „novum” (or nova in the plural) (Suvin, 1972, p. 94), the fictitious novelty(ies) of every SF-world. The novum can exist in different orders of magnitude and range from single (or several) deviations to whole milieus and changing environments. Most prominent in SF, especially in Near-Future Science-Fiction (Mehnert, 2019), is the use of a new technological gadget. However, the novum can also come in the form of political change,³ in the form of environmental change,⁴ or through any other external or internal forces.⁵

Visions of the future, understood as imaginary worlds, are therefore somewhere in the middle of the secondariness-spectrum. They claim to depict the actual world in the future, thus include elements from the present but also elements that deviate from the

³ As in Margaret Atwood’s novel *The Handmaid’s Tale* (1985), in which the government of the fictional country Gilead has drastically shifted the social power and gender dynamics.

⁴ For example, the subgenre of climate fiction, like Kim-Stanley Robinson’s (2018) *New York 2140*, uses environmental catastrophes as the central novum to create the deviation between the actual and the imaginary world.

⁵ As in Tom Perrotta’s (2012) novel *The Leftovers* where the imaginary world is very close to the actual world with the only difference that all of a sudden two percent of all mankind have vanished.



present. Wolf (2012) gives the example of Ridley Scott's (1982) *Blade Runner* which takes place in Los Angeles in the year 2019. Los Angeles is part of the actual world, although the city depicted in the movie deviates from the actual Los Angeles. *Blade Runner's* Los Angeles consists of a number of nova which deviate the depicted world from our actual world – mainly new technologies like replicants, artificial animals or flying cars but also cultural changes like housing situations, interplanetary traveling and a rising Asian population. However, the relations of the elements show similarities to the actual world. For example, the technologies shown are owned by private tech-corporations that use them to gain power and wealth. The replicants, artificial human beings, are owned by the corporations and treated like slaves fighting for their freedom. Hence, the elements in these imaginary worlds might differ, but their relations are similar to the relations in the actual world. These kinds of imaginary worlds show us an estranged form of our actual world and allow us to reflect on the aspects that are left unchanged.

(2) Accessibility & Completeness

Both worlds are structured hierarchically, meaning that the actual world contains imaginary worlds. Storyworlds, although being fictional, exist in the Primary World, as we can refer to them, talk about them but also experience them by immersing ourselves into stories presented through books, films, video games and other media formats, such as appendices, glossaries or maps or images, sounds, or other artefacts. In short, for an imaginary world to be experienced, it needs to be accessible through a medium. Ryan, focussing mainly on literary texts, uses the metaphor of *text as window* and says:

„The text is apprehended as a window on something that exists outside language and extends in time and space well beyond the window frame. To speak of a textual world means to draw a distinction between a realm of language, made of names, definite descriptions, sentences, and propositions, and an extralinguistic realm of characters, objects, facts, and states of affairs serving as referents to the linguistic expressions.” (Ryan, 2001, p. 91)

Understanding narrative texts as windows into other worlds means to rely on the linguistic expressions which allow access to the realm of the extralinguistic, the world behind the text. As Pavel puts it: „Thus, to speak about a [world] containing colours, one needs a language that possesses qualitative predicates” (Pavel, 1989, p. 52).

In SF, the postulated changes are expressed through language. However, many of the elements presented do not exist in the actual world and therefore are lacking the words to describe them. At this point, language needs to be reinvented through the use of neologisms. Wolf points to the role of neologisms in representing deviant and imagined worlds and says that new words or different names can draw attention to different aspects of familiar things or even define new concepts (Wolf, 2012, p. 35). The SF author William Gibson, one of the most important authors for contemporary SF, creates in his debut novel *Neuromancer* (Gibson, 1984) a variety of examples of this, as can be seen in the following brief description of the world. In the story, we follow Case, a *Console Cowboy*⁶ who lives

⁶ Console Cowboys stands for an archetype of a hacker.



in the *Sprawl*⁷ and suffers from the loss of his ability to tap into the cyberspace matrix. He used to be a thief who worked for other thieves, hacking through *ICE*⁸ to steal data from large multinational corporations called *Zaibatsus*. One day he stole from his clients, who in return cut off his access to cyberspace.

The neologisms highlighted above do not make sense without the appropriate context that is of the imaginary world. To create the context, SF authors work with a multitude of small glimpses and episodic descriptions of the everyday life of the protagonists and their individual life worlds. These impressions condense in the reader's mind to a holistic understanding of the altered world and allow a context to emerge during the reception. With regards to the recipient, narratologist David Hermann (2003) also speaks of cognitive mapping, referring to the process by which readers develop mental models of the (spatial) relationships between characters, objects, places, and regions mentioned or implied in a narrative (p. 21).

While we can access imaginary worlds from the actual worlds, there is also a connection the other way around. Sometimes, elements from the imaginary world spill over and find their form in the actual world. Staying with the example of Gibson's *Neuromancer*, the term *Cyberspace*, which he popularized through his novel, became a vision for engineers and developers of VR-applications in the 1990s. Als literary critic Katherine Hayles points out:

„The Neuromancer trilogy gave a local habitation and a name to the disparate spaces of computer simulations, networks, and hypertext windows that, before Gibson's intervention, had been discussed as separate phenomena. Gibson's novels acted like seed crystals thrown into a supersaturated solution; the time was ripe for the technology known as cyberspace to precipitate into public consciousness.” (Hayles, 1999, 36)

As an example, Hayles refers to John Walker, the co-founder of the software company Autodesk, who uses the term cyberspace in the formulation of his vision of three-dimensional virtual reality image software (Walker, 1989). On Walker's account, pop-cultural fiction advances to become the guiding principle for technological development of the company, which is not very uncommon. Elements from imaginary worlds of SF are often adopted by the industry. Schröter emphasises here that the adoption of popular semantics can be useful because terms such as cyberspace are also connectable outside of science, which under certain circumstances favours communication between research and industry or the procurement of funds for research projects (Schröter, 2004, p. 32). However, often the elements that spill over from the imaginary world into the

⁷ Officially known as the Boston-Atlanta Metropolitan Axis; an urban area that developed along the east coast of the United States and merges all major cities between Boston and Atlanta. Geodetic domes cover parts of the *Sprawl* (n.d.), which hinders the residents from experiencing the natural day-night cycle and the weather. As describe in the fandom glossary of the imaginary world: „Before dawn the geodesics are lightening into gray and then pink” („*The Sprawl*”), which also explains the famous first lines in the book: „The sky above the port was the color of television, tuned to a dead channel” (Gibson, 1984, p. 1).

⁸ *Intrusion Countermeasures Electronics* is a spatial firewall that protects sensible data and computer systems: „Ice patterns formed and reformed on the screen as he probed for gaps, skirted the most obvious traps, and mapped the route he'd take through Sense/Net's ice. It was good ice. Wonderful ice. ... Its rainbow pixel maze was the first thing he saw when he woke. He'd go straight to the deck, not bothering to dress, and jack in. He was cutting it. He was working. He lost track of days” (Gibson, 1984, p. 67).



actual world lose their relational properties. While the cyberspace in the world of Gibson's *Neuromancer* is a hostile place that holds the human mind captive, the cyberspace used in the vision of Autodesk and other industry companies becomes a shinier and glossier one, where the potential critical parts are left out.

(3) Inscription & Interpretation

Understanding futures as worlds means that every image of the future is a window to an imaginary world. However, oftentimes crucial elements constituting the imaginary world are only implied, meaning, they are in the world but not inside of the window.

For one, the actual world inscribes itself into the imaginary world. Therefore, a hermeneutic analysis of SF narrations can help to uncover the assumptions of how technology is supposed to shape society - assumptions that were guiding the anticipatory extrapolation of the author (Mehnert, 2021), as the visions presented in the narrative are not presenting an actual future but instead represent the sociotechnical imaginaries (Jasanoff and Kim, 2015) of the author's zero world and the foundation on which his or her speculation is based upon.

Aside from the author, the reader also engages with the depicted world by extrapolating it further and exploring the areas outside of the window frame. This process, that Ekman and Taylor call „readerly worldbuilding” (Ekman and Taylor, 2016, p. 11), builds upon the hermeneutical construction of the reader who adds elements to a structure presented by the author. Ryan points out that the reader constructs in imagination a set of language independent objects to build a more vivid representation of the imaginary world. For this activity, the reader imports information from their own „cognitive models, inferential mechanisms, real-life experience, and cultural knowledge, including knowledge derived from other texts” (Ryan, 2001, p. 91). Thus, immersing oneself into an imaginary world relies on the way in which texts are set up and what clues are perceived, but also on the reader's reconstruction of these cues during the reading process. Or, as Bruner puts it:

„As our readers read, as they begin to construct a virtual text of their own, it is as if they were embarking on a journey without maps-and yet, they possess a stock of maps that might give hints, and besides, they know a lot about journeys and about mapmaking. First impressions of the new terrain are, of course, based on older journeys already taken.” (Bruner, 1987, p. 36)

What Bruner and Ryan hint at are the learned experiences of the readers from other journeys into imaginary worlds. To navigate an imaginary world of the future, it presumably helps to have read other texts about imaginary worlds of the future before. In each text we learn something new about the potential existing elements and through reading about them, we become familiar with these elements. In this context, Damien Broderick (1994) points to the existence of an extensive mega-text of SF which is composed of the numerous individual texts and resembles a collection of different elements and relations from which SF authors and readers can quote or refer to. This megatext includes elements such as alien monsters, spaceships, robots, futuristic cities, but also things like space travel, the technological enhancement of the human body, and



more. At the same time, the mega-text is not rigid, but expands and changes over time and with the new novels that are added:

„When novelties like hyper-space and cyberspace, memex and AI (Artificial Intelligence), nanotech and plug-in personality agents are very quickly taken up as the common property of a number of independent stories and authors, we have the beginnings of a new mega-text.” (Broderick, 1994, p. 59)

Just as the mega-text is not a rigid entity, the elements themselves are also subject to processes of change and thus do not have an unchanging meaning. The robot, for example, is a steady element of the SF-megatext but its relation to the human has been reinterpreted several times (Lin, 2022). For example, robots range from dangerous or disturbing machines in the Terminator franchise, to helpful or funny assistants in the Star Wars universe. Yet all these variants bear certain similarities, meaning a specific element (e.g., the neurointerface, robots, spaceships, etc.) are hold together by a limited number of narrative vectors and only attract a relatively small range of possible meanings and relations (Broderick, 1994, p. 60).

The SF-megatext also entails spill-over effects from the imaginary world to the actual world. Through the repeated use of typical elements, for example emerging technologies like robots, neurotechnologies or tractor beams, SF normalizes these elements and makes its readers comfortable with them. It therefore reduces the disbelief or the acceptance that these elements could potentially exist in the actual world. With a reference to the film *Threshold* (Pearce, 1981), the media scholar David Kirby (2010) explains how SF was as used a format of public relations to reduce „public anxiety about the implantation of a permanent artificial heart in humans”. In the movie, the artificial heart became the novum of the imaginary world and is identified as the one element that sets the two worlds apart. Kirby refers to this as *diegetic prototypes*, these prototypes are displayed in the context of the film and the imagined world. They „entail an additional visual and narrative rhetoric specifically framed so as to encourage audience support for the development of the technology on the screen” (Kirby, 2010, p. 44). Through the use of diegetic prototypes, emergent technologies are contextualized within a social sphere.

Becoming familiar with the estranged ideas and unconventional elements presented in the imaginary worlds of SF also reduces our doubt about these elements becoming part of our actual world, or as SF author Isaac Asimov pointed out:

„Science fiction writers and readers didn’t put a man on the moon all by themselves, but they created a climate of opinion in which the goal of putting a man on the moon became acceptable.”⁹

With these reflection on the relationship between worlds, I will now explore three different ways of SF to build imaginary worlds.

EMBARKING TO OTHER WORLDS

To explain how SF writes about change and how it writes about different worlds that are estranged from ours through the novum, I will start with what Eugene Thacker calls the „mode” of SF:

⁹ The actual source of the quote is unknown.



„Science fiction names a contemporary mode in which the techniques of extrapolation and speculation are utilized in a narrative form, to construct near-future, far-future or fantastic worlds in which science, technology and society intersect.” (Thacker, 2001, p. 156)

Thacker differentiates between two modes of exploration: Extrapolation and speculation. These two modes of thinking are at the core of SF and also regulate the level of secondariness, the deviation between the actual and the imaginary world as explained above. According to McHale (McHale, 1989, p. 244), extrapolative SF¹⁰ begins with the current state of the actual world and proceeds to construct a world which might be a future extension or consequence of the current state of affairs. Speculation on the other hand involves an imaginative leap from the actual world which cannot (or only vaguely) be connected to the current state of affairs¹¹. In other words, SF based on extrapolation displays a larger attachment to our actual world than SF based on speculation does.

Beyond the secondariness of an imaginary world, there are different ways in which the relation between the elements in the world are displayed. Judith Merrill, SF-writer and activist, suggests in her essay „What do you mean: Science? Fiction?” (1966) three different types: (1) Teaching Stories, (2) Preaching Stories, and (3) Speculative Fiction. These three different approaches can be positioned between two extremes which author Robert Heinlein defines as follows:

„There are at least two principal ways to write [SF] — write about people or write about gadgets.” (Heinlein, 1947/2017, p. 17)

(4) The Teaching Stories

If we follow Heinlein's quote from above, *Teaching Stories* assemble stories solely about gadgets, meaning new technologies or fantastic inventions. The stories focus on possible innovations, convey scientific ideas, present new technological applications, and hold an educational function in the sense of science communication.

The approach has its origins in the fantastic works of Jules Verne or H.G. Wells. Inspired by the techno-romantic tales of flying ships, time machines, and submarines, American authors in the early 1920s wrote stories about inventions such as rocket engines or robots. In the history of SF, this period is better known as the *Pulp Area*, because the short stories appeared in so-called pulps, meaning inexpensive magazines printed on cheap paper and sold as dime novels (Mamczak, 2021, p. 66). The most important magazine in hindsight was *Amazing Stories - The Magazine of Scientification*, edited by author, publisher and technology enthusiast Hugo Gernsback. Under the credo *Tomorrow's machines today*, Gernsback published short stories about possible machines of the future. The stories were not particularly sophisticated and usually followed the

¹⁰ As examples we can think of any kind of near-future SF (Mehnert, 2019), such as *Black Mirror* (Brooker, 2011) or the film *Her* (Jonze, 2014).

¹¹ Examples for this would be *The Foundation Trilogy* (Asimov, 1942/2010), *The Lefthand of Darkness* (Le Guin, 1969) or *Dune* (Herbert, 1965/1990). These three series of novels each play in one imaginary world. In each of these worlds, humankind has expanded over lightyears away from earth, founded new colonies, developed new technologies and even transformed human beings evolutionarily to the point of unrecognizability.



same pattern. They contained detailed descriptions of technological innovations, delivered in ponderous prose and illustrated by flat characters and wooden dialogues. They were technocentric, putting technology in the foreground and discussing social implications or societal changes - if at all - only in passing. Therefore, the world depicted can be described as rather thin.

Before Gernsback concentrated on SF, he published magazines about radios, such as *Modern Electrics*, *The Electrical Experimenter* or *Radio Amateur News*. Here he repeatedly interspersed fictional stories about curious inventions. The stories were so well received that he turned them into his own magazine (Mamczak, 2021, p. 67). Hence, Gernsback saw *Amazing Stories* as an innovative format for science communication. The detailed descriptions of the technologies aimed at inspiring discussions about the technologies themselves, as Gernsback (1926) emphasized in the preface to the first publication of *Amazing Stories*:

Not only do these amazing tales make tremendously interesting reading — they are also always instructive. They supply knowledge that we might not otherwise obtain — and they supply it in a very palatable form. For the best of these modern writers of scientifiction have the knack of imparting knowledge, and even inspiration, without once making us aware that we are being taught. (p. 12)

Hayles Twenty years after Gernsback, authors such as Arthur C. Clarke and Isaac Asimov continued this form of SF under the title of *Hard SF*. Their works were oriented towards what was technologically feasible and served as inspiration for future generations of engineers by providing technological imaginaries.¹²

(5) The Preaching Stories

The counterpart to *Teaching Stories* are *Preaching Stories*. On Heinlein's *People-Gadget* spectrum cited above, these stories would be on the *People* side. They are allegories or satires that are more concerned with the behaviour of human society than with its future technologies. These include works by Ray Bradbury, Aldous Huxley, and other representatives of utopian and dystopian novels. The stories, as well as the worlds described in these stories, follow the author's moral concepts rather than the causal implication chains of technological innovations.

With the focus on socio-cultural changes, this mode of SF is also called *Soft SF* and includes narratives that primarily concentrate on the extrapolation from the social sciences (e.g., sociology and psychology)¹³ or narratives in which engineering and natural sciences do not play a relevant role (Prucher, 2007, p. 191). Examples of this mode are stories that deal with future social orders, such as George Orwell's (1949) *1984*, a novel

¹² For example, Clarke's collaboration on the screenplay for the movie *2001: A Space Odyssey* (Kubrick and Clarke, 1968) formed the way we imagine the aesthetic of space travel up until today, and Asimov's three laws of robotics still serve as a significant imaginary in the discourse surrounding the development of A.I. and robotics.

¹³ A famous example would be Aldous Huxley's *Brave New World* (Huxley, 1932), whose world builds upon an extrapolation of behaviorism and conditioning, the psychological paradigms of the early 20th century. For another example, see the anthology *Apeman, Spaceman: An Anthology of Anthropological Science Fiction* (Stover and Harrison, 1972).



about a totalitarian state that is sustained by new technologies. However, the novum here is not the technologies but rather the dictatorial program of the INGSOC party. The novel follows the guiding question of *What if England were to turn into a totalitarian regime?*

Another example is H.G. Wells' (1895) novel *The Time Machine*. The novel is about two unnamed time travelers who travel to the future of the year 802.701, a world in which humanity has evolved into two groups: the Eloi and the Morlocks. While the Eloi live on the surface of the Earth and enjoy carefree living, the Morlocks are condemned to a life underground and operate huge machines that enable the Eloi to maintain their standard of life. The novel focuses on the social class differences that Wells extrapolated from Victorian England into the future. The new technology in the novel - the time machine - serves only as a plot device to advance the development of the story. It becomes a means of transportation so that the protagonists can travel within the diegetic world and so the author can explain the world to the reader through the eyes of protagonists. As a soft SF narrative, the novel thus deals with social class differences and creates an analogy to the conditions of the time. The time machine itself takes only a supporting role. If the novel were a hard SF story, Wells would address the physics of time travel and describe the (im)possibilities of the technology, while the class distinctions he moralizes about would fade into the background. Wells is also unconcerned with how the world and how society would change with the introduction of a time-machine,¹⁴ because the machine itself plays no role in the future world he describes.

(6) Speculative Fiction or SF as Technology assessment

The previous modes of SF can be understood as two dichotomous extremes. Individual works tend more towards one end of the spectrum or the other and either tell stories about gadgets or about people, while others lie somewhere in between and tell stories about gadgets and their relations with people. Thus, it is not just a matter of describing a future technology with technical precision (see Teaching Stories) or reflecting on political and social upheavals (see Preaching Stories). Instead, imagining the sociotechnical changes driven by new technologies can also provide the point of reflection in the narratives. A good example for this is the following phrasing:

„A good science fiction story should be able to predict not the automobile but the traffic jam.”¹⁵

This mode emerged in the Golden Age of SF and is heavily influenced by the work of publisher Joseph Campbell and his interest in the social impact of new technologies (Merril, 1966, p. 32). One of the writers in Campbell's network was Robert Heinlein. With his essay „On the Writing of Speculative Fiction” (1947) he coined an approach to SF that was deliberately different from the modes described earlier:

What we do mean is the speculative story, the story embodying the notion ‘just suppose...’ or ‘What would happen if...’. In the speculative science fiction story accepted science [...] are extrapolated to produce a new situation, a new

¹⁴ As is the case, for example, in the novel *How to Live Safely in a Science Fictional Universe* (Yu, 2011).

¹⁵ It's unclear who to give credit for this quote, as SF-authors Robert Heinlein, Isaac Asimov and Frederik Pohl (among others) all used it in different context (see O'Toole, 2019).



framework for human action. As a result of this new situation, new human problems are created – and our story is about how human beings cope with those new problems. The story is not about the new situation; it is about coping with problems arising out of the new situation. (Heinlein, 1947/2017, p. 3)

SF thus becomes a form of „narrative technology assessment” (Steinmüller, 2016, p. 328). Read as a possible future development, this form of SF creates knowledge about the future, using methods similar to those used in foresight processes, for example scenario building. SF in the mode of Heinlein’s Speculative Fiction becomes a thought experiment on sociotechnical interaction: It introduces an emerging technology into the known world and creates an estranged environment that reveals something about the new technologies and human interactions with it (Merril, 1966, pp. 26-27).

The understanding of SF as a sociotechnical thought experiment runs through SF studies to this day and has established itself as a general definition of the genre. For example, Alex McDowell, the set designer for the film *Minority Report* (Spielberg, 2002), describes SF as a space in which to prototype more detailed interactions between new technologies, potential users, the places they live in, and many other elements of the imaginary world (von Stackelberg and McDowell, 2015, p. 32). The German futurologist and SF author Karlheinz Steinmüller speaks of *epistemological science fiction*, in which various aspects of new technologies, such as prerequisites or consequences, are cursorily explored (Steinmüller, 2016, p. 321). Former IBM futurologist Brian Johnson (2011) speaks of „science fiction prototyping” and describes a way of using speculation about new technologies as a method for ideation processes in the industry. In the context of so-called „Responsible Research and Innovation”, Stahl et al. (2014) state that writing SF that relates to the actual development process of new technologies can help developers explore and better understand the social, ethical, and cultural implications of the technologies being developed (p. 82). While SF writing has now also found its way into the training of engineers and developers (Berne and Schummer, 2005), diverse educational institutions rely on the use of SF as a resource and heuristic. Arizona State University and the Centre for Science and the Imagination or the Future of Humanity Institute at the University of Oxford are most notable for drawing on SF in order to think about the future in different contexts and to understand the intertwined concatenations of change that might result from postulated technological change (Vint, 2021, p. 42).

Futurologist Ruth-Ellen L. Miller concludes that deliberate speculation about the possible consequences of new technology is a useful complement to the rather dry, analytical, and statistical assessment of emergent technology. SF brings into focus cultural and human factors that are often ignored by other foresight processes. As an example, she cites Robert Heinlein’s story „Blowups Happen” (Heinlein, 1940/1975), in which Heinlein described the Three Miles Island accident nearly forty years before the event happened in the actual world:

„Heinlein wrote a story that focused on the constant pressure on personnel to keep abreast of what was happening in a reactor. In the process, he managed to predict almost exactly the one set of events that the team preparing the IA report on the project had dismissed as too improbable to evaluate [...] – but which were very close to what actually occurred [...]” (Miller, 2015, p. 108)



From this example, Miller concludes that impact assessments of a technology often address only social systems, values, and political issues, or focus on technologies, economics, and ecologies but leave out the direct human experience. The worlds developed in SF on the other hand entangle the technologies, economies, and ecologies, and share them through a focus on the characters' experiences. Taken together, the two approaches provide a full picture of the potentials, with some overlap (Miller, 2015, p. 109).

SF, in the sense of the Speculative Fiction thinks technology & society together as a sociotechnical system. SF stories create a kind of scenario which differs from the scenarios from classic foresight processes in the depth of detail. While classical scenario processes try to open up multiple futures, SF stories go into depth, describe in detail one potential future and build an imaginary world around it. This world is described and explored, for example, through the perspectives of different characters or with focus on the impact on different aspects of the world (e.g., different milieus, cultures, environments, behaviours, etc.). Thus, while the world developed does not intend to be compared with other worlds - as in best vs. worst case scenarios - it does create a higher level of detail in the form of dense descriptions of sociocultural changes under the influence of emerging technologies. Literary scholar Eva Horn describes this in the following way:

„[SF authors] ask: ‘what if ...?’ and answer this question with a set of hypothetical narratives that are as well-informed, fact-based, but at the same time as creative as possible. Their epistemological advantage over abstract modelling of the future lies in their concreteness: they offer a ‘thick description’ of the future that serves to imagine it en détail, in the simultaneity and complex interconnectedness of its various aspects. (Horn, 2014, p. 39)

CONCLUSION

Reading Technofutures as imaginary worlds allows us to engage differently with the postulated visions in several ways. First, understanding that Technofutures are only windows into imaginary worlds reminds us that the depiction is necessarily incomplete. There is more of the world beyond the window frame which needs to be explored to create a more *responsible representation* of the imagined future at stake. This can be done by engaging in an extrapolating activity based on the cues of the imaginary world that have already been laid out (*readerly worldbuilding*). Such an activity can also help re-imagine the presented imaginary world, by for example, replacing elements or changing the presumed relations. As the future does not have to be a technological design, this activity also invites to re-imagine imaginary worlds that can help foster different perspectives and estrange our ways of knowing the world.

Second, worlds are entangled, that means it is not just about one element on its own, but it is about the relations of these elements to each other and the actual world. Becoming aware of the entanglement and the feedback cycles that are created between both worlds allows us to reflect on the role that mediated imaginary worlds play in reflections of the future.



Lastly, imaginary worlds are inspired by the worldview of the authors. Thus, analysing worlds can also help us understand how we currently perceive the world and how this world could be different. Every future imagination is bound to the „immanence of the present” (Grunwald, 2006) and to the statements and imaginaries about futures that are currently circulating as part of a larger megatext. Therefore, they must be read as the product of their present and not as statements about an actual future.

Using the framework of understanding and analysing futures as imaginary worlds can offer a thorough approach of analysing images of the future and helps us reimagine the future of emerging technologies more holistically.

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