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Science fiction has always been a part of literature, and books and novels categorised as science fiction often contain technology. The technology introduced in the book might be known to us, and some of the technology might be something the future holds. Technology is a big part of human life, although technology is not just things that are electric; this is what most people think of when they hear the word technology. Everything made by humans can be categorised as technology; the wheel, for example, is one of the most important inventions made. However, in this essay, the technology that will be analysed does have some connection to electricity. Frank Herbert's *Dune* was published in 1965, and is categorised as one of the classic science fiction novels. This essay will look at and analyse some of the technology found in *Dune*, using Sheila Jasanoff and Sang-Hyun Kim's concept of sociotechnical imaginaries. This is a term used when describing ideas of the past or present that will affect the future. The definition is retrieved from chapter 1 of the text "Future Imperfect" (2015). In "Future Imperfect" their definition of sociotechnical imaginaries is that the imaginaries are visions of a desirable future that are collectively held. This could include advances in social life, or it could be within science and technology (2015, Jasanoff & Kim). Jasanoff and Kim also begin their text by mentioning that "technological innovation often follows in the heels of science fiction" (2015).

Frank Herbert's *Dune* is categorised as hard science fiction; therefore, this essay will look at the definition of the term hard science fiction. As Kathryn Cramer writes in the chapter "Hard Science Fiction" in *The Cambridge Companion to Science Fiction* (2003), David Hartwell made a list of criteria used to recognise hard SF. According to this list, hard SF is a category of literature that focuses on the beauty of the truth; this includes making the events of the story seem plausible (2003). To make the story seem plausible, it engages in technology. In *Dune* the characters interact with technology; even though the technology is made up for the universe *Dune* is set in, it gives the reader something realistic and plausible to focus on. The technology chosen from the book are the shields, the aircraft called ornithopter, the stillsuits, a vital technology that reproduces water using the moisture from the wearer's body, and the hunter-seeker, an assassination device.

The stillsuits in *Dune* is comparable to cyborgs; therefore this essay will look at Donna Haraway's text "A Cyborg Manifesto" (1984). In this article Haraway defines the term cyborg as a hybrid of organism and machine; one part cannot live without the other (1984).

Frank Herbert wrote *Dune* in 1965. The plot of *Dune* itself is set in a distant future,

where humans have colonised the universe. In this book, we meet Paul Atreides and his father Leto and his mother, Jessica. The family is moving to another planet, where they are taking over the leadership, this is the desert planet Arrakis, which is very different from their lush home planet Caladan. Arrakis is the only place to find the most valuable element in the universe, the spice Melange; this spice makes space travel possible, and it has the ability to increase the lifespan of a person. Thus people and creatures of the universe want to control the planet. On Arrakis, Paul Atreides and his family meet the natives of the planet, called the Fremen. The Fremen have developed a technology that helps them survive in the desert and to survive Paul, and his family have to learn how to use this technology efficiently. After the Harkonnens, who lead the planet before Paul and his family came and took over, attacks the Atreides family and kills Paul's father. Paul and his mother flee into the desert where they are taken in by the Fremen; Paul and Jessica get to live with the Fremen for a while. While living with the Fremen, Paul and Jessica teach their way of fighting to the Fremen, and the Fremen teaches Paul how to fight like them; they create a partnership. In the end, this partnership is what helps Paul and the Fremen win the war against the Harkonnens.

During Paul and Gurney's training exercise (1965, p.36) the reader is introduced to the body shields. Gurney is the master of arms, and he is responsible for teaching Paul the way of personal combat which uses the shields and how to penetrate them. The defensive shields are created by a Holtzman generator (1965, p.573), and they provide almost perfect defence for the wearer, the space crafts or the ornithopters using it. The shield deflects fast travelling projectile weapons and the only way to penetrate the shield is with a slow-moving attack (1965, p.573). A Holtzman generator is powered by the Holtzman Effect; the definition of this is not given in the novel or found in any articles. Paul feels the electric tingling of the shield, and every time the edges of the shields touched, he could feel the tingling (1965)**.** Body shields, also known as full shields, are easy and quick to use, and they do not take up much space when they are not in use. "Paul snapped the force button at his waist, felt the crinkled-skin tingling of the defensive field at his forehead and down his back, heard external sounds take on characteristic shield-filtered flatness." (1965, p. 37). When the shield is not active it is stored as a belt, the shields also attune to the topography of the wearer or the craft and do therefore not form an 'air bubble' or a projected surface; making the shields easy to use and non-restraining. However, in David Lynch's movie rendition of *Dune* (1984) the shields are portrayed as blocks. Making the shields less aerodynamic.

Despite this, there are some limitations with the shields; these limitations include the

lack of oxygen and vulnerability of the wearer. As mentioned above, the only way to penetrate a shield is with a slow-moving attack. A fast-moving object or attack on the outside of the shield will be deflected. This does also apply when firing weapons from the inside of the shield; if a weapon is fired from inside the shield, this might result in the shooter getting killed by the radiation created by the shield.

In the training scene with Paul and Gurney, Paul talks about the way to pierce the shield's defence, "'In shield fighting, one moves fast on defence, slow on attack,' Paul said. 'Attack has the sole purpose of tricking the opponent into a misstep, setting him up for the attack sinister.'" (1965, p. 37). Growing up with Gurney's shield training, Paul learns a particular way of fighting, a slow and personal way. On Arrakis the fighting is quite different than he is used to, as the shields pose a treat out in the desert it is not used by the Fremen. The electrical currents made by the shield have the ability to summon sandworms, which are large worm-like creatures that live in the desert. The Fremen have learned to fight in a way that does not require shields, therefore to be able to fight the Fremen the opponent has to de-activate the shield, as the shield blocks projectile weapons; resulting in the shooter being vulnerable.

In the Deep Desert areas of Arrakis, a live shield will always attract a giant sandworm, as Kynes tells Duke Leto on their way out into the desert "'activate a shield within the worm zone and you seal your fate. […] No man wearing a shield has ever survived such attack.'" (1965, p.125), meaning wearing a shield in the desert is practically suicide. Their shielded ornithopter can fly over the desert with no problem, but even then, the pilot must avoid flying to low. Hence, warfare in the wasteland is, as mentioned above, mostly done with projectile weapons and a personal firearm. The Harkonnens and Sarduakar, "the soldier-fanatics of the emperor" (1965, p.571), are used to the Fremen not using the shields; this leads to their, the Harkonnens, demise at the end of the book. After Paul and his mother flee to the desert, they train with the Fremen and decide to use shields in the end-war to be able to overpower the Harkonnens and Sarduakar, who are expecting the Fremen to fight without shields. The Fremen are ruthless in the fighting, and the Harkonnens has always been able to take them down with the help of firearms and projectile missiles, but when the Fremen uses the shields, there are protected from the attacks.

Another limitation with the shield is that the air inside it goes stale after only a few minutes of combat. This is shown in the training exercise between Paul and Gurney, and every time the shields touch the air inside grows thicker "[t]he air within their shield bubbles

grew stale from the demands on it that the slow interchange along barrier edges could not replenish. With each new shield contact, the smell of ozone grew stronger." (1965, p.38). For longer fights, the wearer would have to de-activate their shield to catch their breath, and then return to the fight. Although, doing so would make the wearer vulnerable to firearms and projectiles, as mentioned before.

However, in the end, there is no such thing as a "perfect" defence. Given enough energy or mass, any defensive shield or system can be overpowered. The fact that the sandworms have the ability to destroy a shielded target would indicate that shields do have a weak spot. Nevertheless, it is easier for the wearer to take cover from incoming fire, than it is for the airborne ornithopter if they are trapped somewhere without the shield. This is not technology available in real life yet, and it might take many years before it will be possible. The shield is a technology that would be useful to for example Médecins Sans Frontières, MSF/Doctors without borders, as they would be able to do their job without getting caught in the middle of the danger. MSF does not have any reasons to fire out of the shield as well, making this technology perfect for them and this kind of work.

After Paul and his family arrive at Arrakis, Paul is in his room when the headboard over the bed opens up. From within the headboard, a hunter-seeker reveal itself, this is an assassination weapon that, as Paul mentions in the book, every royal child learns about. The hunter-seeker in the novel is described as tiny and no more than five centimetres. The seeker is guided by an operator not far from it. The hunter-seeker is described as an assassination weapon that "could borrow into moving flesh and chew its way up nerve channels to the nearest vital organ." (1965, p. 72). The size and way of attacking make the hunter-seeker the perfect assassination weapon; the tiny device would be hard to detect for the untrained eye, and its attack would be quick and quite fatal. As mentioned, the hunter-seeker is remote controlled, this means that the operator does not have to be in the same room as the target.

However, there are some limitations to the hunter-seeker. The operator depends on the transmitter eye, and as explained by Paul in the novel the eye would need light to reflect its target (1965, p.72). This would mean the operator would have to look for any kind of movement, risking hitting something else than the target.

This technology can be compared to drones. The first unmanned aerial vehicle (UAVs) was built during the First World War (2018, IWM staff). Having said that there are several types of drones. As Roger Berkowitz writes about in the chapter "Drones and the Question of 'the Human'." in the text *Ethics & International Affairs* (2014), there do exist some

misunderstandings of what a drone is. Berkowitz presents two sources for these misunderstandings; the first is the extensive disregard to technology, and the second is the line that is drawn between the transport drones and the military drones. In the text, Berkowitz looks at the drones and how they are used in war, where he mentions the speech of the roboticist Ron Arkin that talks about how robots are able to "' identify, target, and engage in the battlefield without human intervention.'" (qtd. in Berkowitz p.166). The description given by Arkin fit the hunter-seeker, and the hunter-seeker is used as a military weapon. The hunter-seeker is a sociotechnical imaginary, it is a technology that will be available sometime in the future, but as in *Dune,* it will be a part of the military drones and not the drones that can be used for transport of cargo. Stark Draper Laboratory in Massachusetts is working on a backpack that will be used on insects made with nanotechnology (2017, Jackson). This technology is the closest thing to a hunter-seeker that can be found in real life.

When Paul and his father go to the desert for the first time, with the ecologist Kynes, they are introduced to the Fremen technology called the stillsuits. The stillsuits are described as a "body-enclosing garment invented on Arrakis. Its fabric is a micro-sandwich performing functions of heat dissipation and filter for bodily wastes. Reclaimed moisture is made available by tube from catchpockets" (1965, p.574), meaning the suits takes the moisture produced by the wearer and turns it into drinkable water. This technology is a vital part of the survival on Arrakis. The suits, therefore, becomes a part of the ecology on the planet. Ronny Parkinson writes in the text *Et Cetera,* in the chapter discussing the ecology in Frank Herbert's *Dune*, that ecology is a central theme of the novel (2010). It is mentioned that the novel looks at the "relation and interaction between organisms and their environment" (2010, Parkinson), in this case, the organisms in the novel are the humans and the residents on Arrakis. After World War II ecology grew to be one of the major themes in science fiction, "The precariousness of the human ecological situation har gradually but inevitably become one of the major themes of SF" (qtd. in Stratton, p. 303). The writers created alien ecologies, like in *Dune.* With that said, the stillsuits has become such a crucial technology for the residents of Arrakis; the residents are comparable to cyborgs. Their lives depend on the machine, and in "A Cyborg Manifesto" Donna Haraway describes a cyborg as "a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction" (1984, p.5,), one part cannot function without the other. The Fremen developed this technology to be able to survive in the desert for longer periods. If someone is stuck in the desert, the only thing that can save them is the stillsuit. With water being so precious on

Arrakis, Paul and his family have to learn how to use the suits properly. The suits collect their body water and after someone dies the water of the person belongs to their tribe. The water of the dead is divided between the remaining tribe members. One of the reasons the Fremen uses water sparingly is that they are trying to change the ecology of the planet. Thus, the suits help them save water, that later can be given to the planet. The technology closest to the stillsuits found in real life is rebreather for Special Forces Dive team; the rebreather circulates the gas around allow the diver to re-use their gas, this means the suit produces no bubbles and is silent (Poseidon). The rebreather technology is used today in for example the US Navy (2018, Szondy). The stillsuits, however, is a technology that is not necessary on earth today but might be sometime in the future.

On their way out into the desert, Paul and the rest use the aircraft technology called ornithopter, commonly known as 'thopter. The aircraft is described in the book as "any aircraft capable of sustained wing-beat flight in the manner of birds" (1965, Herbert, p.568). The 'thopters are used as the primary planetary defence. Ornithopters are propelled by jets and bird wing flapping, and remarkably better than modern aeroplanes. The effective defensive shields reduce their effectiveness significantly in traditional combat as they cannot fire. As mentioned before, the shield would have to be dropped for the aircraft to be able to fire a projectile weapon.

'Thopters are the primary means of air transport. The 'thopters range in size from small scouting crafts to large carryalls (an aerial workhorse of Arrakis). They are powered by jets and have the possibility to stand still in the air, like modern helicopters, and like the Hummingbird; "Stub wings elongated, cupped the air. […] holding the wings to a gentle beat" (1965, p.127).

The aircraft is often compared to birds and their wings, "Leto fed power to the wings, felt them cup and dip – once, twice. They were airborne in ten meters, wings feathered tightly and after-jets thrusting them upwards in a steep, hissing climb." (1965, p.120). Later in the book, the 'thopter is described as a bird of prey, "the strange 'thopter dived out of the night onto them, stooping like a giant hawk above the desert with wind screaming through its wings." (1965, p. 201). The 'thopters do not need much space to take off, like helicopters in real life, but the bird-like flapping with the wings would mean that the 'thopter would have to have some space to lift off. The wings on the aircraft make steering more relaxed, and it is possible, as shown in the novel, to keep the 'thopter hovering in the air with just some gentle beats (p.127). In David Lynch's rendition of *Dune* (1984), the 'thopters has lost the bird-like

flapping of the wings, and are just portrayed as hovering planes. With that said, the 'thopters are powered by jets making the speed of the aircraft comparable to the speed of modern jets. This aircraft technology would be revolutionary if it became a reality, but like most of the technology found in science fiction, it would have been used mostly for military purposes. The technology found today that is closest to the 'thopters is the VTOL aircraft or Vertical Takeoff And Landing Airplane, (2018, Lastoe).

The technology discussed is excellent examples of what sociotechnical imaginaries are. The technology would be useful in today's society; however, it is some year away. The depictions introduced in the novels give the imaginaries mostly the same outcome. In 1984, David Lynch directed the movie *Dune*, and his vision of the technology in the book became the base for the visualised sociotechnical imaginaries found in it, and for years this has been the only base.

However, technology has changed drastically since 1984, and in 2020 there will come a new version of the movie (2019, IMDb), which will contain the modern version of the image shared by the audience, creating updated imaginaries. Although the movie will have more modern adaptions of the technology found in the novel, it is hard to analyse the technology without having the movie at hand. Having said that these two movies will show how time affects the way the book is interpreted.

Frank Herbert's *Dune* (1965) is, as mentioned, one of the classic science fiction novels; the technology found the novel has contributed to some sociotechnical imaginaries, as Jasanoff and Kim writes "technological innovation often follows in the heels of science fiction" (2015). The technology in *Dune* was inspired by technology found in the real world at the time it was written, and it has inspired technology that came after and perhaps someday the technology in *Dune* will be available to the society. Even if most of the technology looked at in this essay have been compared and connected to military technology; it is, as mentioned, possible to use them for other settings as well; example given the Médecins Sans Frontières, MSF/Doctors without borders, and other first aid organizations as they would be able to do their job without getting injured or in danger. David Lynch's 1984s movie rendition of *Dune* (1965) and his vision of the technology in the book became the base for the visualised sociotechnical imaginaries found in it.

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