CHAPTER 5 OUTER SPACE AND SENSORY DEPRIVATION (OR WHY IS OUTER SPACE SO BLAND?)

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1 Introduction

In truth, the question 'Why is outer space so bland?' may be misleading. We cannot experience outer space first-hand, which means that when we travel in outer space, we do so through an artificial and controlled environment in a spacecraft or mediated through a spacesuit. It is not as if you can stick your head out of the spacesuit's visor and smell outer space or directly touch space debris. We cannot walk unaided in outer space, neither touch nor smell the final frontier directly. All our senses, except perhaps for the sense of sight, are interceded by technological means and conflated into a bland experience of sameness, even dullness. Readers may well ask how I know that outer space is bland when what we can experience of the event is mediated, harnessed, armoured and, at best, indirect contact. My analysis will rely on the available research, documentation and testimonies of those who have been in outer space, as well as fictional and imaginary fantasies of what outer space is like. My assessment of outer space's dullness does not mean that it has no authentic smell, taste or does not have an existential and sensory reality. Instead, it suggests that humans are not yet equipped to immerse ourselves unprotected and unmediated in the full sensory experience of the event.

We are, however, well-equipped to live and have a sensory-rich experience on the planet where we are currently homed, namely, Earth. In fact, Hannah Arendt already stated in *The human condition* that 'earth is the quintessence of the human condition', adding that the 'earthly nature' may be unique in the universe to provide humans with a habitat where they can move and breathe unaided.[1] I find this such a profound realisation, namely that Earth may be the only place in the universe where we as humans can move and breathe (mostly freely) and have unmediated

1 H Arendt *The human condition* (1958) 6 2.

sensory experiences.[2] Thus, the blandness of outer space is related to the mediated nature of the experience, first and, second, to the ill-equipped human constitution for the adventure and the inhospitality of the extreme outer space environment.

If we accept that embodiment is a requirement for being human, what happens to embodiment and our sensory experiences in outer space? What is the impact of life post-earth on the astronaut's body, physiologically and psychologically, and phenomenologically, one may add? My concerns are not necessarily shared in the dominant discourses on the subject since science (and here I include aerospace medicine, molecular and cellular biology, material science and engineering, radio-biology, space and astronautical science) is very confident that the stressors placed on human embodiment are merely temporary hurdles that will eventually be overcome. As Charles L Limoli observes, for instance, about the pertinent problem of cosmic radiation:[3]

> Although I agree that cosmic radiation is a difficult and challenging issue for deep-space travel, it is by no means a 'deal breaker'. It is 'merely' an engineering problem, albeit a hard one. In the late 1800s, some assumed that powered flight for humans would not be possible. Given the numerous examples from the natural world, others instead saw human flight as an engineering challenge that could be overcome.

For my exploration, outer space refers primarily to travelling in deep space or interstellar space missions and acclimatising to extra-terrestrial terrains and exoplanets. Also, as already hinted at, my analysis relies on selected research in space and astronautical sciences, as well as cinematic and imaginary representations of the sensory realm and outer space. I mix fact and fantasy. In other words, I will work through literature, data, rhetoric, research findings and images to make some suggestions and interpretations about the human sensory state in outer space.

2 When I state unmediated, it does not imply that our sensorial experiences on earth are not mediated through embodiment, language and symbols, and even technologically, but the encounter differs significantly from outer space.

3 J Kelly 'Cosmic can-do' (2017) 6 *Scientific American* 316.

2 On blandness

The term 'bland' has the Latin *blandus* in its origins, which means something with an 'unclear origin'.[4] This seems correct if related to outer space intuitively, for space constitutes vast and unclear origins. Synonymous with bland are 'flat', 'flavourless', 'tasteless', 'savourless', 'vapid', 'unexciting' and, importantly, 'unstimulating'. At first, it may appear impossible that outer space can be all these things, and unstimulating probably is the most unlikely. Yet, read any astronaut's diary, and the monotony of confined space in microgravity jumps from the pages.[5]

However, this is not the complete picture, for the sense of awe and sublimity exists with the drab monotony and, here, the almost religious experience of looking back at Earth comes to mind. The 'overview effect', as coined by White, is described as

> a cognitive shift in awareness reported by some astronauts and cosmonauts during spaceflight … It refers to the experience of seeing firsthand the reality that the Earth is in space, a tiny, fragile ball of life, 'hanging in the void', shielded and nourished by a paper-thin atmosphere. The experience often transforms astronauts' perspective on the planet and humanity's place in the universe.[6]

We thus have a description of a sublime experience in the overview effect with definite sensory repercussions. However, for purposes of my analysis I will steer clear of the overview effect when exploring the sensory realm in outer space as this chapter does not include a discussion on the experience of the sublime and the somatosensorial implications thereof. I acknowledge that despite the blandness of outer space, there are magisterial opportunities to be exposed to awe and sublimity.[7] The focus nevertheless

4 *The Sage's English dictionary and thesaurus* (2020).

5 See for instance the autobiographies of B Aldrin *Magnificent desolation: The long journey home from the Moon* (2009) and S Kelly *Endurance: A year in space, a lifetime of discovery* (2017).

6 F White *The overview effect: Space exploration and human evolution* (2014) 2.

7 For more discussion on the sublime and religious experience of the overview effect, see DL Weibel 'The overview effect and the ultraview effect: How extreme experiences in/of outer space influence religious beliefs in astronauts' (2020) 11

is on the mediated and 'artificial' controlled context presupposed by deep space missions and the simulation of earthly sensorial experiences.

Extended space travel, also described as the 'perfect boring situation',[8] calls for design and engineering strategies, from specially-designed habitats, comforting interiors, to the immersion and overlay of other realities to curb the blandness.[9] It is often proposed that immersive virtual reality (VR) 'should be considered a plausible measure in preventing mental state deterioration in astronauts'.[10] One of the immersive VR strategies is to expose astronauts to simulated natural settings, and it seems as if 'early results are promising, showing that a short amount of time spent exposed to a natural VR environment can reduce levels of stress … and improve concentration and cognitive function on long space missions'.[11] Here the fictional Holodeck featured in the *Star Trek* series pre-empts contemporary research into the recreational role of VR during deep space travel. Finding a more recent filmic example of how an immersive natural environment may operate is available in *Ad Astra* (2019, Director: James Gray). In this regard, the intrepid space traveller, Major Roy McBride (Brad Pitt), is sent to a 'comfort room' on the Moonbase after failing his psychological evaluation (Figure 5.1). McBride realises that his legendary space pioneering father is still alive, and his emotions flare up. He is submerged in a space filled with images and sounds of nature. We see huge colourful flowers and fields of green vegetation gently swaying in the wind, the sound of birds and insects in the background, followed by dramatic waves rushing to shore. The immersive experience aims to calm

Religions 418.

8 As aptly reflected in the titles of research from several space related institutions: See R Peldszus et al 'The perfect boring situation – Addressing the experience of monotony during crewed deep space missions through habitability design' (2014) 94 *Acta Astronautica* 262.

9 For the design of space crafts and interiors, see AM Sequin 'Engaging space: Extraterrestrial architecture and the human psyche' (2005) 56 *Acta Astronautica* 984; V Martinez 'Architecture for space habitats. Role of architectural design in planning artificial environment for long time manned space missions' (2007) 60 *Acta Astronautica* 588; TS Balint & HL Chang 'Pillow talk – Curating delight for astronauts' (2019) 159 *Acta Astronautica* 228.

10 See for instance N Salamon et al 'Application of virtual reality for crew mental health in extended-duration space missions' (2018) 146 *Acta Astronautica* 119.

11 Salamon et al (n 10) 119.

and centre McBride again. The choice of scenery and soundscapes is also determined because they are archetypal, 'What was the first sound heard? It was the caress of the waters … the sea …', just as the 'wind, like the sea, possesses an infinite number of vocal variations', notes Schafer.[12] Furthermore, 'no sound in nature has attached itself so affectionately to the human imagination as bird vocalisations'.[13] The intricate interwovenness of humanity with earthly soundscapes and landscapes is affirmed in the scene, for only in 'returning' McBride to Earth can he be restored to become 'operative' again.

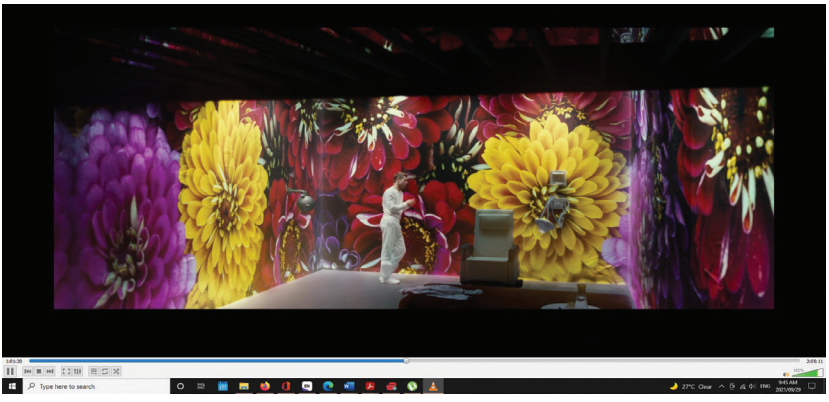

Figure 5.1: Scene from *Ad Astra* (2019, Director: James Gray) with Major Roy McBride (Brad Pitt) immersed in a 'comfort room' on the Moonbase after failing his psychological evaluation. (Screenshot by author)

In contrast to natural sound and landscapes, the environment of prolonged space missions is often compared to the habitation of submarines and bases in Antarctica, identified as 'isolated and confined environments (ICEs)'. Most of us had a foretaste of the definite consequences of isolation and confinement during the recent and ongoing COVID-19 pandemic lockdown. Life in a submarine or on a polar base indeed is extreme and analogous to outer space. However, Suedfeld warns that even though these

12 RM Schafer *The soundscape. Our sonic environment and the tuning of the world* [1977] (1994) 15 21.

13 Schafer (n 12) 29.

ICEs share similarities, they are not mere imitations of one another. In other words, postulations about outer space made from polar expeditions should be compared in terms of the 'experiences within environments rather than of environmental characteristics'.[14] Suedfeld thus pushes the research of how humans behave in ICEs back to human (sensory) experiences. It is not enough to look at the environment and then postulate predictions about human behaviours. It is more prudent to start from the human experience that leads to certain behaviours. This means that the Mars500 mission also partially addressed the environment and experience interrelated connections since the project was still undertaken on Earth.[15] Dealing with the harsh environment in outer space thus corresponds to other ICEs, but it also poses unique challenges. Some of these challenges remain unknown and will become known only once experienced.

What we are left with are predictions and postulations. In this regard, the reports on extended stays in outer space document psycho-social problems such as depression, extreme feelings of isolation, sleeplessness, loneliness, and even cognitive decrement.[16] Inseparable from the psycho-social implications is the physical toll on the bodies of astronauts. All the physical impacts will not be dealt with here, but I will rather apply my attention to the senses of vestibular movement and balance, as well as to the sense of proprioception, after which I will address the impact of microgravity on sensory awareness. Before these are addressed, I offer a few pointers about how the senses of smell, taste and sight are depicted and reported in outer space.

14 P Suedfeld 'Antarctica and space as psychosocial analogues' (2018) 9-12 *Reach* 4.

15 The Mars500 mission comprised of a 520-day long simulation of a round trip to Mars: 'After going through an intense selection process, 6 individuals from various countries lived and worked for several months in a pressurized facility in Moscow, Russia, mimicking as close as possible the conditions of real space flight'. See DA Urbina & C Romain 'Symposium keynote: Enduring the isolation of interplanetary travel' (2014) 93 *Acta Astronautica* 374.

16 See in this regard N Kanas 'From earth's orbit to the outer planets and beyond: Psychological issues in space' (2011) 68 *Acta Astronautica* 580.

3 What does outer space smell, taste and look like?

The sense of smell has recently been discussed on many online platforms inquiring about what outer space smells like. Reportedly cosmic odours are 'not an especially appealing bunch [as] many are austere and harsh'.[17] What is noteworthy in sensing outer space is that 'the smells of Earth will always be our reference points'.[18] Outer space scents are related to earthly base tones and, therefore comparisons with 'seared steak', welding fumes, gasoline, gunpowder and strangely metallic aromas are often used to describe the smells.[19] Once again, it is not as if the astronaut can open the latch of the spacecraft and take a deep breath – the sense of smell can only be activated in a delayed manner or as an after-thought. The olfactory sense is stimulated once astronauts return from a spacewalk and a distinct smell fills the re-compression airlock. The strange smell clings, particularly to their spacesuits, gloves and helmets.

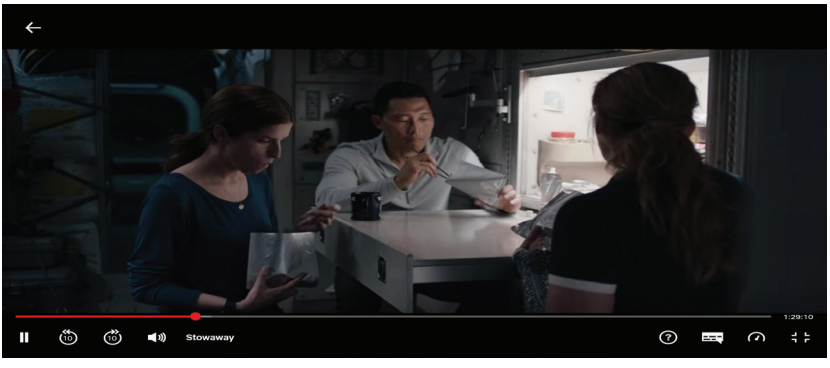

Figure 5.2: Crew members eating pre-prepared dried food in *Stowaway* (2021, Director: Joe Penna). (Screenshot by author)

17 H McGee 'What does outer space smell like?' *Wall Street Journal* 2020, https://www.wsj.com/articles/what-does-outer-space-smell-like-11603512060 (accessed 1 August 2022).

18 As above.

19 See for instance L Schiffman 'What does space smell like? *Popular Science* 2011, https://www.popsci.com/science/article/2011-01/fyi-what-does-space-smell/ (accessed 1 August 2022); 'The smell of outer space' (nd), https://sfumatofragrances.com/blogs/news/the-smell-of-outer-space (accessed 1 August 2022).

When we turn to the sense of taste, the correlation with 'flavourless', 'tasteless' and 'savourless' becomes even more evident. In the recent *Stowaway* (2021, Director: Joe Penna) the character of Zoe Levenson (Anna Kendrick) playfully dishes up dinner and says: 'We're sorry, you missed the filet mignon, but this is the next best thing. We think this is spaghetti.' She hands her fellow astronaut a flat envelope container to eat with chopsticks (Figure 5.2). According to *Astronaut Foods,* space food consists of 'a mixture of low moisture, freeze dried, pre-cooked or canned foods. Since there is no refrigerator in space, the food must be shelf stable.'[20] The pre-prepared lifeless food is unappetising at best and, in addition, astronauts lose some sense of taste and smell:[21]

> Lack of gravity causes astronauts' mucus to float around in their bodies rather than draining through their noses, creating congestion and often making them feel as though they have a head cold. As a result, astronauts suffer from a stuffy nose and lose some of their sense of smell, *making everything taste bland*.

One may probably grin and bear the blandness for a week or two, but an unending version of this for months and years must border on torture or a considerable compromise at least. There are concerns in the literature about astronauts' undereating as they typically consume only 80 per cent of their daily calorie requirements when in space.[22] The only sense that does not seem to be receding is that of sight. Virilio remarks the following about the prominence of vision during space travel:[23]

> Other than the view, there is no physical or physiological contact. No hearing, no feeling in the sense of touching materials, with

20 See 'Space food 101: What astronauts really eat in space?' *Astronaut Foods* 2018, https://astronautfoods.com/blogs/news/space-food-101 (accessed 1 August 2022).

21 A Waldman & B Standeford *What's it like in space?* (2016) 60 (my emphasis).

22 See in this regard AJ Taylor et al 'Factors affecting flavor perception in space: Does the spacecraft environment influence food intake by astronauts?' (2020) 19 *Comprehensive Review in Food Sciences and Food Safety* 3439.

23 A Ujica & P Virilio 'Toward the end of gravity II' trans S Ogger & BW Joseph (2003) 10 *Grey Room* 65.

> the exception of an actual Moon landing. Thus, the conquest of space, of outer space – isn't it more the conquest of the image of space? Everything is perceived by means of the eyes. The main information for the cosmonaut or astronaut is the images, because the other senses are unable to give any significant extra or contradictory information. Vision supercedes touch, smell, even movement through space – even in a space suit or on excursions outside the ship. The individual is totally scopic. Thus, the question … is how to live with a perception of the world limited to visual space, limited to vision to the detriment of all the other senses? What sort of loss do we suffer in that case?

Although Virilio's concerns are justified and, in many respects, the astronaut is reduced to a solipsistic all-seeing entity that cannot touch, taste or smell properly, human vision, as the other senses, also is physically compromised in outer space. In fact, substantial evidence exists that astronauts' sense and perception of the distance and size of objects are altered in microgravity and during long-duration missions.[24] These alterations in sight lead to distortions and misperceptions and accordingly 'represent potentially serious operational consequences'.[25] It is therefore proposed that robotic and telerobotic operations will increasingly have to compensate for these human oversights. Other forms of visual impairment also occur due to the central and headward flow of fluids in microgravity,[26] which leads me to deduce that although sight perhaps may be the less hindered or obstructed within space missions, it also is failing.

24 G Clément et al 'Distance and size perception in astronauts during long-duration spaceflight' *Life* (Basel) 13 December 2013 535.

25 As above.

26 See in this regard K-I Iwasaki et al 'Long-duration spaceflight alters estimated intracranial pressure and cerebral blood velocity' (2021) 599 *Journal of Physiology* 1067.

4 Falling down or falling up?

In space faring, the astronaut no longer is 'falling down', but it is more correct to state that he or she is 'falling up',[27] as the reference axis to any gravitational localisation has been disconnected. This is confirmed by the artist Louise Wilson's description of her limited microgravity experience during parabolic flights: 'Your organs are lifted up and feel they are now temporarily located in your mouth. You are not floating but falling upwards.'[28] In fact, astronauts must make a conscious decision about which way is 'up' while habituating space stations, for instance.[29] Reconnecting with the etymological roots of bland, Story Musgrave, also known as the 'dean of astronauts', describes the indeterminate state of falling both up and down as 'the twilight zone'. He notes: 'You don't know where earth is, it could be in any direction. You also don't know where the shuttle is around you. You are not touching anything … You go into the twilight zone …'[30]

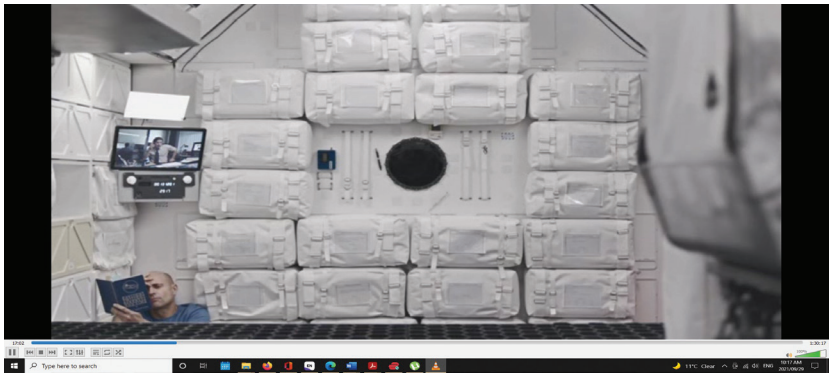

Figure 5.3: Scene from *Approaching the unknown* (2016, Director: Mark Elijah Rosenberg), with Captain Stanaforth subjected to sensory deprivation. (Screenshot by author)

27 P Virilio *The futurism of the instant: Stop-eject* (2010) trans J Rose 52.

28 LK Wilson 'Naïve subjects: Intra-actions and gravitational states' (2017) 7 *Virtual Creativity* 47.

29 Waldman & Standeford (n 21) 30.

30 Academy of Achievement 'Story Musgrave interview' last modified 22 May 1997, http://www.achievement.org/autodoc/page/par0bio-1 (accessed 23 September 2021).

A similar representation comes in *Approaching the unknown* (2016, Director: Mark Elijah Rosenberg) when stoic Captain William D Stanaforth (Mark Strong) on a mission to Mars reflects in his diary: 'I can't tell I'm moving.' The film focuses on Stanaforth's 'progression' into solitary confinement as his sense of time, space and place becomes increasingly distorted (Figure 5.3). The speed at which he travels has no phenomenological meaning because absolute acceleration has the unintended consequence of 'polar inertia or immobile inertia',[31] meaning that the faster we move, the less we have a sense of moving. Furthermore, Stanaforth has also by this time lost sight of Earth, and the so-called 'Earth-out-of-view phenomenon' becomes a reality for him.[32] Disconnected, he can no longer relate the speed at which he travels to the gravitational axis of Earth, and he becomes his own referential axis – the centre of the cosmos. By appropriating Virilio's notion of 'extraplanetary emancipation',[33] it can be suggested that the world no is longer before Stanaforth but now is behind him. Whereas the reference axis used to be centred outside the self towards Earth, it has now shifted inside as 'protruded man [turns] into a planet' onto himself.[34]

Stanaforth's vestibular movement and balance sense has also been compromised.[35] The vestibular sense provides humans with the much-needed information about where our heads and body are in relation to one another in space. It also aids us in staying upright when we sit, stand and walk. Yet, for Stanaforth, as for all astronauts, 'up' and 'down' have no specific meaning, except in the predetermined sense that we are engineered as perpendicular and bipedal beings – on Earth, at least. In addition, astronauts' sense of proprioception also is often debilitated; in

31 P Virilio *The great accelerator* (2012) trans J Rose 65.

32 In fact, we have no conclusive evidence of how humans will react to this phenomenon. As Kanas observes, 'the psychosocial impact of a permanent divorce from the home planet is unclear'; N Kanas 'From earth's orbit to the outer planets and beyond: Psychological issues in space' (2011) 68 *Acta Astronautica* 580.

33 P Virilio *Open sky* (1997) trans J Rose 131.

34 Virilio (n 33) 129.

35 See in this regard BK Lichtenberg 'Vestibular factors influencing the biomedical support of humans in space' (1988) 17 *Acta Astronautica* 203; AP Mulavara et al 'Vestibular-somatosensory convergence in head movement control during locomotion after long-duration space flight' (2012) 22 *Journal of Vestibular Research: Equilibrium and Orientation* 153.

other words, their sense of where body parts are relative to each other is disturbed.[36] Astronauts frequently lose sense and sight of their limbs. They may fall asleep only to wake with a startle realising that they have no sense of their arms or legs until they wilfully command their limbs to move. This connection between limbs, however, is quickly forgotten when they *fall* asleep again.

Therefore, the dialogue between Stanaforth and his fellow astronaut, Captain Emily Maddox (Sanaa Lathan), on her way to join him in setting up a future colony, is significant. He relates a dream to her: 'I had a dream that I was falling. Ironic, don't you think?' She quickly responds: 'It is not a dream. You are falling'. We may read Maddox's response to implicate a more mythological and even religious sense of falling. After all, being human is to have an aptitude for falling, it seems. The tale of the falling man perhaps is best foretold in Ovid's myth of Icarus. Accordingly, 'the story of Icarus has often been accepted as the foundation myth of the aeronautic and astronautic adventure'.[37] The most dominant force in determining the preconditions and directions for falling naturally is the invisible force of gravity. In what follows, the role of gravity on somatosensorial experiences is explored.

5 Gravity mimicked

During the launch into space, astronauts go from gravity (1*g*) to an increase in g-forces three to five times more than normal gravitation (3*g*) to reach escape velocity and break 'free' from the Earth's atmosphere and gravitational pull. It is only when the 'second cosmic velocity' of approximately 11,2 kilometres per second is achieved that microgravity is experienced. This dramatic escape from Earth's pull is often depicted in film. In *Stowaway* (2021, Director: Joe Penna) we hear the ground controller exclaiming, 'Good break. Good break' as the Kingfisher spacecraft launches into escape velocity. Earth is depicted as an entity that grips and binds, and one needs to move at an exasperating speed and with

36 Helpful in this regard is D Riva et al 'Postural muscle atrophy prevention and recovery and bone remodelling through high frequency proprioception for astronauts' (2009) 65 *Acta Astronautica* 813.

37 J Arnould *God, the moon and the astronaut: Space conquest and theology* (2016) trans D Cowlsey 100.

great force to get beyond this grasp. In other words, when depicted in fiction, there always is a sense of escape and freedom, even relief, after the gripping g-forces diminish into microgravity. This is also true for *Stowaway* as we see how the astronauts' bodies go from the forceful and noisy torment of g-forces to the sudden serenity and lightness of microgravity (Figure 5.4).

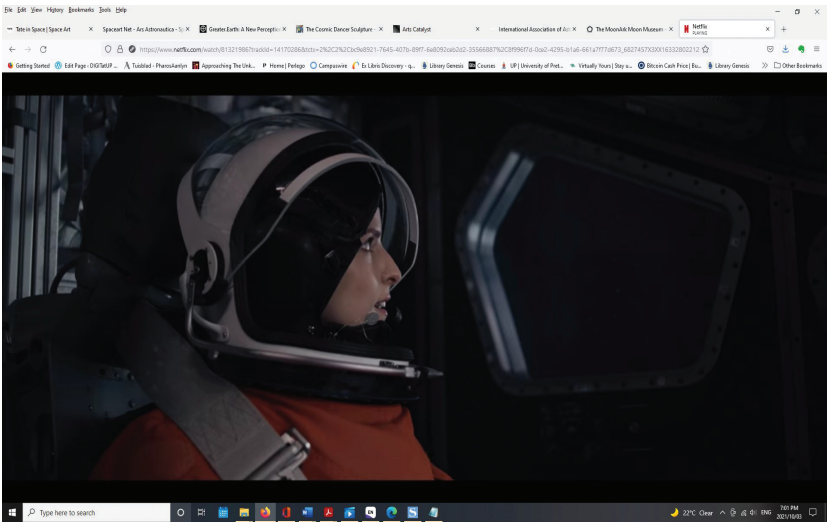

Figure 5.4: Scene from *Stowaway* (2021, Director: Joe Penna). Zoe Levenson's (Anna Kendrick) choker can be seen drifting in microgravity and softly makes a noise as it collides with her visor. (Screenshot by author)

If the expedition is lengthy, travelling to Mars, for instance, the spacecraft should preferably be designed in such a way as to recreate gravity employing artificial gravity. Artificial gravity is 'generated by steadily rotating the structure about its central axis to continually accelerate the station's occupants [and] creates a (centrifugal) force … which is perceived by the occupant as "gravity"'.[38] However, artificial gravity currently is restricted to science fiction because of the tremendous cost and the size requirements of a spacecraft that could accommodate such a centrifugal

38 Sequin (n 9) 984.

system.[39] What it means in terms of the analysis here is that deep space faring will require that Earth's pull is mimicked so that astronauts can go about their daily tasks. The reason is simply that one of the most critical challenges facing the outer-spatial body is the low level of gravity or microgravity.[40] For instance, the body is stretched during long missions as the spine straightens out without the compression of gravity. Human bodies, muscles, bones, cells and even moods respond and correspond to terrestrial gravity:[41]

> Life on Earth has evolved over the past three and a half billion years in an unchanging gravitational field. In that context, it shouldn't be a surprise that so much of our physiology appears to be defined by, or dependent upon, gravity. Take gravity away, and our bodies become virtual strangers to us.

The altered gravitational state and somatosensory changes do not end once astronauts land, for instance, on Mars. Recent research proposes that astronauts may not even be able to set foot on the new planet 'due to the loss of proprioception or the sense of movement'.[42] In fact, it is anticipated that

39 See in this regard R Feltman 'Why don't we have artificial gravity?' *Popular Mechanics* 23 May 2013, https://www.popularmechanics.com/space/rockets/a8965/why-dont-we-have-artificial-gravity-15425569/ (accessed 1 August 2022); B Brookshire 'Staying grounded in outer space requires artificial gravity' *Science News for Students* 4 May 2021, https://www.snexplores.org/article/staying-grounded-in-space-requires-artificial-gravity (accessed 1 August 2022).

40 The available research on the topic is vast and I list only recent references to stem cells: K Singh et al 'Microgravity: A paradigm to understand the stem cells behavior and function' (2018) 9-12 *Reach* 5; the impact on genes: L Buravkova et al 'Microgravity effects on the matrisome' (2021) 10 *Cells* 2226; reproduction: M Boada et al 'Microgravity effects on frozen human sperm samples' (2020) 37 *Journal of Assisted Reproduction and Genetics* 2249.

41 K Fong *Extreme medicine. How exploration transformed medicine in the twentieth century* (2014).

42 A Tennant 'Walking on Mars: UC research helps astronauts take first steps' *Uncover* November 2018, https://www.canberra.edu.au/uncover/news-archive/2018/november/helping-astronauts-walk-on-mars (accessed 1 August 2022). For the research findings, see A Marchant et al 'The effect of acute body unloading on somatosensory performance, motor activation, and visuomotor tasks' (2020) 11 *Frontiers in Physiology* 318.

> [if] astronauts make it to Mars, when they disembark from the spaceship, even if their bones and muscles are at full performance levels, their proprioception will be lacking, which will result in them falling over, so we want to try and help them reorient themselves.[43]

In essence, there is not a cell in the human body, nor a physiological process, left untouched or unchanged by long-term space travelling. The only redeeming factor perhaps is the return to Earth which in most instances can reverse the apparent physiological effects but not necessarily the psychological forces that are unleashed.[44] It is suggested that mortality is not so much the problem but the condition of 'astronaut morbidity'[45] – a general sense of unwellness and malaise. The human body's inability to clear the build-up of toxins and a resultant auto-immune effect is identified as the main culprits in the 'greatly increased morbidity' detected among astronauts.[46] Suppose we link the increased morbidity to the overall analysis that outer space may be more unappealing than expected. In that case, the state of morbidity likewise is described as being 'depressed', 'agitated', 'nonresponsive' and 'ungroomed'.[47] Thus, not only is the environment bland, but astronauts may also turn dull.

6 Unfolding within the fourfold

The expansive exploration into deep space and the habitation of exoplanets are not postulated as a probability but, as already noted, it is stated as certainty. The only aspect that raises concern is the weakest link in the process, namely, the human which requires considerable re-engineering.

43 Tennant (n 42).

44 Reports of astronauts returning to earth as changed beings abound and not always in the negative. Although depression, lethargy and alcoholism have been mentioned as post-space occurrences, renewed universalism and spiritualism have also been documented. A renewed sense of appreciation for life on earth is reported.

45 See FA Cucinotta et al 'How safe is safe enough? Radiation risk for a human mission to Mars' (2013) 8 *PLoS ONE* e74988; M Li et al 'Hindlimb suspension and SPE-like radiation impairs clearance of bacterial infections' (2014) 9 *PLoS ONE* e85665.

46 Li (n 45) 11.

47 Li (n 45) 3.

Human life and existence are reduced to a mathematical and mechanised problem, which Arendt describes as follows:[48]

> And, indeed, among the outstanding characteristics of the modern age from its beginning to our own time we find the typical attitudes of *homo faber:* his instrumentalisation of the world, his confidence in tools and in the productivity of the maker of artificial objects; … his conviction that every issue can be solved and every human motivation reduced to the principle of utility; his sovereignty, which regards everything given as material and thinks of the whole of nature as of 'an immense fabric from which we can cut out whatever we want to resew it however we like' his equation of intelligence with ingenuity.

Arendt's reading of the instrumentalisation of humanity can be corroborated with Heidegger's unpacking of the machination (*Machenschaft*) of reality and the later development of the enframing (*das Gestell*) that reveals reality as a standing reserve (*Bestand*). Heidegger's idea of machination can be understood 'as a world-historical disclosure of being, as a metaphysical constituent of an entire epoch of planetary being … by making everything from the earth to ourselves orderable for its own overpowering, circular and self-strengthening power of manipulation and mastery'.[49]

In addition to how machination and technological universalism reveal the world, Heidegger proposes the fourfold (*das Geviert*) as the gathering and revealing of our worldly existence in its 'utter relationality'.[50] The fourfold is the gathering or intersection of earth and sky, mortals and immortals (divinities) and it is in this relationality that things are unfolding and opening. In short, the four consist of mortals or human beings who 'are called mortals because they can die'; the immortals or divinities as 'the beckoning messengers of the godhead'; the Earth as 'the building bearer, nourishing with its fruits, tending water and rock, plant and animal'; and, finally, the sky which 'is the sun's path, the course of the moon, the glitter

48 Arendt (n 1) 305.

49 M Joronen 'Dwelling in the sites of finitude: Resisting the violence of the metaphysical globe' (2011) 43 *Antipode* 1128.

50 AJ Mitchell 'The fourfold' in BW Davis (ed) *Martin Heidegger. Key concepts* (2014) 208.

of the stars, the year's seasons, the light and dusk of day, the gloom and glow of night, the clemency and inclemency of the weather, the drifting clouds and blue depth of the ether'.[51] None of the four can be reduced to the other; in other words, they remain themselves in the gathering and revealing because 'each member forms a bridge by which the thing relates to the world'.[52]

One of the significant aspects that Heidegger stresses about the revealing that takes place in the openness created by the fourfold is that the event of the revealing cannot be reduced to 'the moulds of total revealing'.[53] In other words, how the revealing occurs cannot be predicted, manipulated or calculated. Accordingly, Earth resists complete calculation and revealing and cannot be known fully. The same goes for the other elements in the fourfold, namely, the mortals, immortals and the sky. Just as we cannot know either the Earth or the human completely – although forms of revealing take place (for instance, knowledge about the human and Earth is available) – there is also the 'resistance of concealment'.[54]

The following aspects become important if I can transpose the interaction between revealing and concealment to outer space journeys. For deep space travel, we need to make assumptions about both the human and the Earth. Thus, by planning and plotting existence in outer space, we must act as if we know the Earth entirely and as if it has revealed itself to us without any concealment. Also, we need to assume that we similarly know the endless malleability of humanness when dislodged from earth and death. In other words, we need to act and plan as if the unfolding of human existence between the force field of earth, sky, mortals and immortals is fully revealed to us. The fourfold also needs to be severed from one another into separate knowable entities. This is the type of knowing that *das Gestell* presupposes, or rather, this is how reality is revealed through technological enframing. The way the world is unfolding in the fourfold event differs considerably from technological enframing because although it creates an opening, it does not create transparency.

51 M Heidegger *Poetry. Language. Thought* trans A Hofstadter (1971) 176.

52 Mitchell (n 50) 215.

53 M Joronen 'Heidegger, event and the ontological politics of the site' (2013) 38 *Transactions of the Institute of British Geographers* 634.

54 As above.

Of the four, the mortal humans '*are* in the fourfold by *dwelling*'.[55] Furthermore, 'mortals dwell in that they save the earth', understood not only as preserving or saving from danger but also to set it 'free into its own presencing'.[56] Here Heidegger counters technological interventions: 'To save the earth is more than to exploit it or even wear it out. Saving the earth does not master the earth and does not subjugate it, which is merely one step from spoliation.'[57] Thus, for Heidegger, the Earth will not be saved through the *Gestell* and its workings but rather in allowing for the revealing of the Earth, in relation to the sky, as it unfolds in the drama of mortals and divinities. He adds: 'Mortals dwell in that they receive the sky as sky. They leave to the sun and the moon their journey, to the stars their courses, to the seasons their blessing and their inclemency; they do not turn night into day nor day into a harassed unrest.'[58] However, our existence unfolds differently in outer space since our relation to earth and sky shifts, just as our relation to mortality and immortality also alters. The fourfold implodes as the horizon just becomes sky, and the prospects of mortals become immortality. Even more, mortals receive the Earth as divinities from up in the heavens. If I can interpret what Heidegger also suggests here in terms of outer space travel: Beyond the Earth's horizon, the human can no longer receive the sky as sky, but the sky now becomes the ground(ing). In other words, as the Earth recedes from view, the human ground turns to only sky, and Earth is received as sky, and sky is received as Earth. No longer do Earth and sky mirror one another as different and yet relational; in deep space the one disappears into the other's horizon.

Tellingly once again, in the reflections of Stanaforth in *Approaching the unknown*, as a hubristic being who has lost sight of Earth completely, he perceives himself as immortal divinity when landing on Mars. We hear him considering: 'Nothing has ever lived here. Nothing has ever died here. Maybe I'll live forever.' Stanaforth may assume that his new habitat will unfold in relation to sky, as it did on Earth. He may even assume it is the same sky, but this is a new unfolding and the ground he stands on is not the Earth.

55 Heidegger (n 51) 148 (emphasis in original).
56 As above.
57 As above.
58 As above.

7 Conclusion

The expansion into outer space is a reality that increasingly immerses human embodiment into controlled and mediated technological environments. The context of Earth where our sensorial experiences have a particular pattern is challenged and altered. In the above discussions, references are made to how smell, taste and sight are impacted in the new context of space faring. Although the discussion did not deal much with touch and sound, the indications are that these senses also are highly mediated and lulled in deep space travel. The senses of vestibular movement, balance and proprioception are disoriented and even dramatically impacted. In addition, the confused understanding of up and down and the experience of microgravity are significant factors in adapting human embodiment to the new environment. The key lens through which the senses were analysed here, namely, blandness, allowed some insights into the challenges and obstacles awaiting humans in interstellar voyages and habitation of exoplanets. It is suggested that the overwhelming sense of blandness that befalls space travellers may philosophically and phenomenologically be related to the revealing of the fourfold as put forward by Heidegger. When exchanging the unfolding of the interface of Earth, sky, mortals and divinities for a new frontier, our sense of being in the world is unfirm and, along with it, our sensorial reality.

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