Astronomy and Satellite Constellations: Pathways Forward
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Countering the threat of space pollution: awareness raising via sustainability narratives

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Abstract. This paper engages with the conference themes of community engagement and awareness raising, through proposing narratives which provide alternative stories to the belief in unrestricted technological development. The plan to launch up to 400,000 satellites into Earth orbit is an example of unregulated corporate capitalism: many private corporations and governments are encouraging rapid growth of the space sector without sufficient consideration of broader and potentially consequences for Earth and space environments or the interests and welfare of the wider community. My question in this paper is how far sustainability narratives from the humanities and social sciences can assist in the attempts to limit pollution of the sky and near-Earth environment.

Keywords. satellite constellations, sustainability narratives, harmony

1. Introduction

The discussion I want to raise in this paper is how far sustainability narratives from the humanities and social sciences can assist in the attempts to limit pollution of the sky and near-Earth environment. At my institution, the University of Wales Trinity Saint David, we now host a UNESCO Bridges Hub,† the purpose of which is to employ the humanities and social sciences to broaden the appeal and success of sustainability science. In this respect I would like to begin with a quote from the so-called La Palma Declaration of 2007 (Starlight Initiative 2007):

> . . . a view of the starlight has been and is an inspiration for all humankind, . . . [and] throughout history, the contemplation of the firmament has sustained many of the scientific and technical developments that define progress.

The declaration was put together by a coalition including UNESCO, UNWTO and the IAU, but it is noticeable how, having established a broad remit ('an inspiration of mankind') this is then narrowed down to 'scientific thoughts'. My question here is why there is no appeal to a wider constituency, namely the humanities and social sciences in academia, and those in the wider public who may have a spiritual or religious conception of the universe. In part. the reason may be associated with anti-religious polemics amongst astronomers (Tyson 1999). The meeting point between astronomy and spirituality, though, is found in the concept of 'awe', a non-scientific word commonly used by astronomers to justify their interest in the sky (Campion 2011; De Witte 2022). My point here is that an over-emphasis on the word science may limit the scope

† https://www.uwtsd.ac.uk/unesco-bridges-hub/ [accessed 3 November 2023].

and appeal of the resistance to sky and near-Earth pollution. How many amateur astronomers, who spend their nights tracking dark sky objects, would agree with the Roman Emperor Marcus Aurelius (161-180 CE)? He was the author of the following inspirational passage: "Survey the circling stars as though yourself were in mid-course with them. Often picture the changing and re-changing dance of the elements. Visions of this kind purge away the dross of our Earth-bound life." (Aurelius 1964). These days one might say that dark skies are beneficial for one's well-being (Campion 2016a). As Michael Dahlstrom wrote, emphasising science may be less effective than employing narratives that make sense to an otherwise non-specialist public (Dahlstrom 2014)‡

> when the context moves from data collection to the communication of science to nonexpert audiences, stories, anecdotes, and narratives become not only more appropriate but potentially more important. Research suggests that narratives are easier to comprehend and audiences find them more engaging than traditional logical-scientific communication ... engagement into the world of a narrative ... uses enough emotional and cognitive resources that it is difficult for audiences to generate counter-arguments against the evaluations to which they are exposed.

SpaceX/Starlink's promotion emphasises sustainability, environmental awareness and the good of humanity (SpaceX 2022). Counter narratives emphasise the polluting effects of SpaceX activities (Whittaker 2018). The key is found in effective science communication (Besley & Dudo 2022).

2. Contexts

Light pollution became a major concern for astronomers in the 1980s: the International Dark Skies Association was founded in the 1980s. But recently, events took a more intense turn. As O'Callaghan (2022) wrote,

> The mega constellation era began in May 2019, when Elon Musk's firm SpaceX launched the first 60 satellites in its Starlink constellation. Today the constellation's numbers have swelled to more than 3,000 and account for fully half of all active satellites in space.

O'Callaghan is concerned with the environmental harm resulting from satellite constellations. Venkatesan, Lowenthal, Prem & Vidaurri (2020) adopt an apocalyptic narrative and raise the problem of disadvantaged communities:

> the rapid increase in satellite constellations is a simmering crisis that is silently approaching the point of no return ... The rush to claim near-Earth space is also leaving out the world's most minoritized communities, including Indigenous peoples, who need to be involved as stakeholders in decision-making.

At the extreme end of the problem is the weaponisation of space (Tyson & Lang 2018). The metaphor of space as a new and completely unregulated 'Wild West' has become common for writers on the topic (Cruddas 2020). Narratives tend to be doom-laden and emphasise negative messages.

In addition, opinions about whether the Outer Space Treaty of 1967 or the United Nations Office for Outer Space Affairs (UNOOSA), can be effective are divided. For example, commentators are divided as to the balance between Space Law on the one hand, and national governments or private corporations in relation to asteroid mining. UNOOSA has excellent objectives: space for climate action supports UN Sustainable

‡ See also Downs (2014); Jones & Anderson Crow (2017); Muindi, Ramachandran & Tsai (2020).

Development Goal 13: "Take urgent action to combat climate change and its impacts." (United Nations 2015). It is difficult to see how this has any relationship to the problems outlined in the 2022 GAO report, including increase in orbital debris, emissions into the upper atmosphere and disruption of astronomy (U.S. Government Accountability Office 2022).

3. Sustainability narratives

A useful distinction between different kinds of narrative was made by the sociologist Max Weber (1864-1920), who drew a distinction between objective truth, which deals in scientific facts, and narrative truth, which tells stories (Campion 2016b; Kalberg 1980). Spence (1982) wrote that "Interpretations are persuasive not because of their evidential value but because of their rhetorical appeal." The questions then, are "what value do we put on space exploration?", and "how does it express our values?" The problem for opponents of satellite constellations is that SpaceX adopts sustainability narratives. For example, it is indeed working to lower satellite brightness (Crider 2022). Other commentators report on satellite technology's potential to assist with research into climate change (Urban 2021). For wider context, oil companies, banks, airlines and other operations which are the target of environmental concern increasingly promote their 'green credentials', a phenomenon known as 'greenwashing' (Das 2022). The wider concern is with greenwashing amongst the new private actors in space (Christensen 2022). And, even if Starlink is successful in reducing light pollution from satellite constellations, that still leaves the space junk problem. This has already disrupted space flight (Jones 2023).

For wider narratives, then, we can look at wider issues. For example, D'Amato (2021) identifies five kinds of sustainability narrative. Of these, SpaceX/Starlink could well appeal to four: the circular economy, the bioeconomy, the sharing economy and sufficiency. The fifth, green economy, is the one which SpaceX would have the most difficulty with as it emphasises the total picture: 'Protecting and enhancing ecological functions to support human well-being (e.g., ecosystem services accounting, ecosystem conservation and restoration, nature-based solutions and green infrastructures). It is therefore not enough for SpaceX/Starlink to take mitigation factors over brightness without addressing launch pollution and space junk problems, and the fact that the stated aim is to reduce light pollution, rather than eliminate it may help, but does not solve the problem of potential damage to the wider ecosystem (United Nations Environment Programme 2020).

One important sustainability narrative, which deals in positive solutions has been developed by the United Nations - 'Harmony' (United Nations undated):

> the Earth and its ecosystems are our common home, and expressed their conviction that it is necessary to promote Harmony with Nature in order to achieve a just balance among the economic, social and environmental needs of present and future generations.

'Harmony' proposes a model of the Universe in which, because everything is interconnected, an action in one part has impacts in other parts (Campion 2020; Wales, Juniper & Skelly 2010). It has an ancestry in western thought in classical models, which Marcus Aurelius knew very well, which saw the world as a single functioning organism (Plato 1931). In modern environmental thought close parallels are found in chaos theory (Gleick 1998) and 'deep ecology' (Naess 1973). And, as expressed through economic affairs (Chrysopoulou 2020):

A well-being economy recognizes that people need to restore a harmonious relationship between society and nature, enjoy a fair distribution of resources, and live in healthy and resilient communities.

This is, then the test for SpaceX/Starlink and other actors in the field: whatever your intentions, what is the effect of your actions on all our communities? Does sky pollution harm our collective heritage in the sky - also mentioned in the La Palma Declaration?

The fundamental narrative of Harmony is positive: that because there is an inherent balance in the environment, we can act to make things better. This, at least, is the classical conception. The fundamental proposition of Harmony is that all things are interconnected and that we therefore have an inherent right to have a say in what happens in our environments, including the space environment. It is not up to powerful corporations to impose new technology on the rest of us just because they can, and without regard to the consequences. In this context, Greenpeace challenges companies planning to mine the Pacific Ocean with the slogan 'Our Pacific: not yours to destroy' (Greenpeace International 2021). We might equally say, in response to plans to populate space with constellations of 400,000 satellites, or mine the Moon or asteroids, 'Our Space: not yours to destroy'.

In this paper I have discussed the nature and value of narratives which do not rely on science. It may well be that national governments have the biggest say in whether satellite constellations continue, if they become fully aware of the space-junk risks to their own space programmes. But, in the meantime, it is up to the rest of us to use what narratives we can.

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