

“Houston, We Have a Problem”: The Paucity and Promise of an Empirical Space Criminology

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ABSTRACT

Space as a hyper-commercial and advanced technological domain, as well as the expanse beyond heavenly bodies and their atmospheres, attracts various crimes and harms. Space criminology should address criminological empirical gaps in the study of space crime and its control, forming a pioneering before-the-act empirical space criminology that comprises uncharted territory, as crimes in international waters, airspace, and cyberspace once were. Unlike after-the-fact criminologies of maritime, aviation, and cybercrime, space criminology could proactively study space crime. Space’s specific challenges of microgravity, radiation and the absence of Earth’s borders and enforcement leads to this article’s main question: How are criminologists supposed to do empirical work on space crime and its control, despite physical limitations and inaccessibility to space? To answer that question, this article will explore the possibilities of using science fiction (hereafter sci-fi), astronaut analog missions, and Virtual Reality (VR) to set the agenda for an empirical space criminology.

Keywords: space crime, space crime control, space criminology, methodology, empirical turn

1. Introduction

Space, in the contemporary imagination, predominantly comprises sci-fi movies, rockets to the Moon, and more recently, NASA’s Mars Rover expedition, the James Webb Telescope pictures, and human-missions to Mars, like the one that forms the center of Elon Musk’s SpaceX program. Generally, we look up to the stars and marvel about space exploration, deriving meaning from it and hoping for a better future off a climate-changed, doomed Earth (Dunnett et al. 2019; Lasch, 1979). Space could have the potential to unite us outside of Earth where we “no longer dream of overcoming difficulties but merely of surviving them” (Lasch, 1979: 49). A recent survey on U.S. attitudes (N=10.329) toward space shows monitoring asteroids and studying the climate as top priorities. Space tourism is ex-

pected to become routine traveling for 55% of U.S. adults, yet only 35% want to orbit Earth, and private space companies receive mixed reviews, as 70% of them consider companies to be responsible for space debris (Kennedy & Tyson, 2023).

Next to being hopeful, and in a practical manner, space is vital for daily (digital) life on Earth (ESA, 2022). Society depends on satellite-based real-time data use (e.g., navigation applications), used as well for climate change control, such as monitoring of flooding, draughts, fire dangers, crop failures, nitrogen “greenhouse” emissions, food-water-energy nexus dangers, earthquakes, volcanic activity, and asteroid and comet hazards (AGU, 2017–2019). Willfully destroying satellites has direct, large-scale harmful effects on Earth. Satellites are also crucial in global warfare, such as the Ukrainian military that may have used SpaceX’s Starlink satellites to attack the Russian army, which has been denied by Elon Musk (Reuters, 2023). So, undeniably, space is a vital venue for international (political) conflict (e.g., Russia’s 2022 exit from the ISS), war, and harm back on Earth (Rothe & Collins, 2023).

Although in literature it is generally discussed how space enables warfare (Klein, 2012; Lupton, 1988; Rothe & Collins, 2023), whether space may enable crime—and is therefore criminogenic—remains a question that is virtually unaddressed. The idea that, for example, astronauts could commit a crime (Gohd, 2020), or how NASA and the European Space Agency (ESA)’s plans to return Martian rock samples to Earth in the 2030s (with Martian microbes) could harm our planet by contamination causing another pandemic (Stuart, 2022), are possibilities not yet given the same amount of scrutiny as space war has received (e.g., Hirst, 2005). In fact, space crime, ranging from interpersonal everyday volume crime, such as violence, robbery, theft, assault, rape, and murder in space, to existing environmental crime, such as space debris, have received little attention in public debate, in law and specifically in criminology, making criminological knowledge on space crime and its control scarce (Eski, 2023a/b/c; Lampkin & White, 2023). Moreover, an empirical space criminology is non-existent.

Therefore, from a criminological starting point (cf. Farinha et al., 2023; Kruse & Svendsen, 2017; Matti et al., 2023; Van Dasselaar et al., 2023), the aim of this article is to conceptualize and identify possibilities for a *before-the-act* space criminological empirical endeavor that addresses space as a highly commercial and hyper-advanced technological domain that is prone to all sorts of crime and is thus ripe for new evidence-based crime control initiatives. By focusing on how a theory-informed space criminology can comprehend space crime and its control empirically, this article addresses the question how criminologists are supposed to do empirical work on space crime and its control, despite the physical limitations and inaccessibility of outer space? To answer that question, this article will explore the possibilities of using science fiction (hereafter sci-fi), astronaut analog missions, and Virtual Reality (VR) to set the agenda for an empirical space

criminology. This article shall first discuss the current empirical lack of space criminology and possible reasons for it. Afterward, it will be discussed what the empirical impact is that space criminology could have, followed by an overview of which methodological opportunities there are to “get to space.” This article will be concluded with a consideration of the wider (theoretical) applications of an empirical space criminology.

2. What Is Out There? Some Considerations on the Lack of Empirical Studies on Crime in Space

“What constitutes space crime?” is in and of itself a novel question, and difficult to answer when that answer is to be grounded in empirical evidence, if only because there are no (known) official records of space crimes. If anything comes up in the imagination, it is the Challenger disaster that killed the entire crew of seven astronauts on January 28, 1986, being the first fatal spaceflight, as well as one of the first cases that has been theorized by criminologists as state-corporate crime (Kramer, Michalowski & Kauzlarich, 2002). However, it was not a crime *in* space as such.

The first known crime in space, in the strict sense of the word, may have almost happened when in August 2019, U.S. astronaut Anne McClain, while operating from the International Space Station (ISS), allegedly gained unpermitted access to her ex-fiancée Summer Worden’s bank-account (Baker, 2020). However, NASA investigated and the accusations turned out to be baseless (Marshall, 2023). Nevertheless, the McClain-case revealed numerous legal (definitional) issues regarding space crime, notwithstanding the existence of the 1967 Outer Space Treaty, the 1968 Rescue Agreement, the 1972 Liability Convention, the 1976 Registration Convention, the 1979 Moon Treaty, the 1998 ISS Agreement, the 2021 U.S. Tenets of Responsible Behavior in Space, and the 2022 Astra Carta Charter (Sustainable Markets, 2023). And although space *safety* is being addressed by extending aviation laws to regulate commercial human spaceflight safety and proposing legal amendments related to lunar activities (Foust, 2023; Ravisetti, 2022), specific space criminal laws remain absent. In fact, as it stands, different space agencies, including NASA and ESA, are not publicly vested in, nor have they made explicit the urge for generating scientific knowledge on (criminogenics of) space crime. This can be considered remarkable, given the rise of space tourism that will bring (more) civilians in space (Chang, 2015; Crouch, 2001; Reddy, Nica, & Wilkes, 2012), which has implications for safety and security onboard spacecraft (Koller, 2022; Kramer, 2023), as well as that during human-missions to Mars, harmful behavior could arise and threaten such missions (Szocik, 2019; Szocik, Campa, Rappaport, & Corbally, 2019).

Legal scholars have considered space in relation to crime, (the lack of)

criminal law, justice (courts) and in-space jurisdiction since the 1960s (Diederiks-Verschoor, 1967, 1979; Gorove, 1972a/b; Haughney, 1963), and more recently, legal scholarship on space crime is expanding (Sachdeva, 2023). There is, however, no robust criminological paralleling of legal scholarship on space crime or its control. Space crime is simply not yet a serious, mainstream criminological concern, as recent criminological literature points out (Eski, 2023a/b/c; Eski & Lampkin, 2025; Lampkin, 2021, 2020; Lampkin & Wyatt 2023, 2022; Lampkin & White, 2023; Takemura, 2019), whereas over two decades legal scholars have proposed to study space crime (Chatzipanagiotis, 2011; Gorove, 1991; Potter, 1995; Robinson, 1974; Sgrosso, 1998).

In fact, concerns about the rise of different, specific forms of space crime have been expressed, such as earthly crimes in or via space, including unauthorized satellite use (Potter, 1995); “drugs in space” (Tatum, 2020); and space piracy, hijacking, and non-terrestrial terrorism (Emery, 2013; Miller, 2019). Furthermore, the space crime lens could be broadened to include dangers and harms related to human-missions to, for example, Mars when spacefarers who are living in confined spaces may suffer from (mental) health issues that can cause (violent) transgressions, crime, and suicide (Axpe et al. 2020; Robinson, 1974; Patel et al. 2020; Szocik, 2019). Environmental crimes affecting pristine space milieus form a topic of scientific scrutiny by criminology too, such as the issue of extraplanetary debris through (disabled) satellite, or other floating “space junk” (Eski, 2023a; Bradley & Wein, 2009; Lampkin & White, 2023) and the phenomenon of (commercial) space mining (e.g., lunar/Martian eco-theft) (Durrani, 2018; Milligan, 2015). Not necessarily defined as a space crime in the strict sense, but relevant to consider as well, are extraterrestrial-biological and anthropogenic damages. These include (unintended) physical harms caused by microgravitational effects on the body, like deterioration of bone tissue (osteoporosis) or human enhancement medicines that prevent may such health issues but could make it impossible to return to Earth due to fundamental changes to the body (Szocik et al., 2019). Human activity can be in and of itself harmful when considering interplanetary microbial, organic contamination due to retrieval missions, like NASA’s OSIRIS-Rex mission that visited, collected and returned a sample from asteroid Bennu to Earth on September 24, 2023 (Witze, 2023), or because of returning space crews (cf. Bianciardi, 2022; Chan et al., 2020; Lampkin & Wyatt, 2022; Van Houdt et al., 2012).

The public and scientific inattention for space crime could be explained by how we rather imaginatively stick to optimistic dreams about living *outside* Earth (Billings, 2007) than consider negative realities that include space colonialism, unequal access to space and narrow-minded technological solutionism (Popper & Rakotoniaina, 2019). As such, space crime can be regarded a negative imaginary/reality as well—a negativity that defies the space optimism that sustain by neoliberal political-economic thinking (Dickens & Ormrod, 2008). To acknowl-

edge space crime, in that sense, could automatically be seen as a critique on the state-corporate harms caused by, for example, NASA and SpaceX.

It is also the (politics of) space optimism that brought about a hyper-commercialized space industry that will generate more than U.S. \$1 trillion in revenues by 2040 (Morgan Stanley, 2020). The space industry ranges from tech-billionaires and their commercial spaceflights to small space start-ups that deliver solutions to the most pressing questions (Space Capital, 2022), such as simulating human-missions to and living on Mars (Dass, 2017), and by creating oxygen and food under conditions resembling the harsh environments of space and other planets (Canon & Britt, 2019; Hoffman et al., 2022). Moreover, international space agencies (e.g., NASA or ESA) are commercializing through public-private space investment, or “space biz” (Christensen et al., 2017; Clark et al., 2014; Gregg, 2021).

Given the space industry’s anticipation of economic advantages that are derived from rapid space tourism growth, serious investments are likely to be made in enabling more people to enter space, which consequently should require “laws reflecting the same type of scenarios that are encountered sometimes on Earth” (Gorove, 1991: 46). As a result of the growing number of people in space, the risk of (more) crimes in space increases (Crouch, 2001; Chang, 2015; Gorove, 1991; Reddy et al., 2012). Yet to this point criminology, unlike legal scholarship, remains slow and only conceptually oriented on space crime (Lampkin & White, 2023), and it has not conducted empirical research on space crime yet (Eski, 2023d). Such a lack could be especially problematic because space optimism not only sustains unawareness of space crime (Billings, 2007), but has also been considered to additionally cloak narcissist Earth-escapism (Ormrod, 2007) and exploitation of natural resources in space environments to be used up on Earth (Eski, 2023c; Lampkin & Wyatt, 2022). For example, on 13 October 2023, NASA and SpaceX launched a solar-powered spacecraft on a 2.5 billion miles journey to the asteroid belt between Mars and Jupiter to target asteroid 16 Psyche that has an unusual iron-nickel composition, potentially worth U.S. \$100,000 quadrillion (Carter, 2023; Donaldson, 2023). The harmful environmental consequences of extracting mineral from meteorites or asteroids, such as 16 Psyche, to be used back on Earth, have not been regarded as crimes (Lampkin & McClanahan, 2023).

Since the alarming signs of climate change (IPCC, 2022), there has been especially a lot of public concern about narcissist escapism of neoliberal space leadership (Vdovychenko, 2022), seemingly reflected in Elon Musk’s, but also Amazon’s Jeff Bezos’ and Virgin’s Richard Branson’s Billionaire Space Race, according to Kern (2021). There is wide-spread critique on “the rich [that] are planning to leave this wretched planet” (Marikar, 2019—online source). This suggests that the powerful—often responsible for climate change-related ecocide (White, 2022)—may escape both the consequences of climate change on Earth, enjoying impunity, while continuing harmful and (eco)criminal acts in space and on other planets; harmful

space corporate activity that is presented as socio-technological optimistic solutionism (Tutton, 2021) and remains unpunished as there is no space policing and criminal justice system (Eski, 2023c; Froehlich, 2021; Szocik et al., 2020). Within the international astronaut community concerns have been raised by Dutch astronaut André Kuipers, who worries that “with entrepreneurs at the helm of new space companies, one may wonder where they will lead us. Let us hope that they don’t get so big and powerful that they start making their own rules in space” (2022: 22).

The anxiety about how space could allow for unbridled space ecocrime, white-collar lawlessness, and criminal impunity to flourish, is not unrealistic. The fact that powerful entrepreneurs consider space as a legal vacuum became apparent when on October 28, 2020, SpaceX released its Starlink Terms of Service for their broadband mega-constellation to provide global internet connectivity. The following is from the “Governing Law” section of those Terms of Service:

Services provided to, on, or in orbit around the planet Earth or the Moon will be governed by and construed in accordance with the laws of the State of California in the United States. For Services provided on Mars, or in transit to Mars via Starship or other colonization spacecraft, the parties recognize Mars as a free planet, and that ***no Earth-based government holds authority or sovereignty over Martian activities***. Accordingly, disputes will be settled through self-governing principles established in good faith at the time of Martian settlement (Starlink, 2024 – online source, emphasis by author).

Before-the-act space criminological empirical studies would not operate in a complete vacuum of insights. Several international emerging efforts to establish and regulate space safety and security exist. In 2023, the (1959) UN Committee on the Peaceful Uses of Outer Space (COPUOS) started to discuss new rules for peaceful, safe, and sustainable space exploration, which for the first time included space debris management, a joint traffic system in space, and monitoring space weather (NSO, 2023). In December 2023, the U.S., UK, and Australia announced their plans to bolster space monitoring by ground-based radars to enhance space domain awareness, encompassing technologies, autonomous systems, AI, quantum technology, and industry partnerships, particularly aimed at countering China (Khalaf, 2023). Also, Canada amended its criminal code to account for crimes on the Moon (Ravisetti, 2022). Most recently, Dish Network, a U.S. telecommunications company, has been penalized \$150,000 by the U.S. government for not properly disposing of a satellite and for violating the Federal Communications Commission’s (FCC) anti-space debris rule, which regulates satellite waste in space. This marks the first-ever space debris penalty imposed (by the FCC) (Clayton, 2023), but it is not based on an existing specific space (criminal) law. COPUOS has

a long history of negotiating what later became international treaties dealing with outer space, mentioning criminal jurisdictions challenges (Ireland-Piper & Free-land, 2020). However, these treaties and international agreements (e.g., the Space Station International Agreement of 1998) have not codified “space crime” specifically and have not brought about an actual space criminal law enforcement (cf. Marshall, 2023). Hence, different challenges remain, and specific space criminal law regulations are still non-existent (id.), which makes its legal certainty based on only one nation’s legal enforcement and not on that of internationally agreed on legislation.

As noted above, the Canadian government enabled prosecution of crimes committed by Canadian astronauts on the Moon (Thrower, 2022). Other countries and space agencies have not followed suit, whereas space crime awareness and control are essential for spacefaring crews’ well-being, knowing what acceptable human behavior and which available responses exist, which should “be clearly defined before a spacecraft leaves Earth” (Seshagiri, 2005: 478). There is thus a need for space crime knowledge to deliver appropriate mechanisms for promulgation, enforcement, and administration “to manage the space environment to control and deter criminal action” (Doyle, 1990: 130). Moreover, existing and to be installed authorities should explore possibilities to deliver an international (and interplanetary) criminal code to tackle space crimes, for which that code’s administration, enforcement, and jurisdiction ought to be agreed on (id.). It could assist in discovering what behavior should (not) be criminalized and controlled, without endangering a space mission (Newman, 2016). Moreover, it is vital to discover which morals, ethics and politics would organize life in space and on other planets (Szocik et al., 2016) in relation to harm and crime (control), especially because the mode of life(style) and behavioral problems may very well be completely different from those (experienced) on Earth (Hermida in Mejia- Kaiser et al., 2006).

Criminology, as a governance and policy-advising discipline, has a vital role to play codification of interplanetary criminal justice and policing systems. A serious space criminological *empirical* follow-up could ignite more mainstream criminological interest in space crime and its control by filling in the gaps and learning from legal scholarship. Space law scholars expressed before their concerns about how long-term human settlements in space and other planets cannot be regulated by contemporary criminal jurisdiction rules in space (as founded in the ISS Agreement) in the future. Space criminology should do so critically, because the legal focus on space has been criticized for being too narrow and merely focusing on the ISS and not on other extraterrestrial environments (Lampkin, 2020: 240). That critique itself, however, remains conceptual, and is therefore itself limited as it focuses the criminological scope predominantly on environmental space crimes, including space debris and rocket emissions pollutions.

Space criminological *empirical* research could assist space criminal law-

making and “construct[ing] a new rule for the life there” (id. 430) by including both the legal and (green) criminological foci, as well as by including the more traditional criminological topics of research (theft, assault, murder, rape, and other similar kinds of volume crime, as well as white collar crime) next to environmental space crime. But how are criminologists supposed to do empirical work on space crime and its control?

3. Criminology among the Stars: The Promise of an Empirical Space Criminology

Avoiding how criminology was once very slow to develop *after-the-fact* research on maritime, aviation, and cybercrime (cf. Eski & Wright, 2023; Dekker, 2011; Jaishankar, 2018), space criminology has the potential to pioneer, not by awaiting the first space crime as an after-the-fact criminology, but by pro-actively working toward a *before-the-act* critical and *empirical* space criminology.

Space, as a novel topic for social scientific study in general (Salazar & Gorman, 2023), had groundbreaking effects on anthropology, vis-à-vis space anthropology (cf. Masali et al., 2010; Messeri, 2016) and on sociology, vis-à-vis space sociology (cf. Dickens & Ormrod, 2007). Gearing criminologists toward an empirical space criminology, may have a fundamental impact on criminology by founding a new strain of criminological research to theoretically, methodologically, and empirically discover what (the origin of) space crime and its criminogenics are, how it manifests and damages, and how it can be feasibly controlled. As such, an empirical space criminology has the potential to deliver theoretical and methodological innovation and fundamental epistemological advancement on a deeper level for (critical and green) criminological debates.

Space criminology would not work in a criminological vacuum, yet criminologies of space crimes may require (completely) different theoretical and methodological adaptations and advancements, as well as interdisciplinary integration of other disciplines that are unfamiliar for criminology, such as the space sciences that includes aerospace engineering, astrobiology, astrochemistry, astronomy, astronautics, astrophysics, cosmology, planetary science and space anthropology, space archaeology, space philosophy, space psychology and space sociology.

Space criminology can, therefore, have discipline-altering impact, especially by delivering foresight-orientated criminologies of a domain with its own unique criminogenic characteristics, as the sea, air and cyberspaces contain. Space is inherently differently structured compared to Earth, having a fundamentally different level playing field in several ways, including microgravity, unfiltered radiation, and different chemically composed atmospheres (e.g., no oxygen) (e.g., Atomi, 2015; Nelson, 2016; Strey, 2019). These differences are (often lethally)

harmful to human beings, which necessitates living in air-tight, usually very small and confined living conditions with limited nutrition in order to survive the harsh conditions of space (Williams et al., 2009); living conditions that themselves create psychological stress, frustrations and interpersonal disagreements among space crews (Dunn Rosenberg et al., 2022; Laham, 2023; Sucamele, 2021), potentially leading to on-mission harmful conflict. Additionally, national borders do not exist, and it remains unclear which authority—*back on Earth*—is legally and practically capable of being responsible for enforcing legal compliance (Li, 2020). In fact, space has virtually no borders and is considered potentially limitless; it is not entirely sure where or whether the universe ends (Sutter, 2018), creating all sorts of legal uncertainties (Schladebach, 2018). Such limitlessness can be in and of itself criminogenic, considering that, for example, astromining companies explain they extract lunar, Martian, and other cosmic bodies’ natural resources because there is not scarcity; they assume there are infinite space natural resources, which would justify unbridled exploitation of space resources (cf. Lampkin & McClanahan, 2023).

Slightly similar to cyberspace, Earthly (“normal”) time and space constructions do not hold for space. Off-planet, there is no day or night. For example, the ISS orbits Earth at 27,600 km/h, completing an orbit every 90 minutes, which provides astronauts with sixteen sunrises and sixteen sunsets in 24 hours (Raveendran, 2023). Moreover, a Mars-day, for example, is slightly longer than an Earth-day, by 39 minutes and a Mars year has 687 Earth days (The Planetary Society, 2023). An empirical space criminology would have to account for the influence of such characteristics on crimes in space, while having to find epistemological, theoretical, and especially methodological ways to attune itself to those characteristics.

Because, what makes space a groundbreaking new domain for empirical space criminological scrutiny, is simultaneously what makes it extremely challenging to study space crime and its control. Put simply: detaching yourself from Earth’s gravity costs money, making direct criminological fieldwork in space nigh impossible (for now and in the near future, at least). Unless you participate in a free going-to-space ticket competition, as Virgin Galactic once held, costs of going to space for a couple of days could reach \$55,000,000 (Carter, 2021). Therefore, as realistic as possible alternatives and affordable alternatives are required to study space crime and its control.

On top of that, the space community off- and on Earth resides in a closed culture (Schwartz, 2005; Vaughan, 1996) and can therefore be considered a hidden and hard-to-reach community (cf. Ellard-Gray et al., 2015). In the broadest sense, the space community contains many interconnected public-private sectors, actors, and organizations (Bromberg, 2000), the most well-known actor being the astronaut. Equally important are, but not excluded to, ground segment and space port personnel, space equipment developers and manufacturers, space (technological)

engineers and researchers, spacefaring instructors, space medicine and nursing experts, space legal experts and space policymakers (cf. Ronci, 2019). Due to the rise of space commerce, all (future) space tourists, space industrial leaders (e.g., Musk), space corporations, investment and start-ups, and the related branches (Space Capital, 2022) are now also included in the space community. Altogether, it leads to the fundamental question an empirically oriented space criminology must tackle first: how close can we get?

4. Getting as Close as Possible: Space Crime Sci-Fi, VR, and Analog Missions

Given how VR and analog astronaut environments are used already to study group cohesion and loneliness in space (Rai et al., 2012; Berger, 2023), as well as that augmented reality aids astronauts (Keller, 2023), space criminology could start to create and study space crime VR environments and astronaut analog missions that include space crime scenarios, allowing criminologists to come as close as possible to space crime, in an as immersive as possible manner—a methodological innovation that has the potential to advance criminology in an important way. VR and analog missions are scenario or script-driven (e.g., Chtereov & Panero, 2021; Dragoni, Ghidini, Busetta, Fruet, & Pedrotti, 2015; Imhof, Hogle, Davenport, Weiss, Urbina, Røyrvik, ... & Nottle, 2017), which means that, first of all, space crime and its control scripts must be created, because these form the base for VR and analog space crime studies.

4.1 Sci-fi based imagining and scripting of space crime and its control

Social scientists study the contemporary by considering the past and/or by analyzing “the now,” but rarely by studying the future (Hajer, 2017). However, doing research with and on fictional expectations (Beckert, 2016; Hancock, 2017) allows researchers to empirically orientate on a multitude of different actors who make decisions with high uncertainty that are based on “collectively held and performed visions of desirable futures” (Jasanoff & Kim, 2015: 12).

Resembling how sci-fi content can inform space diplomacy (Swiney & Dickey, 2023) and ESA’s 2001 study “Innovative Technologies from Science Fiction” (Battrick & Warmbein, 2001) that used science fiction literature to offer forward-thinking technological concepts for realizing current or near-future technology, space criminology could engage in the study of imaginations of the earlier mentioned international space community regarding space crime and its control, through sci-fi analysis-based interviewing and questionnaires, and also perform expert interviews with space sci-fi (cf. Weaver, 2010), leading to a future-oriented, interpretative understanding of their (shared) imaginaries of space crime and how to control it. It could also reveal which fictional expectations carry more (dis-

cursive) authority or legitimacy than others and why that is the case (id.). Hajer (2017) argues that those imaginaries make it possible to develop new knowledge, and in this case, space criminological knowledge.

The suggested criminological imaginative reconnaissance of possible (future) space crimes and their control is necessary, again, because officially, space crime—at least in the strict sense, arguably—has not happened yet. The next best option is, therefore, to interpretatively comprehend space crime (control) by relaxing the cognitive restrictions of space criminology’s anticipated research populations by stimulating a (new) understanding of different trajectories and approaches to space crime through the use of sci-fi prototyping (cf. Burnam-Fink, 2015; Merrie et al., 2018; Johnson, 2022; Schwarz, 2014). Space criminology would not be the first branch of research to apply sci-fi prototyping. There is a strong synergy between popular sci-fi and real-world scientific research and development, in particular regarding technological and computational studies, as well as business and military studies (Augé, 2021; Bell et al., 2013; Jordan et al., 2016; Mubin et al., 2016; Popper, 2015).

Sci-fi prototyping leaves from the premise that sci-fi ruptures with “established truths and knowledges,” to unfold “societal and ideological structures that ground the reality one knows and understands,” making sci-fi to function as a “crowbar against conventional reality” (Hellstrand, 2015: 1). Using a sci-fi lens would enable space criminology to provide realistic speculation about possible future events [i.e., space crime (control)], based solidly on adequate knowledge of the real world, past and present, and on a thorough understanding of the nature and significance of the scientific method through which “the improbable [is] made possible” (Heinlein in Joy, 2021: 235). For space criminology, “science fiction [functions] as a constructive lens for developing scenarios [...] to explicitly explore nonlinear change and the intertwined dynamics of;” in this case, space crime and its control (Merrie et al. 2018: 23).

What happens if your glove gets stolen and you are not able to perform your task outside a spacecraft or what if the life-support system is sabotaged? (Johnson, 2019). To which extent does living and working in a confined space with truly no breathable air outside a lunar base allow for (acceptance of) certain interpersonal violence and harm, such as sexual assault? (Santaguida & Lapierre, 2022). There is then literally nowhere to go, but how are you supposed to still interact with the aggressor afterward? Where are the police, who will be at all policing (aboard) spacecraft, and how to prosecute a space crime and where? (Seshagiri, 2005). Which courts will be available to try and penalize space crime? (Casey, 2022; Sagdeva, 2021; Szocik et al. 2016). Can this be done in a digital at-a-distance court (cf. Swierczynski, 2022) on Earth, and would that constitute a fair trial of a space crime? To which extent is spacefaring being served best by individuals capable of self-policing and punishment? (Taubenfeld, 1961–1962). These are but a few ex-

amples of questions amongst many more on space crime and its control through (self-)policing, as well as on prosecution and punishment, that have been asked theoretically but have not received serious empirical consideration by the space community, or mainstream criminology.

Sci-fi triggering the imagination of the space community regarding space crime (control) matters additionally because only 676 people have been in space (Hobbs, 2023) and currently at this time of writing there are 14 people in space (WhoIsInSpace.com, 2025), and again, space crime—narrowly defined—has not manifested itself yet (Williams, 2021). It altogether makes the research population that has been in space extremely small and even more hidden. That means that the larger share of members of the space community have not been in space, which requires the triggering of the imagination of space crime (control) by bringing not bring them to space, but space to them (cf. White & Smith, 2013). In doing so, space criminology could parallel earlier work by Szocik et al. (2020) who provided imaginations of what a Martian Criminal Justice System may look like and what types of crime could be encountered on Mars in the future. Such “future gazing” has become common in both science and the industrial sectors, especially by using focus groups (Cooper & Baber, 2002; Hancock, 2017).

Resembling the vignette method (De Goede, 2020; Humphreys, 2005), sci-fi prototyped vignettes can be used by space criminologists as succinct stories that act as a lens through which research participants can perceive in “some of the pleasure and pain” of the study’s subject in question (Humphreys, 2005: 842). They offer the opportunity to make visible what normally remains invisible in research (De Goede, 2020: 2). Sci-fi vignettes portraying space crime (control) can focus on interaction between past experiences, perceptions of the current state of affairs, intelligence of (the activities of) others and the estimation of what these aspects reveal when integrated into a shared imagination that is then projected onto the contemporary landscape (Hancock, 2017), in this case, of space crime (control).

4.2 Integrating and studying VR and analog mission space crime (control) scripts

The gathered imaginations could form the basis for “the development of sharing of scenarios” that go “beyond the aggregation of individuals’ opinions” (Cooper and Baber, 2002: 139) to eventually design space crime (control) scripts that can be integrated into VR and astronaut analog mission environments, following crime scripting practices of criminology and crime policymaking (cf. Cornish, 1994; Dehghanniri & Borrión, 2021).

Scripts allow their audiences to partially leave from “their existing world-view of short- term concerns to a broader conception of the future” (Burnam-Fink, 2015: 50), in this case of space crime (control). Leaving existing world(view)s is made possible by emerging in created VR and analog worlds and is especially rele-

vant for an empirical space criminology that aims to overcome the current impossibility of researching space crime (control).

First, by creating immersive space environments, participants are allowed to experience VR space crime (control) situations. VR technology enables the creation of various environments to study crime, including examining factors that deter burglars in neighborhoods (Van Sintemaartensdijk et al., 2021). Moreover, VR is increasingly being adopted for simulating space missions (Human Space Program, 2023), making it a logical choice for understanding space crime (control) proactively, meaning, before-the-act, as close as possible space criminological research can get.

In a VR environment with embedded space crime (control) scripts, it becomes possible to study how crimes and harms (and their feasible control) are taking place off- Earth, on spacecraft and other planets, in particular when using physiological measures to monitor the VR immersion into space crime (control) scripts (Van Sintemaartensdijk, 2025). The physiological data gauge the level of immersion and emotional engagement, in tandem with interviews immediately after the VR experience to understand participants’ perceptions, emotions, and comprehension of space crime (control) scenarios. This way space crime (control) VR can shed light on (group) mission behaviors (cf. Groemer et al., 2012; McMenamin et al., 2020; Rai et al., 2012), leading to, sustaining or being the result of space crime (control). The significance of VR extends beyond space criminological research, as it is already recognized as a crucial tool to counteract loneliness and boredom during actual space missions (Berger, 2023). Moreover, augmented reality, which involves overlaying virtual information onto the real world, has potential applications in aiding astronauts with tasks outside a spacecraft (Keller, 2023). Consequently, the use of virtually simulated environments represents an apt approach to comprehending space crime (control) phenomena empirically (Van Sintemaartensdijk, 2025).

Second, space crime (control) scripts can also be integrated in astronaut analog missions to subsequently study these missions that provide key insights into (group) mission behaviors (Groemer et al., 2012; Kaiser, 2025; McMenamin et al., 2020; Rai et al., 2012). For example, a script can allow for the study of biobehavioral and psychosocial aspects that can lead to mental harms, as well as conflict and interpersonal violence. In recent years, the number of analog missions is growing, including CHILL ICE II & I in Iceland, APICES in Spain, MINAR IX+ in the United Kingdom (UK), EMMIHS-III (HI-SEAS) in Hawaii, IGLUNA 2021 in Switzerland and M06 2023 (LUNARES) in Poland. Furthermore, focus groups with key stakeholders from the space community, in particular (analog) astronauts, space engineers, space safety and security experts, policymakers, and legal scholars, could ensure the accuracy and feasibility of the space crime (control) scripts for the analog missions as well as VR environments (or to be used for astronaut training purposes, for example).

5. One Small Step for Criminologists, One Giant Leap for Criminology: Implications of an Empirical Space Criminology

Space criminology must avoid going down a same path as philosophers of technology once did when attempting to take the empirical turn by predominantly evidencing their assumptions, while remaining overly abstract and pessimistic about future technologies (Bosschaert & Blok, 2023). Instead, the promise of an empirical space criminology lies within the possibility to get as close as possible to data on space crime (control), without losing sight of the inherently political nature of crime, space, and control in general, and thus also of space crime (control).

A viable way to assure that empirical promise, is to integrate criminological theory into the aforementioned VR and analog approaches, from which new empirical insights would result, also in new space criminological theory. Another way to guarantee the promise, is by working together with, and integrating space criminology in, other disciplines close to criminology that have already attempted to deliver empirical space sociologies, space anthropologies and space psychologies. It can also work more closely with the disciplines of space science with an empirical focus, including aerospace engineering, astronautics, astrophysics, and planetary sciences. By integrating criminology's methodological advancements in using sci-fi, VR, and analog missions, novel theoretical, methodological, and empirical insights into the realm of space crime (control) can be developed, expanding the boundaries of criminological knowledge and that of relevant disciplines on (how to research) crime in off-planet harsh, microgravitational and lawless settings.

Empirical space criminology may also enrich criminology with fresh, insights for shaping teaching programs and future interdisciplinary research in outer space to advance comprehension of space crime (control). Finally, an empirical space criminology could provide unique immersive contexts for studying, as well as deliver a knowledge-base about space crime (control) that can additionally provide valuable input to enhance space crime, safety, and security training, as well as related governance and effective lawmaking (cf. EEAS, 2023) to be implemented by space agencies and commercial spaceflight lines. Especially astronauts may benefit from learning about empirical space criminological findings, as they reside in space for extended periods in space stations and on human-missions to other planets.

However, these are all but promises yet. Although space criminology is not dormant anymore and in fact is gaining slowly but steady more momentum (cf. Eski & Lampkin, 2025; Lampkin & White, 2023), there must be advancement of its methodological capabilities and empirical understanding. Let this contribution be but a small step by a criminologist, but what could become a giant leap for space criminology.

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