Space sex-machines: trans-planetary ethics and the mediatization of things

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1 Introduction: Towards a mediatization of things: networking space sex-machines

Initial debates on mediatization delved into the "shaping" of contents by media logics (Altheide, 2015), and how that altered the social and cultural understandings of the world (Krotz, 2014), to encompass the transforming environment that includes devices, platforms, software (data), infrastructures (storage centers, and cables) as well as skills, and languages. Those debates have now moved away from broadcasting media ecosystems to gravitate towards discussions on information access, sharing, and presentation, bringing the concept of mediatization towards the analysis of media as interfaces (Scolari, 2012).

This transition to analyse new ecosystems is forcing an update of the classic (and ironic) mediation of everything (Livingstone, 2009) to the opening of new fertile discussions about the geographic dimensions of media (Fast, et al., 2017), as much as building bridges between the European and the Latin American traditions (see Scolari, Fernández & Rodriguez-Amat, 2021); and more recently Benz, Hepp, & Kirschner, 2022). The conceptual uplift in mediatization research includes the distinction between general and applied mediatizations (Scolari & Rodriguez-Amat, 2018), as well as the publication of new edited volumes (Kopecka-Piech & Bolin, 2023) or intrepid explorations to the deep mediatization (Hepp, 2019), and human-machine interaction and artificial intelligence (Hepp, Loosen, Dreyer, et al., 2022), or the incorporation of robots as objects of media and communication studies (Hepp, 2020) and their networked character (Duller & Rodriguez-Amat, 2021). The new frontier for these explorations is dealing with objects and humans in a complex mesh of interactions.

This paper unfolds the discussion about the incorporation of the material as a form of mediatization that connects with the tradition of Science and Technology Studies (Hackett, Amsterdamska, Lynch & Wajcman, 2008; Felt, Fouché, Miller & Smith-Doerr, 2016), and defines it along three dimensions of epistemological shift: the networks of interconnection between human and technology; the ecosystemic

interaction of the material technology and the planetary; and the notions of humanity and sociality rearranged in their features of care and sexuality. Each dimension carries profound ethical challenges that ripple across their extension, integrating and generating tensions and new questions about the good, the fair, the deserved, or the permitted. This text drills into some of those emerging ethical paradoxes at the center of this constellation, as a double epistemological opportunity: first, to inaugurate a research field that we call mediatization of things connecting with the materiality of objects that define it, as an homage to Latour and his way of thinking with the things, and with the notion of the "internet of things" and their rhizomatic and tentacular interconnectedness; and second, this text aims to challenge the fundamentals of our own current ethical frame and test its resilience against new forms of space intimacy and life with robots. As would happen in cutting edge physics experiments, to challenge the heuristic capacity of concepts such as in this case the mediatization of things and its behavior as a humanly constructed artifact, we send the discussion to the vacuum of outer space. In other words, doing what Bourdieu called epistemological rupture (Bourdieu & Wacquant, 1992), we challenge the liminality and the duplicities entangled within the hegemonic discourses of their forms of social and cultural embeddings by pushing them to the margins (Bhabha, 2013): be these the uncanny de-naturalisation of human-robot interaction (Złotowski, et al. 2015), the paradoxes around planetary sustainability (Haraway, 2016), or the embedded values in the notions of care (DeFalco, 2020, Puig de la Bellacasa, 2011).

This article maps the current debates in literature for these dimensions and then connects all three. This allows us to open an ethical discussion about these transformative changes and their implications. This triple exploration culminates with sex-machines as central devices in the mediatization of things as embodiments of new human-machine relations, built of materials that transform planetary life, and as enhancements for the senses of care and the forms of sociality. Previous discussions on the ethical and social implications of sex machines focused on introducing the idea of threat modeling to sex machine safety and security linking hardware (body and machine), software (mind and operating system) and networked related threats (Duller & Rodriguez-Amat, 2019; Duller & Rodriguez-Amat, 2021). Aligned with that, this paper places the types of sex-machine in outer space to query the ethical complications

along the three dimensions of the mediatization of things, from the margins of the human inhabited planet.

2 Human - technology interaction: integrating ethics and responsibility

Media and technology are integral in all areas of life (Hepp, 2020). Humans and machines intertwine in almost every act of everyday life. Debates on data and software as trading flows of information about human behavior, demography, and human geographies trigger sensitive questions about ownership, protection, privacy, and surveillance; but at the same time human life is penetrated by algorithmic and artificial intelligence driven decisions (including writing texts, autocorrect, search engines, timeline priorities, or optimized driving routes, or recommended jobs). These data-human entanglements overlap with discussions on robots, devices, and materially integrated technologies: data-flows and substances recombine with human flesh to build complex societal interfaces and assemblages (datafied welfare states (Dencik, 2022) or the integrated circuits structuring the public sphere (Brantner, Rodríguez-Amat & Belinskaya 2021). The mediatization meta-process illustrates the ongoing change in everyday life, in society, identity and culture linked to media development (Krotz, 2007). In a mediatized society of interconnected networks of bodies, of complex physical and technological hardware, flows of neuro-computational signals, and interconnected networks modify human performance and communication. The modes of connectivity and joint performance within the framework of participating technology research, reclaim ethical responsibility (Döring, 2017).

Human-machine relations enthrall the users' capacity with examples such as smart assistants (Suchman, 2007), self-driving cars, or ChatGPT (Rudolph, Tan & Tan, 2023), and lead us to forget that human-machine interconnections are multifaceted networked processes involving ways of studying and representing things and their world-making effects (Puig de la Bellacasa, 2014).

Robots, machines, and algorithms are linked to labor: the Slavic etymology of "robot" as "forced labor", might veil that robots are labor demanding too. The myth of automatism dissolves in its heteromatic nature (Pasquinelli & Joler, 2021): machines are designed, and maintained as complex systems of agents, engaging in the chain of

interconnected groups of robotic and technological systems (Chien & Wagstaff, 2017) and human agents interact not only through machines, but also on and about them (Duller & Rodriguez-Amat, 2021). Machines and robots are far from neutral or natural products. Robots are representations and as such they are producers of social life and mirrors of it (DeFalco, 2020). They are profoundly culturally embedded and ideologically informed, as battlefields of inegalitarian interests (Williams, Miceli and Gebru, 2022).

Despite the uncertainties associated with the widely applied concept of Responsible Research and Innovation (RRI) (Burget, Bardone, Pedaste, 2017), its principle still brings some light to the development of robots because it considers the "effects and potential impacts on the environment and society" (Dignum, 2019, 49). That frame implemented in Europe since the Seventh European Framework Program (Regulation (EU) No 1291/2013, 2013) ensures the inclusion and diversity, transparency and openness, reflection and anticipation, adaptiveness and responsiveness, as well as the inclusion into the process of as many voices as possible, such as industry and business, research and education, policymakers and civil society (Dignum 2019, 50). These principles of RRI can be established in the practice of threat modeling to identify pitfalls and map potential risks in the realm of physical, software, networking, or middleware components of robotic technology (Simonjan, Taurer, and Dieber, 2020). And yet, these principles of RRI are only a first step towards an improvement of the governance of robot making that build on the understanding of the networked reality (Bellinger & Krieger, 2021) as a form of networked responsibility (Coeckelbergh & Loh, 2020) in which accountability is distributed across several actors (Saurwein, 2019). From a safety and security perspective, this approach is key to explore robot ethics and to engage with threats affecting space robotics, and further shaping space robot ethics (Duller, in publication).

And yet, the complexity of these networks of (non)-human actors of distributed responsibility, does not happen in the void. Making technology dents a planet that cannot permanently provide and reproduce. The discussion on human and machine networks must move further into the second dimension of the mediatization of things: a new planetary era that connects technology to environmental endeavors.

3 The (trans)planetary systems in the new space era: integrating environments

The intricacies and embeddings of technology at planetary system scale include non-human species and a new geological epoch. The trajectory of the Great Acceleration (Steffen, et al.; 2015) and the rupture of the relationship between the humans and the Earth System has been theorized as Anthropocene (the Age of the Human Being), superseding the geological period of the Holocene (Crutzen & Stoermer, 2021). The idea recenters beyond the human being and its entanglements with its own mechanical product to understand the interconnections of human activity with the planet Earth as a complex geologic and biologic system. Haraway critically approaches this "time-space-global thing [as] an almost laughable rerun of the great phallic humanizing and modernizing Adventure, where man, made in the image of a vanished god, takes on superpowers in his secular-sacred ascent, only to end in tragic detumescence, once again" (Haraway, 2016, p.34). She then suggests the alternative notion of Chthulucene for the tentacular shape of the entanglements between human and non-human beings:

> "The order is reknitted: human beings are with and of the Earth, and the biotic and abiotic powers of this Earth are the main story. (…) The unfinished Chthulucene must collect up the trash of the Anthropocene, the exterminism of the Capitalocene, and chipping and shredding and layering like a mad gardener, make a much hotter compost pile for still possible pasts, presents, and futures" (Haraway, 2016, p.36)

Dealing with the living and the growing, pollution and tourism, ecology and the exploitation of natural resources, the extractive and dumping practices of materials, changes the planetary surface, and the ecologic balances, of carbon-based life and their reproductive processes. Communicative practices also generate geological impacts (Parikka, 2015), as much as data practices do with artificial intelligence (Crawford, 2021), or with the "costs of connection" (Couldry & Mejias, 2019).

While "our beautiful planet is sore" (Puig de la Bellacasa, 2011, p. 85), space exploration is on the rise too. The American National Aeronautics and Space Administration (NASA) aims to return a gender-diverse human crew to the moon (NASA: Artemis, 2022), while China, Russia, and Europe unfold space programs

(Dubé, et al., 2023). Public-private partnerships actively research, build, and prepare for space tourism (Green 2021), changing the ecosystem of global space activity (Paikowsky, 2017).

DeLanda (2021) referred the historical transformative power of traveling genes when describing the colonial sicknesses reaching the new worlds (with examples from epidemics in South America after the European colonization). Mirroring those processes, the invigorated spatial race spreads an invisible machine driven contamination-colonization: Mars is polluted with the remains of five NASA owned rovers (Sojourner, 1997; Spirit and Opportunity 2004; Curiosity 2012, and Perseverance 2020; and China's Zhurong (Quach, 2023)), adding to the dramatic pollution caused by 5465 orbital satellites UCS, 2022). This is already disrupting the migration routes of terrestrial species (Perras & Nebel, 2012) and the cultural knowledge of world peoples (Venkatesan, et al.,2020), prompting an urgent need that "before explorers search for life elsewhere, investigators need to identify the microorganisms that may be transported with crew members," (Regberg, 2023). These questions not only ethically challenge the uncontrolled gold rush of space explorations, but also point to the need to explore and discuss future forms of reproduction of human and terrestrial life in space.

4 The caring body, post-trans-humanism and humusities: integrating kinship

This mesh of transformative relationships with environment and with technology redefine being human as an onto-political category extending to the relations among humans or other kin. Alternative to the Anthropocene paradigm, Shoshitaishvili (2021) suggests the concept of Noosphere (a sphere of thought) in which humans form a planetary awareness that extends into self-awareness, too. This has historically led to conflictual and still human centered posthumanism: 'Haraway: (…) I think it's a bit impossible not to use it sometimes, but I'm trying not to use it'. (Gane, 2006); or the techno-enhanced transhumanism that reduces humanness to computer-enabled cognitive capacities. The human norm is very ideologized: systematically masculine, youthful, and able-bodied (Braidotti, 2013, p.26). The efforts to liberate from that norm force emerging and ephemeral concepts that led Haraway to ironically use the concept "humusities" (2016) as alternative to humanities. Paleo-archaeologists describe future

human species as “organic-mechanical hybrids” (Carbonell, 2023) while other scholars look into artificial partners (Döring 2017; Dubé & Anctil, 2021). Still, being human is a relational process involving emotional and social relations “based in communication, [and] changing conditions for such relations may have the effect that changing forms of social and emotional relations may also come into existence” (Krotz, 2014, p.82). Intimacy, sexuality, and sensuality pose important integrative aspects to human identity, and care encompasses them as a theoretical opportunity (DeFalco, 2020):

> Care is “a set of relational practices that foster mutual recognition and realization, growth, development, protection, empowerment, and human community, culture, and possibility…[nurturing] relationships that are devoted…[to] assisting others to cope with their weaknesses while affirming their strengths’ (Benner et al., 1996: xiii).” (p.34)

Care is an existential characteristic of being human as companion species; “an affective state, a material vital doing, and an ethico-political obligation"(Puig de la Bellacasa, 2011, p.90), and "the making of kin" (Haraway, 2016). As well as a “capacious concept flexible enough to theorize the incredible range of human/non-human interdependencies and ontologies that produce and sustain life" (DeFalco, 2020, p.35). As a broad relational form; the notion of care reaches towards non-human carers drawing attention to the ethical implications of robot/human interactions nuancing then the meanings and functions of care and the relationality it brings with: "visuality, tactility, audibility of humanoid robots reminds viewers of the centrality of flesh and skin, of embodiment, not only for agency and care but for the identity politics that determine embodied subject positions, carbon and silicon alike" (p.37). These redefinitions of care as relationships and of interactions activate the feminist techno-scientific perspective according to which care involves forms of producing life and its everyday ‘sustainability’ and the survival and ‘flourishing’ of everything on the planet (Puig de la Bellacasa, 2011).

An all-encompassing notion of care overtakes competitive capitalistic principles, to include affection, sensorial, intellectual stimulation, or syncretic forms of body and mental (self)care, and disciplinary regimentation: training, fasting, dieting, and worshiping. Care connects with sexuality beyond metabolic needs (male ejaculation linked to prostate health, orgasms preventing stress and anxiety, and improving sleep

quality), to pleasure, connection, and eventually reproduction. Sexual needs are key in human-non-human relations whether on earth or in space.

Puig de la Bellacasa (2011) links the Latourian embodied sociality of machines with feminist care to encourage the translation of caring into thinking things:

> Care is 'everything that we do to maintain, continue, and repair "our world" so that we can live in it as well as possible. That world includes our bodies, ourselves, and our environment, all that we seek to inter-weave in a complex, life sustaining web' (Tronto, 1993, p.103; see also Fisher and Tronto, 1990) (Puig de la Bellacasa, 2011, p.93).

As caring robots, sex robots are 'odd boundary creatures' (Haraway, 1991, p.2) and politically challenging agents emerging in ideologized, masculine and capitalistic environments where care includes labor and gender exploitation, perpetuating the undervaluation of care, the denigration of dependency and the distinction between valuable and disposable bodies: clean handed, guilt-free, their "bodily capacities are derogated, making their affectivity superexploitable or exhaustible unto death, while other bodies or body capacities collect the value produced through this derogation and exploitation' (2007: 25–26)" (DeFalco, 2020).

The exploration of mediatization of things against extra-terrestrial and beyond-human environments of sex/machines in outer space highlights its political-ethical complexities. The forthcoming discussion recenters sex machines against the triple dimension of mediatization of things as an emerging element of the three overlapping zones (Fig 1) to show the role and relevance of discussions on sex-machines. The discussion points at factors contributing to the governance of the design, construction and integration of sex machines as networks of agents (Duller, 2022), and the regulatory frames for quality and machine safety, ethical and responsive networks of responsibility and security against cyber-vulnerabilities. By considering sex machines in outer space as an earlier classification of sex machines, the discussion then helps to identify ethical complications, issues, and relevant pitfalls that help the governance of their designs and implementation to benefit future work on space-sex-machines.

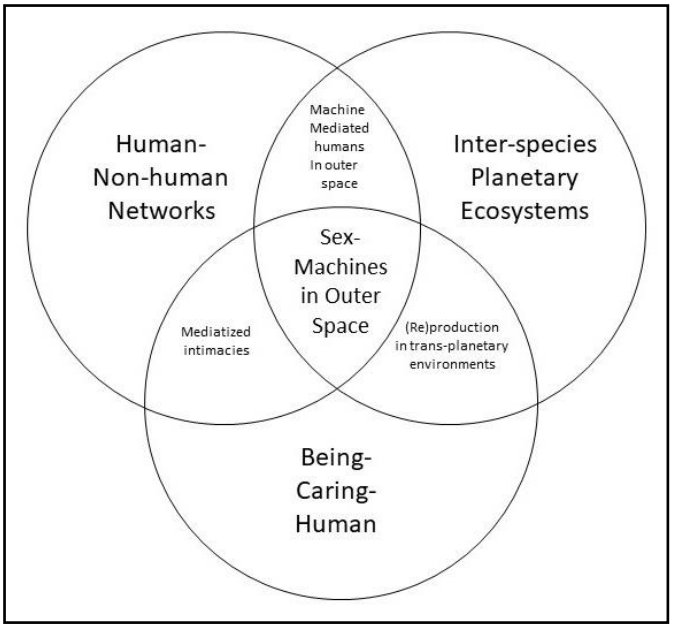

Fig.1 The three dimensions of mediatization of things (and sex-machines in outer space)

5 Discussion. Centering sex machines (in space)

At the center of the three overlapping areas described above that define the mediatization of things, sex-machines in outer space trigger a final context for the discussion on technosexuality.

Humans cannot survive in space. (Human) life in extra-terrestrial environments is only possible with technology. Machine-mediated life generates constant surveillance and measurement of heartbeat, air pressure, pupil dilation, and bowel movement. Mobility is limited by mechanical oxygen supplies, which impacts on the body's capacity and fitness. These (self)datafied logics turn human-life into technological maintenance challenges, and the humanness features of privacy demand research on mediatized intimacies (Duller, 2021) and forms of mechanised-mediatized care including life (re)production or affection and body, self-care or mental health. This machine-driven care reaches sexuality in outer space; as a former NASA senior medical adviser shared "If we look at sexual health as a core component of health, it's important to understand the conditions we are putting individuals in" (Sina, 2021).

Narratives of innovation and integration practices, techniques, and technologies of self (care) bond tightly as media-technology-sexuality assemblages. Research on caring

robots and care-machines (DeFalco, 2020) shows that they embed, and are designed within, cultural and ideological contexts that make them "repositories for humanist hierarchies and biases [that] occupy an uncanny position as animated tools and affective machines, at once representations of caregivers and caregivers themselves, a dizzying confluence of imagination, market economics, technological capacities, narrative and visual cultures." (p.41). Caring robots, then, are also bearers of human problems rather than their alternative.

Human sexuality in outer space is still a black hole. The environment is hostile: life aboard spacecraft, stations or settlements are challenges for human intimacy. The discursive figures of astronauts and space travelers are strongly tied to heroic intrepid narratives, but the questions of sex and care remain untouched. The conditions governing sex in space (pleasure and health, but also, reproduction, including intercourse, conception, and procreation while weightless) are necessary knowledge for plans for long-duration space missions. "It’s one thing to land rovers on another planet or launch billionaires into orbit — it’s another to send humans to live in space for extended periods of time" (Dube et al., 2021b). Sexuality inevitably factors into space missions. While space science is progressing, our understanding of sex in space is still basic, scarce, sketchy at best, and barely shared; the most available information is built on myths and science fiction. There have been claims that experiments were run in the 1980s by Russian space expeditions and by NASA (Oberg, 2010). Space agencies deny such activities, and there are "few studies (...) on the impacts of radiation and micro- or hyper-gravity on animal reproduction (rodents, amphibians and insects)" (Hidalgo Whiteside, 2000), while the issue is often publicly dismissed as “there is nothing to discuss” (Bryner, 2008), or by denying any room to pleasure or sex in space expeditions because they are of "professional nature" (Sina, 2021). The little available research (Henley, 2010; Levin, 1989) shows that microgravity and weightlessness decrease astronaut estrogen levels, lowering their sex drive. However, data builds on masculine hormonal checks because the women that have been in space (12% of space missions), artificially paused their menstrual cycles by altering their hormonal levels. Sex drive readjusts after a few weeks in space (Sina, 2021) but discussions about disrupted circadian rhythms, radiation exposure, isolation, stress relief (likely helpful during high-

pressure space missions), gravitational changes, social isolation, and the distress of remote, confined habitats, are yet to be fully explored.

> “(I)nstead of prohibition and enforcing limitations, or reacting after the emergence of detrimental circumstances, space agencies and private companies must start engaging in an international, intercultural and intersectional dialogue to co-create innovative ways to recruit, train, support, and assist anyone living in space safely navigate the intricacies of (future) extraterrestrial intimacy” (Dubé, et al. 2023, p.26).

Space sexology as a new discipline (Dubé, et al. 2023) aims to holistically address human erotic needs, if we aim at an ethical, successful, safe, and pleasurable journey to the final frontier. Space sexology also checks design systems, habitats and training programs that allow intimacy to take place beyond our home Earth planet. Abstinence is not a viable option, nor the reduction of sex to reproductive practices: masturbation is linked to physical and mental wellbeing which does not change in outer space.

> "Enabling space eroticism could help humans adapt to spacelife and enhance the well-being of future space inhabitants [but also] addressing the sexological issues of human life in space could also help combat sexism, discrimination and sexual violence or harassment, which are unfortunately still pervasive in science and the military — two pillars of space programs." (Hidalgo Whitesides, 2000).

Instead, the priorities of space travel have made crowded crafts (Vigliarolo, 2023) very noisy, with loud fans and other mechanical equipment and lack in privacy, while intimacy associated with self-care and sexuality does not fit well with hyper-connected and hyper-datafied life in a tin can.

At the center of these necessary discussions, sex machines in outer space gain prominence as responses to the sexual and reproductive needs of astronauts in long-duration missions. In this sense, the research field of mediatized intimacy and sexuality of the mechanical condition of life in outer space inevitably connect with the increased prominence of caring and sex-machines, but also with the reproductive trans-planetary context.

New media and technologies should not only help fulfill “our desires as sexual beings but [they] play a pivotal role in defining desire itself” (Kannabiran, 2014, p.78).

Networks of humans-technology with body-care and mind connect in a fluid performance of online-porn, of interconnected sex toys, of VR and AR applications, of sexting and of the rise of machines taking part in all areas of everyday life, including sexuality. This is the field of technosexuality that explores "novel forms of sexual desire into practice because of particular constellations of design choices and social behaviors" (Kannabiran, Bardzell, & Bardzell 2012, p.655), similar to erobotics that explore "the co-evolution of the interaction and co-evolving of humans and erobots" (Dubé & Anctil 2020, p.1). Aligned with these fields, sex-machines are:

> "a network of communication practices– devices, bodies, social understandings, cultural meanings, technopolitics, political economies –on mediatized sexualities (…) far from being neutral devices, (they) are technologies, and as sexuality is, they are dispositifs of power (Foucault 1983). Hence sex machines inform a field of political tensions, including rules of imposed normality and patterns of hegemony, dissonance, negotiation, discrepancy and resistance" (Duller & Rodriguez-Amat, 2019).

They are not about replacing human sexuality, but about augmenting and adapting (DeFalco, 2020) "exposing the hybridity, the cross-species organic/inorganic networks already at play and ripe for exposure, expansion and augmentation" (p.49).

6 Making sex-machines (for space)

The design and development of sex machines is a highly complex and delicate field with major ethical implications. The three dimensions of the mediatization of things (human-machine interactions, planetary systems, and human care) are already packed with ethical complexity that is now elevated through the transversal factors that embody sex-machines: health and safety connected to human interactions, (trans)planetary and reproductive natural impact, and the materialization of features that involve caring. Sex-machines, as caring robots (DeFalco, 2020), must be the product of strong interdisciplinary collaborations including engineers, designers, all types of stakeholders within sex and gender communities, experts in (post and trans) humanities and robot ethics scholars; they must be understood as assemblages of agents contributing to ensure the governance of the distributed responsibility. Only through such an

interdisciplinary material culture of matter and mattering, can ethics of sex-machines be fully addressed.

Such collaborative networks call for systems of interconnected models of production fitting the frames of transparent responsible research and innovation (RRI) that apply to any European publicly funded project but not necessarily anywhere else. According to the principles of RRI, for future space sex-machines we suggest using threat modeling - the projection and identification of vulnerabilities in a system (Simonjan, Taurer, and Dieber, 2020) - to consider any possible impacts, threats, and responsibility in the distributed process of their creation. This frame requires awareness to detect and tackle issues before the damage has been done (Debatin, 2010) for the mitigation of possible physical or cyber-related vulnerabilities that could be exploited. The identification and proactive minimization of risk in increasingly collaborative robotic systems is not over prioritized as part of their development and integration (Hofbaur and Rathmair, 2019). The lack of homogeneous planetary regulatory frames that considers the design and development of robots and their safety and security is more prominent in the extraterrestrial context: the difficulty at ensuring single models of quality regulation (ISO) or of safety grows when applied in outer space, more so if equipment, machinery, and technology are designed, developed and integrated by multiple actors and stakeholders, public and private, around, and above the planet.

7 Threat modeling sex-machine types (in space)

There are six types of sex-machine according to their shape and function: machines of similarity (humanoid and android robots), of extension (interactive devices), of substitution (fucking machines), of sublimation (pornographic monsters), of sensuality (environments of pleasure) and of creativity (accidental and DIY) (Duller & Rodriguez-Amat, 2012; Duller & Rodriguez-Amat, 2019). Each type of machine stimulates a transdisciplinary discourse on their relevance and possibility for outer space missions.

The following experimental discussion of the six sex-machine types serves as a start, but also highlights its limitations: sex-machines are perceived as individually designed masturbatory devices, but in extra-terrestrial environments any form of sex -also

reproductory- requires mechanical support. Therefore, before exploring the six types, a discussion about sex in space that involving intercourse enabling devices is required.

Wolpe, former senior bioethicist at NASA, suggests Velcro- originated for space travel- as a rudimentary sex-enabling device. He explains the relevance of gravity in sexual intercourse:

> "Sex involves pressure. In space, without any counterforce, you end up constantly pushing your partner away from you. [And he suggests that] everything on the walls of the space station is covered in Velcro, so you could take advantage of that by velcroing one partner to the wall. You have to get creative in this space." (Sina, 2021).

Similarly, the 2suit or twosuit designed by Vanna Bonta after an experience in zero gravity was tested to enable two persons to attach each other with the suit for intercourse (Boyle, 2006).

Sex-machines of similarity are designed to resemble human beings, in form of android robots, Hiroshi Ishiguro's Geminoids for example, are robots designed after specific humans (Hiroshi Ishiguro Laboratories, 2023) and are tested for their effects and affects at the Advanced Telecommunications Research Institute International (ATR): "Many ATR employees who controlled a Geminoid reported that they felt like they had been touched directly when someone touched the Geminoid." (Hiroshi Ishiguro Laboratories, 2023). In the realm of intimacy and sexuality, the Realbotix product Harmony^{AI} combines robotics, AI, and app development and sexuality; Luxbotics' "ultra-realistic service humanoids" operate as business applications (waiters, receptionists,among others), educational and health applications (health care assistant, tutor, pandemic assistant) and private applications (elderly or adult companion, or body double) (Luxbotics, 2023)

In space, sex-machines of similarity, as android companions, modeled after absent loved or close ones could provide emotional connection and physical, visual, and haptic proximity. "Studies demonstrate that how a robot appears will determine human relations with that robot, regardless of what it objectively 'is', what kind of mechanical life it can claim to have (Coeckelbergh, 2011, p.199)" (DeFalco, 2020, p.45). They could support navigational tasks but would take a lot of room within the cramped

transplanetary vehicles. Threat modeling machines of similarity means to thoroughly check hardware related safety and hygienic conditions; checking software would involve data protection issues extending to human-robot rights to privacy and protection from hacking and network related vulnerabilities.

Sex-machines of extension take less room and may work better. They are interactive cyber-devices that extend human body flesh to stimulate it. Shaped to imitate human orifices or extensions, they might include digitally enhanced affordances such as vibration or activation enabling remote interaction and connection. They re-activate a discussion about health discourses involving sex and release as medicalized, but also as solitary and masturbatory practices, as much as they activate critical "countersexual" discourses (Anderson, 2020). For space expeditions these machines are handy; they could even be designed to imitate human parts of known people to help with emotional and terrestrial connection (potentially remotely connected as interactive performances).

Threat modeling sex-machines of extension both challenges and transforms the idea of instant communication and interaction via future interplanetary (Internet) connections stretching issues of interplanetary signal quality, delay, and time difference, as well as network related vulnerabilities including issues on privacy and data protection safe from the possibility of Denial of Service (DoS) attacks, while hardware maintenance related issues include hygiene protocols. Still, they can be indicated as portable or even wearable.

Sex-machines of substitution, or fucking machines have a machine-like appearance, not hiding motors, screws, motherboards, or metal. Built as reminders of industrial cultures they combine appliances of de- and reattached thrusting, sucking and caressing units (Duller & Rodriguez-Amat, 2012). Parts of planetary rovers, mobile robotic arms, or robotic research appliances from explorational machines could be module-designed as potential outer space fucking machines. This would enhance the space-life-necessary symbiotic link between human organisms and technology. This could even grant agency for the machine to analyze and update astronaut hormonal and body functions while on the human-machine interaction ritual. The relative autonomy of devices fits within the models of caring for the machines (Puig de la Bellacasa, 2011), activating emotional connections for the maintenance and sustainability of the devices, as well as seamless

fitting within the highly performance-oriented machinery and mission goals of space. Threat modeling machines of extension means to secure their hardware (as necessary for other functions), software (eventually interacting with space-ship core data processing units) and network related components, as well as hygienic protocols. The opportunity here is that fucking machines can interface within a self-contained ecosystem of machine, life-enabling devices, and pleased humans within the spacecraft.

Sex-machines of sublimation are transmedia products of (science) fiction embedded into popular and creative culture. These are creations designed to stimulate sexually through the sublimation of human desires through the imagination. Their role involves multiple transmedia ways (screens, interactive gaming, VR and multiple representations); while they are easy to integrate within the spaceship equipment even encompassing the diversity of the crew preferences, they might require renewal and likely privacy for the crew to enjoy them.

Close and complementary to machines of sublimation, sex-machines of sensuality are environments. They have the purpose of stimulating the senses for pleasure. Sound, visual, or haptic milieus can be designed and delivered/consumed as VR or AR applications already available in space traveling, maybe combined with non-Newtonian fluids. The possibility of sensual stimulation can help with the emotional-erotic wellbeing of the crew.

Threat modeling machines of sublimation and of sensuality includes dealing with the psychological challenges of detachment where human-being and sociality narratives and the ethical reaches the borders of the imagination, or of addiction to artificially created stimulating stimuli and environments.

Sex-machines of creativity are accidental or improvised devices. Not designed for the purpose they still function as such. The precarious outer-space material availability mostly reduced to already functional materials and devices requires sharp creativity and skills to engineer alternatives. Pesquet (2022) describes the imaginary banjo improvised and played on a filter before installing it in the new ISS toilet. Networking this example of astronaut creativity with future possible space sexuality, the risk of improvising devices in outer space for sexual pleasure is double: first crew health and safety risking being hurt by inappropriate use, or negligence; and second, equipment safety and

maintenance that could be damaged by an undue use of materials on board. These two factors strongly play against allowing this to happen, by providing safer alternatives.

8 Conclusion: Sex machines, mediatized intimacies and the mediatization of things

Research on outer space is urgent. And life in outer space must be understood too, before the big expeditions and endeavors start and by life we mean care and sexuality. This paper is part of a broader program that extends towards the mediatization of intimacy and sex machines in outer space. Before the full program can take off it is vital to provide a proper theoretical background and a conceptual base that ensures, at least, critical capacity to avoid the pitfalls of the stereotypical reproduction of gender-discriminatory, Victorian, and human-non-human contaminating colonialism. The fundamental changes in our planet and communicative ecosystems present profound epistemological challenges that coincide with the evolution of the disciplinary field studying mediatization. This article suggests an encompassing territory of theoretical and conceptual discussion that grounds within the tradition of research in mediatization while also opening to traditions of Science Technology Studies, and critical cultural research: it is the mediatization of things. As described earlier, this concept spreads in three dimensions: the assemblages of humans and technology and the interfaces of their interaction; the planetary ecosystem of interspecies and tentacular and technological entanglements of their reproduction; and the notion of humanity that gravitates towards the notion of care as a relational form of approaching humans within complex networks of relations, and a moral and ethical disposition of awareness and of living in the world, and beyond. The first part of this text has pointed at the political, ontological, and ethical complications of these epistemological challenges, building the field of the mediatization of things.

The second part of this article has pushed these three dimensions further and against each other, exploring the overlapping zones coinciding with the human-technology assemblages within the planetary systems, the human-technology assemblages of mutual care, and the planetary-human assemblages within ecosystems of reproduction and care. The human-machine, caring-beings-in trans-planetary ecosystems links with sex in outer space and brings sex-machines to the fore.

The marginal position of sex-machines in outer space is a place to challenge ethics, safety, and security, while raising issues on human wellbeing in the new space exploration era. Space machine-assisted-life should not deprive from intimacy, erotism and sexuality. Space Sexology (Dubé, et al. 2023, p.11) and mediatized intimacies, further integrating machines into the discourse, study long-duration space missions and sex in the research ecosystem and mission design. Machines are means for communication, of co-creation, and of transformation, they are part(ners) of kin; the new frame of mediatization of things and of mediatized intimacies are building for it. Sex-machines play a key role in future research (and missions) because they embody a strand of thinking that involves human and non-human needs and difficulties, but that requires designs and action to respond to long term functionality, wellbeing, reproduction, and pleasure.

Revisiting the sex-machine types exiled to the margins of the human reach, changes the balance between creator and created, helping to pull the ethical and epistemological complications associated with their designs and functionalities. Sex-machine making must happen within networks of responsibility, assembling responsible, participatory, safe, and secure multi-agent systems that ensure designs and protocols that include techniques of self-care, maintenance of technosex devices, and human as well as machine hygiene. An inclusive transdisciplinary discourse on safety, security, and sustainability that extends beyond the human-tech interactions, to reach awareness on environmental planetary impacts, and mirrors the caring humanity in the design of the machine will help the survival and future of all agents involved. This paper, thus, contributes to the field of Space Robot Ethics (Duller, in publication) and to the field of mediatized intimacies (Duller, 2021). It does this by rooting in the discussion of the material, environmental, and human dimension of the mediatization of things, bringing the machines back from outer space and having them teach us a little more about their circuits while still on Earth.

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