Citizen Monitoring and the Entrenchment of the Nuclear Order: Foucault's "Panopticon" and Winner's "Autonomous Technology" as Two Approaches to Understanding Their Relationship

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S. Al-Sayed

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1 Introduction – "The People's Panopticon"

Recent decades have seen a growth in internet connectivity, publicly available data and tools, and ubiquitous sensing from mobile cameras to commercial satellites. These technological advances have created a favorable landscape for the flourishing of 'citizen monitoring', where citizens gather and analyze publicly available data to derive insights in contexts as diverse as commerce, public health management, environmental and biodiversity protection, disaster management, conflict management, archaeological site protection, human rights reporting, and weapons activities.

The focus in my thesis project is on citizen monitoring of nuclear activities – activities that may be connected to the development of nuclear weapons. Proposals and initiatives for civil-society nuclear-activity monitoring date back to the 20th century.[1] The practices enabled by 21st technological developments are popularly referred to as nuclear non-state open-source intelligence (OSINT). The nuclear non-state OSINT community comprises researchers, journalists, and activists – if not a hybrid of these. The proliferation of commercial high-resolution satellite imaging technology since the early 2000s has enabled the community to investigate cases with implications for nuclear security, for example, clandestine nuclear weapons material production in Iran and North Korea, nuclear warhead production and missile launch tests in North Korea, and the expanded construction of nuclear missile silo fields in China.

In this thesis project, I explore the connection between citizen monitoring of nuclear activities and the entrenchment of the nuclear order.[2] The entrenchment of the nuclear order is hinted at through notions such as Craig and Ruzicka's 'nuclear nonproliferation

[1] As for proposals, the most comprehensive one is Rotblat's in Joseph Rotblat (1992): "Towards a Nuclear Weapon-Free World: Societal Verification", in: *Security Dialogue* 23.4, pp. 51–61, which also includes a summary of former proposals. Historical initiatives will be outlined in Chapter 2.

[2] The theorization of the 'nuclear order' was first undertaken in William Walker (2012): *A Perpetual Menace. Nuclear Weapons and International Order*, London: Routledge. I clarify the concept in Chapter 2.

complex',[3] Pelopidas' 'nuclear eternity',[4] and Nordmann's 'maintaining the working order of things'.[5] In the following, I briefly summarize these concepts as they pertain to the entrenchment of the nuclear order. Craig and Ruzicka's 'nuclear nonproliferation complex' refers to "dozens of governmental agencies, international nongovernmental organizations, think tanks, and academic programs and institutes"[6] that are well-financed and have dominated the discourse on nuclear weapons during and after the Cold War, thereby shaping foreign policymaking agendas such that nuclear nonproliferation efforts are privileged at the expense of the pursuit of nuclear disarmament, though both nonproliferation and disarmament are pillars of the Treaty on the Non-Proliferation of Nuclear Weapons.[7]

With 'nuclear eternity' Pelopidas captures the futures-making aspects of historical nuclear-weapons–related practices that have led to nuclear weapons becoming a fixture of eternal future horizons – that is, to the naturalization of nuclear weapons and "the idea that no future without them is conceivable."[8] He decries the resulting progressive removal of nuclear weapons from democratic control, whereby public choices around nuclear weapons have been severely constrained and with that, future political possibilities foreclosed.[9]

Finally, Nordmann describes the technological rationality of post-Cold War nuclear security as one not of determining the appropriate means to achieve desirable technical, economic, administrative, political, or strategic ends, but increasingly as one of "car[ing] for and tend[ing] to […] a way in which things are configured, in which they function, mutually support each other or work together,"[10] while suspending moral and political judgment as to whether that order is good or worth preserving. This is a rationality of prudence and circumspection,[11] of attunement[12] – ultimately, of the management of a

[3] Campbell Craig and Jan Ruzicka (2013): "The Nonproliferation Complex", in: *Ethics & International Affairs* 27.3, pp. 329–348.

[4] Benoît Pelopidas (2021): "The Birth of Nuclear Eternity", in: *Futures*, ed. by Sandra Kemp and Jenny Andersson, Oxford University Press, pp. 484–500.

[5] Alfred Nordmann (2018): "Four Horsemen and a Rotten Apple: On the Technological Rationality of Nuclear Security", in: *Arbeit und Spiel: Jahrbuch Technikphilosophie 2018*, ed. by Alexander Friedrich et al., Baden-Baden: Nomos, pp. 279–293.

[6] Craig and Ruzicka, "The Nonproliferation Complex", p. 329. See Footnote 1 in the article for the authors' list of those entities.

[7] Cf. ibid., pp. 329–330.

[8] Pelopidas, "The Birth of Nuclear Eternity", p. 485.

[9] Cf. ibid., p. 485.

[10] Nordmann, "Four Horsemen and a Rotten Apple: On the Technological Rationality of Nuclear Security", p. 282.

[11] Cf. ibid., p. 282.

[12] Cf. ibid., pp. 288–289.

technical working order[13] and maintenance of the order of things by deference to its workings,[14] even as the order falls apart. With this perspective Nordmann seeks to capture the post-Cold War shift from the political questions of security to technical concerns of safety – a shift rendered salient in the post-Cold War preoccupation with managing the risks associated with the presence of nuclear material and weapons. And while it's important to note that this perspective was published in 2018, prior to Russia's invasion of Ukraine in 2022 and the reinvigoration of arms racing dynamics among the U.S., Russia, and China, it's still not entirely clear that nuclear-weapon states' plans to build up their nuclear arsenals correspond definitively to the requirements of nuclear deterrence.[15]

For my exploration of the connection between citizen monitoring of nuclear activities and the entrenchment of the nuclear order, I use two philosophy-of-technology, specifically technological-society, approaches: Langdon Winner's of 'autonomous technology' from his book *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*[16] and an approach based on Michel Foucault's 'Panopticon' from his book *Discipline and Punish. The Birth of the Prison*.[17] I summarize the approaches in the following.

Winner's metaphor of 'autonomous technology' refers to the technical systems underpinning social life in modern rationalized societies obeying, under the mantra of efficiency, technological imperatives to such an extent as to leave little room for democratic control. For through a process he dubs 'reverse adaptation', whereby human ends are adjusted to match the character of the available means,[18] society seems to lose control over the technical means at its disposal, purposed and repurposed as they are by increasingly exclusively technological imperatives. The technical systems thus appear to attain autonomy. Winner outlines five reverse-adaptation behavioral patterns through which technical systems extend their control over society.[19] One of those behavioral patterns has an overt connection to militarism and could be used to understand the dynamics of the interaction

[13] Cf. Nordmann, "Four Horsemen and a Rotten Apple: On the Technological Rationality of Nuclear Security", p. 285.
[14] Cf. ibid., p. 283.
[15] For a perspective on the U.S. context, see, for example, Sharon K. Weiner (Jan. 2022): "The Biden Nuclear Posture Review: Resetting the Requirements for Nuclear Deterrence", in: *Arms Control Today*, available at: https://www.armscontrol.org/act/2022-01/features/biden-nuclear-posture-review-resetting-requirements-nuclear-deterrence, accessed: 31/5/2024.
[16] Langdon Winner (1977): *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, Cambridge, Massachusetts: The MIT Press.
[17] Michel Foucault (1975): *Discipline and Punish. The Birth of the Prison*, trans. by Alan Sheridan, 2nd ed., New York: Vintage Books, 1995.
[18] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 229.
[19] The five reverse-adaptation behavioral patterns are detailed in ibid., pp. 238–251.

between nuclear non-state OSINT practices and domestic and international politics: the system discovering or creating a crisis from the perception of threat – though increasingly rather *risk*, one should note – to justify the system's own further expansion.[20] However, I show in this work how each of the five behavioral patterns manifests in the nuclear non-state OSINT context.

As for Foucault's 'Panopticon', the concept refers to a model for the disciplinary mechanisms that constitute the relations of power and large-scale control in industrialized societies in the 19th century.[21] Foucault's concept is inspired by Utilitarian Jeremy Bentham's Panopticon, which, suggesting 'all-seeingness' from its Greek roots, was an architectural plan for a prison conceived by Bentham. Bentham's design was guided by the objective of being able to observe, control, and discipline as many inmates as possible, as economically and effectively as possible. This objective was to be achieved by arranging the prison cells in a ring around the guard post, the walling and lighting conditions composed in such a way that: *a)* the guard(s) in the tower could observe the moving shadows of the inmates in the cells at all times without the inmates being able to see the guard(s); *b)* the inmates could neither see nor communicate with one another through their cells. Any potential attempts at collusion among and mutiny by the inmates would thus be successfully thwarted. The efficiency of Bentham's Panopticon derives from the fact that the intended disciplinary effects materialize irrespective of whether the guard post is occupied at all times, only intermittently, or never; disciplinary power functions automatically.

Generalizing the architecture to a model for modern 19th century societies, Foucault sought to capture the nature of power practiced by social institutions (e.g., education, medical treatment, production, punishment) where individuals become the principle of their own subjection through the panoptic characteristic of automatic functioning of power – the characteristic brought about by their consciousness of their permanent visibility despite the unverifiability of the surveillance action. But as with Bentham's prison, knowledge gathering and analysis for insight as to how best to discipline subjects goes hand in hand with the exercise of power and amplifies it, for the knowledge aids in norm fabrication – the outcome of power/knowledge being a maximally productive norm-abiding workforce.

A warning is in order. My appeal to Foucault's 'Panopticon' in this thesis project qualifies as an abuse. In this I join the league of many others who have used the concept to model

[20] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, pp. 248–250.
[21] The treatment of the 'Panopticon' occurs in Foucault, *Discipline and Punish. The Birth of the Prison*, pp. 200–209.

contemporary large-scale surveillance practices. Among those in this league are writers for a 2021 issue of the neoliberal-leaning *The Economist* magazine.

The Economist dedicated a 2021 issue (its cover and Leader[22] (the British name for 'editorial') and Briefing[23] sections) to the promise of non-state OSINT, with special focus on the nuclear kind. The cover lauded the coming-of-age of the "people's panopticon," in a reference to Foucauldian panopticism. (The authors of the Briefing drew additional inspiration from Foucault in their choice of two headers, "An archaeology of knowledge" and "The order of things" in a reference to two of Foucault's works. But an exegesis demystifying the magazine's Foucauldian references is not my interest.) It's instructive to examine the magazine's argument in support of nuclear non-state OSINT in order to elucidate the utility of Foucault's Panopticon as an approach to understanding the contribution of nuclear non-state OSINT practices to the entrenchment of the nuclear order, but also to highlight some of the themes engaged with by scholarly literature speaking to the transformative potential of nuclear non-state OSINT. The issue's Leader says:

> A world where many American, European, Chinese and Russian satellite companies vie to sell images is one of mutually assured surveillance. This is a future that open societies would be wise to embrace. Tools and communities that can unearth missile silos and unveil spies will make the world less mysterious and a little less dangerous. Information still wants to be free—and OSINT is on a mission to liberate it.

The argument for supporting nuclear non-state OSINT seems to be the following. Open societies are good. Free-flowing information is a pillar of open societies. As it happens, "[i]nformation wants to be free, because the cost of getting it out is getting lower and lower all the time."[24] But for a long time since globalized internet use there has been either a tight grip on information flows by authoritarian governments or bad information disseminated by malicious actors. Non-state OSINT, thanks to technological developments, is decentralized and egalitarian and could thus liberate information, by *a)* submitting imagery provision to forces in an international market of U.S., European, Russian, and Chinese imagery providers; *b)* submitting data analysis to vetting by analysts (experts and hobbyists alike) everywhere. All governments could thus be held to account by people everywhere. Open societies would proliferate, and the guarantor for international

[22] "The people's panopticon: The promise of open-source intelligence" (Aug. 7, 2021), in: *The Economist*, available at: https://www.economist.com/leaders/2021/08/07/the-promise-of-open-source-intelligence, accessed: 31/5/2024.

[23] "Trainspotting, but with nukes: Open-source intelligence challenges state monopolies on information" (Aug. 7, 2021), in: *The Economist*, available at: https://www.economist.com/briefing/2021/08/07/open-source-intelligence-challenges-state-monopolies-on-information, accessed: 31/5/2024.

[24] *The Economist* Leader quoting Stewart Brand, "a pioneer of online communities."

security would be mutually-assured surveillance. The world would thus be more secure, and nuclear strategies such as mutually-assured destruction with their sinister visions evoking fear and anxiety could eventually be retired.

In light of my reconstruction of *The Economist*'s argument, how could Foucault's Panopticon shed light on the connection between nuclear non-state OSINT practices and the entrenchment of the nuclear order? While one may argue that *The Economist*'s "people's panopticon" is a whitewashing, euphemistic perversion of Foucauldian panopticism, it bears emphasizing that Foucault's Panopticon is in a sense already the people's – or more precisely, a citizenry's – where the panoptic arrangement of power/knowledge relations enjoys such transparency as to allow for various roles for citizens in the metaphorical observation tower, including oversight of the Panopticon – possibly state-affiliated – functionaries. The arrangement of power/knowledge relations thus lends itself to the democratic control of the disciplinary mechanism of the Panopticon – democratic control acting as a guardrail to the devolution of the setup to tyranny.[25] However, as I show in this work, democratic control constituted by nuclear non-state OSINT is no panacea. In particular, I demonstrate that nuclear non-state OSINT is implicated in several legitimation mechanisms for the most powerful actors in the nuclear order and thus contributes to its entrenchment.

As such, Foucault's 'Panopticon' and Winner's 'autonomous technology' provide in their own unique ways a dynamical understanding of technologically-enabled phenomena of self-generation, -perpetuation, and -reinforcement, which I think makes my choice of approaches apt for exploring the connection between citizen monitoring of nuclear activities and the entrenchment of the nuclear order.

Among the works that engage with the issue of the transformative role of nuclear non-state OSINT in domestic and international politics, some, especially from the early 2000s, are sanguine, celebrating the promise of holding governments accountable, of domestic and global transparency, and of challenging monopolies (on information, technology, authority, legitimacy, narrative,…).[26] Others are more or less critical, skeptical of the claims

[25] Cf. Foucault, *Discipline and Punish. The Birth of the Prison*, p. 207.

[26] See, for example, Karen T. Litfin (2002): "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", in: *Information Technologies and Global Politics: The Changing Scope of Power and Governance*, ed. by James N. Rosenau and J. P. Singh, Albany: State University of New York Press, pp. 65–89; Sean Aday and Steven Livingston (2009): "NGOs as intelligence agencies: The empowerment of transnational advocacy networks and the media by commercial remote sensing in the case of the Iranian nuclear program", in: *Geoforum* 40.4, pp. 514–522.

of some nuclear non-state OSINT community members to counterhegemony.[27] According to my reading of them, none of the works deals with nuclear non-state OSINT practices with respect to their effect on nuclear entrenchment.

This thesis report is organized as follows. In Chapter 2, I give some necessary background for the subsequent analysis. In particular, I introduce the concepts of 'nuclear order', 'OSINT', and 'nuclear entrenchment'. I also give a short history of OSINT and present a preliminary understanding of the relationship between nuclear non-state OSINT and the entrenchment of the nuclear order, demonstrating the limitations of this preliminary understanding and motivating the analysis task of this thesis project. In Chapter 3, I explain the two approaches I use in the subsequent analysis, Winner's 'autonomous technology' approach and the approach based on Foucault's 'Panopticon'. In Chapter 4, I apply these two approaches to elucidate the relationship between citizen monitoring of nuclear activities and the entrenchment of the nuclear order. In Chapter 5, I highlight the similarities and differences between the two approaches as they present in the case under study. I also dwell on Winner's conceptualization of agency and draw connections to contemporary forward-looking proposals for a potentially emancipatory vision of citizen monitoring of nuclear activities. The chapter concludes with a summary of the key points of my analysis in this thesis project.

[27] See, for example, Martin Dodge and Chris Perkins (2009): "The 'view from nowhere'? Spatial politics and cultural significance of high-resolution satellite imagery", in: *Geoforum* 40.4, pp. 497–501; Chad Vincent Harris (2011): "Technology and Transparency as Realist Narrative", in: *Science, Technology, & Human Values* 36.1, pp. 82–107; Nina Witjes and Philipp Olbrich (2017): "A fragile transparency: satellite imagery analysis, non-state actors, and visual representations of security", in: *Science and Public Policy* 44.4, pp. 524–534; Christopher Lawrence (2019): "Heralds of global transparency: Remote sensing, nuclear fuel-cycle facilities, and the modularity of imagination", in: *Social Studies of Science* 50.4, pp. 508–541.

2 The Nuclear Order, Nuclear Non-state OSINT, and Entrenchment – A Preliminary Attempt at Drawing Connections

In this chapter, I take apart the title of this thesis report as a way to establish the background for the analysis I undertake in Chapter 4. I note that the two approaches, Winner's 'autonomous technology' approach and the approach based on Foucault's 'Panopticon', were described briefly in the Introduction chapter and will be detailed further in Chapter 3.

2.1 The Nuclear Order

For a working definition of the 'international nuclear order', or 'nuclear order' for short, I adopt the following one by Walker in *A Perpetual Menace. Nuclear Weapons and International Order*:

> Given the existence of nuclear technology, the international nuclear order entails evolving patterns of thought and activity that serve primarily goals of world survival, war avoidance and economic development; and the quest for a tolerable accommodation of pronounced differences in the capabilities, practices, rights and obligations of states.[1]

A couple of points in the definition bear emphasizing. First, the nuclear order's purposes as implied by Walker – world survival, war avoidance, and economic development – may be in tension. Second, the definition recognizes fundamental distinctions to exist among states, not the least the distinction arising from the difference between nuclear-weapon

[1] Walker, *A Perpetual Menace. Nuclear Weapons and International Order*, p. 12.

states and non–nuclear-weapon states. Third, the nuclear order is amenable to change. Fourth, how differences among states are to be addressed is an inherently contentious issue.[2]

All in all, Walker concedes that the definition may not be universally accepted because a conception of order, nuclear or otherwise, is contested.[3] Nevertheless, this working definition is adequate for my purposes in this thesis project as it gestures to contemporary problems related to nuclear technology that the nuclear order seems thus far to have been incapable of adequately addressing: the increasing salience of nuclear weapons in military planning by nuclear-weapon states, the insufficiently questioned utility and legitimacy of nuclear deterrence for security and peace, the risks of nuclear proliferation and nuclear weapons use through accident, misperception, or miscalculation, and internationally inequitable access to nuclear technology for peaceful purposes.

I take it that these problems remaining unaddressed or becoming more acute may be a symptom of the entrenchment of the nuclear order. This intuition underlies my motivation to study entrenchment dynamics in this thesis project.

2.2 Civil-Society Nuclear-Activity Monitoring: Historical Initiatives

The following are some forerunner examples to today's nuclear non-state open-source intelligence (OSINT) efforts from the period towards the end of the Cold War, gleaned from Wellerstein's *Restricted Data. The History of Nuclear Secrecy in the United States*:[4]

- William A. Arkin, a U.S. Army veteran, starting in 1978, worked off of "obscure reports, declassified documents, congressional testimony,"[5] his private impressions of suspected nuclear weapons sites upon driving past them, and information obtained through a Freedom of Information Act request. That is, he worked entirely in the public domain using an unclassified approach, piecing together information to form a more complete picture that was initially informed by a guess about the locations of

[2] Cf. Walker, *A Perpetual Menace. Nuclear Weapons and International Order*, pp. 12–13.
[3] Cf. ibid., pp. 12–13.
[4] See Alex Wellerstein (2021): *Restricted Data. The History of Nuclear Secrecy in the United States*, Chicago: The University of Chicago Press, Chapter 9.
[5] Ibid., p. 372.

secret U.S. nuclear weapons sites worldwide.[6] Arkin's objective was to compile tangible evidence to enable in the U.S. policy analysis and change in nuclear weapons matters. He regarded some of the policies of his day to be in violation of democratic consent, attributing the problems to the nuclear industry and government secrecy.[7] He hoped, for example, for a serious policy discussion to be launched on U.S. defense spending increases during the Ronald Reagan administration justified on the grounds of the alleged expansion of the Soviet arsenal.[8] Arkin also collaborated with the Natural Resources Defense Council (NRDC) and Greenpeace, whose activities are listed below.

- Arkin's work and similar work by others eventually led to the *Nuclear Weapons Databook*,[9] a multi-volume series published from 1984 to 1994 covering the nuclear capabilities and facilities of the United States, the Soviet Union, the United Kingdom, France, and China. The *Nuclear Weapons Databook* has connections to Stockholm International Peace Research Institute's annual yearbook, *SIPRI Yearbook: Armaments, Disarmament and International Security*.[10]
- Jane's Information Group in the U.K. conducted coverage of nuclear weapons matters as of the 1980s.
- The NRDC was founded in 1970 and focused on environmental advocacy to mitigate or prevent environmental hazards from nuclear reactors or nuclear testing. But in the early 1980s, the NRDC launched a project to provide facts on U.S. nuclear weapons: "how many there were, what they looked like, where they were deployed, and how and where they were made."[11] In 1987, the NRDC started publishing the "Nuclear Notebook" as a column on nuclear weapons matters with annual updates on the world's nuclear deployments and stockpile sizes in the *Bulletin of the Atomic Scientists*. The "Nuclear Notebook" served to update the information in the aforementioned *Nuclear Weapons Databook* volumes. The information was sourced by "scouring reports, statements, official speeches, and information obtained through the Freedom of Information Act to create a synthetic picture."[12] This work was eventually taken up by the Federation of American Scientists in 2010 after

[6] Cf. Wellerstein, *Restricted Data. The History of Nuclear Secrecy in the United States*, p. 372.
[7] Cf. ibid., pp. 372–373.
[8] Cf. ibid., p. 373.
[9] Cf. ibid., p. 373.
[10] Ibid., Chapter 8, Footnote 122.
[11] Robert S. Norris and Hans M. Kristensen (2015): "Counting nuclear warheads in the public interest", in: *Bulletin of the Atomic Scientists* 71.1, pp. 85–90, p. 85.
[12] Wellerstein, *Restricted Data. The History of Nuclear Secrecy in the United States*, p. 374.

the elimination of the NRDC's nuclear program.[13] The "Nuclear Notebook" column in the *Bulletin of the Atomic Scientists* is being maintained and updated through the present day.

- Greenpeace's "Nuclear Free Seas" campaign from 1986 until the end of the Cold War had the objective of identifying U.S. ships that carried nuclear weapons and that docked in foreign ports – an act in potential conflict with the domestic politics of some of the foreign states.[14] Greenpeace's campaign was basically generating unwanted controversy, including with U.S. allies. Eventually, the U.S. removed the nuclear weapons from the ships "to avoid diplomatic headaches."[15]

Post-Cold War examples with the proliferation of archival satellite imagery in the public sphere and the advent of commercial satellites include the Verification Research, Training and Information Centre (VERTIC) in the U.K. and the Federation of American Scientists' Public Eye program. These post-Cold War examples lie at the cusp of the transition to the nuclear non-state OSINT practices familiar today.

According to Wellerstein, the U.S. examples towards the end of the Cold War in the above list reflected the "anti-secrecy" public discourse that emerged towards the end of the Cold War. A shift in secrecy politics occurred at the time, spurred by the public's wariness of official secrecy, having come to know the extent of misuse or abuse of secrecy practices. National security claims would be advanced as a pretext, but instead were a cover-up for mistakes and misdeeds. This was a time when the public had grown disillusioned with the Vietnam War and distrustful of the government upon the revelation of the extent of official lying revealed by the Pentagon Papers and Watergate scandals in 1971 and 1972, respectively.[16]

Anti-secrecy became in the 1970s a "coherent political worldview that began to motivate both individual actors and competing institutions (like the press) to directly challenge not only the *ideas* of the secrecy regime, but its practices and institutions."[17] This was a period of changing public attitudes towards the government and press and their roles and the relationship between them. (Wellerstein defines a 'secrecy regime' as "a bundle of thoughts, activities, and organizations that try to make secrecy 'real' in the world,

[13] Cf. Wellerstein, *Restricted Data. The History of Nuclear Secrecy in the United States*, p. 375.
[14] Cf. ibid., p. 375.
[15] Ibid., p. 375.
[16] Cf. ibid., pp. 335–336.
[17] Ibid., p. 335.

to perform the multitude of acts of epistemological slicing that result in some people knowing things, and other people not."[18])

2.3 OSINT

(State) OSINT is the collection and analysis by state actors of publicly available sources using potentially classified, proprietary methods to derive actionable insights for state action. In the U.S. context, OSINT complements other forms of intelligence such as HUMINT, IMINT, SIGINT, and MASINT, which are U.S. intelligence community acronyms for human, image, signal, and measurement and signature intelligence, respectively.

Earlier examples of OSINT practices took the form of the monitoring of newspapers for useful information across politics, economics, military, technology, culture, and society. Those practices featured, for example, in the American Civil War and in Germany pre- and during World War I.[19] In the context of World War II, public radio broadcast had been established and OSINT was practiced by the U.K.'s BBC Monitoring Service by 1939 and the U.S.'s Foreign Broadcast Monitoring Service by 1941 to monitor radio broadcasts from around the world.[20] OSINT practices continued during the Cold War. However, the acronym 'OSINT' wasn't coined until the early 1990s in domestic appeals to improve U.S. open-source intelligence practices to keep up with new challenges.[21]

By contrast, non-state OSINT refers to the collection and analysis by non-state actors of publicly available sources using unclassified approaches to derive actionable insights and the dissemination of information from the process through public media channels.

According to popular narrative, non-state OSINT practices with a bearing on peace and security gained in prominence thanks to the confluence of two factors: the surge in publicly available data online that is potentially verifiable using increasingly available high-resolution commercial satellite imagery and growing interest in actionable insights from that data. This popular narrative emphasizes sub-meter commercial satellite imagery being made available by DigitalGlobe's QuickBird satellite in 2001 with an unprecedented scale of data availability unleashed by the arrival of social media with Facebook's and

[18] Wellerstein, *Restricted Data. The History of Nuclear Secrecy in the United States*, p. 6.
[19] Cf. Ludo Block (2024): "The long history of OSINT", in: *Journal of Intelligence History* 23.2, pp. 95–109, pp. 99–103.
[20] Cf. ibid., p. 95.
[21] Cf. ibid., p. 96.

Twitter's launch in 2006. Events of historical importance where these technological developments came to bear were, for example, Iran's Green Movement protests in 2009 and the Arab Spring as of 2011, punctuated by the Syrian War.

Generally, the tools that enable non-state OSINT practices are:

- *Internet connectivity.* This refers to internet-equipped mobile phones as well as services and platforms such as e-mail, social media platforms, collaboration platforms, fora, etc. Importantly, internet connectivity allows for the shareability of data, findings, observations, and assertions on nuclear dangers as well as for collaboration.
- *Sensing technologies.* These range from camera-equipped phones to environmental sensors to drones to commercial high-resolution Earth-observation satellites. The enabling trends for the proliferation of these technologies have been miniaturization and declining costs, contributing to scalability.
- *Publicly available data and tools.* These include search engines; searchable databases, websites tracking aircraft and ship routes or featuring transactional data; text, image, and video data on, for example, social media platforms, with the metadata of images and videos uploaded to social media platforms being helpful for geolocation and other identification tasks; Google Street View, map services, and free or commercial high-resolution satellite imagery; data and network analysis tools; 3-D modeling tools, which are useful for figuring out aspects of objects that are obscured or missing in images or video.

The rest of this section addresses nuclear non-state OSINT. In the nuclear security realm, sub-meter commercial satellite imagery marked its debut in the context of the discovery of clandestine enrichment activities in Iran, when a U.S. non-governmental organization (NGO), the Institute for Science and International Security, publicly published in 2002 imagery by DigitalGlobe's QuickBird satellite of the Natanz facility and its analysis based on the imagery of suspicious uranium enrichment activity at the facility. The publication occurred while the International Atomic Energy Agency was still in the process of securing the right to inspect the facility.[22]

This moment heralded the era of contemporary nuclear non-state OSINT that is concerned with monitoring activities that may be related to a given state's nuclear weapons program, be it official or unofficial, internationally known or clandestine. (Such activities are referred to in this thesis as 'nuclear activities'.) Obviously, the contemporary

[22] See, for example, Lawrence, "Heralds of global transparency: Remote sensing, nuclear fuel-cycle facilities, and the modularity of imagination".

practices differ from their 20th century forerunner examples in the sheer scale of available data. However, the politics of the civil-society analysts are also markedly different, as my analysis in Chapter 4 will make clear.

I conclude this section with a couple of notes on satellite capabilities useful for nuclear-activity monitoring and on the most prominent actors making up the nuclear non-state OSINT community. Different satellite imaging spectral bands and imaging modalities can capture different aspects of nuclear activities. While electro-optical (RGB) imagery is intuitively useful for its natural color representation, panchromatic (grayscale) imagery can be advantageous for its sharpness. Near-infrared imagery can reveal vegetation changes, which could indicate burn scars from missile launches or vehicle tracks. Thermal infrared imagery reveals temperature changes, which could indicate the operational status of nuclear facilities and their production capacities. Hyperspectral imagery can reveal material composition, which is useful for the detection of uranium mining activity. Synthetic aperture radar (SAR) imagery can capture submarines, shipping activity, and earthquakes, which could indicate underground nuclear testing. In contrast to their electro-optical counterparts, SAR satellites' gaze can penetrate clouds and darkness.

Moric's work shows that 265 electro-optical imaging commercial satellite systems currently in operation aggregated into a superconstellation could deliver 5m-resolution imagery over nuclear-weapon states' territories at an average revisit rate of one-third of a day and that a superconstellation of 35 SAR commercial satellite systems currently in operation could deliver 5m-resolution imagery at an average revisit rate of only a couple of hours.[23,24] With more and more satellite constellations expected to be launched in the coming years, persistent imaging from outer space is, in principle, attainable in the not so distant future.

The nuclear non-state OSINT community comprises analysis actors as well as commercial satellite operators and imagery providers. The analysis actors are an eclectic mix of academics, researchers, journalists, former government officials, former government intelligence analysts, activists, hobbyists, advocacy groups, and NGOs (both non-profit and for-profit).[25] Commercial high-resolution imaging satellite operators and imagery

[23] Igor Moric (2022): "Capabilities of Commercial Satellite Earth Observation Systems and Applications for Nuclear Verification and Monitoring", in: *Science & Global Security* 30.1, pp. 22–49.

[24] The average is computed over time-of-year and across territories, blurring cloud cover differences. These statistics assume nadir perspective for the satellites and continuous imaging; continuous imaging implies no priority tasking for the satellites and no battery saving downtime.

[25] For a listing of nuclear non-state OSINT NGOs see Table 4.1 in Amy Zegart (2023): "Understanding New Nuclear Threats: The Open-Source Intelligence Revolution?", in: *The Fragile Balance of Terror. Deterrence in the New Nuclear Age*, ed. by Vipin Narang and Scott D. Sagan, Ithaca and London: Cornell University

providers include the U.S. companies Planet, Maxar, and Capella Space and the European Airbus.

2.4 Nuclear Non-state OSINT and the Entrenchment of the Nuclear Order – A Preliminary Understanding

A good working concept of 'entrenchment' as it pertains to the nuclear order could be that fixed by Walker in his 2020 working paper titled *On Nuclear Embeddedness and (Ir)Reversibility*.[26] His definition of the concept takes as its starting point that of Starr in *Entrenchment. Wealth, Power and the Constitution of Democratic Societies*[27] :

> Paul Starr writes that "Entrenchment…can refer to any process whereby an institution, a technology, a group, or a cultural form—any kind of social formation—becomes resistant to pressures for change." He speaks of "tenacious structures." He identifies two kinds of constraint: on, amongst other things, the reversibility of decisions, developments and social formations; and on change itself, through change's channeling in particular directions to the exclusion of others. He points out that entrenchment refers to both a condition and a process, and that it may be both purposive and an emergent, unintended property. It may also arise unconsciously, actors sometimes being unaware that their actions, large and small, are contributing to undesirable entrenchment.[28]

The following are phenomena Walker associates with nuclear entrenchment within an individual state from weak to strong degrees of irreversibility: the process or condition that "invariably accompanies advocacy and the commitment of resources and expertise"; resistance to the abandonment of a nuclear weapons program, as demonstrated even by South Africa; "commitment to the possession of nuclear weapons and practice of nuclear deterrence"; the state where "commitments, practices, and states of mind become extremely hard to shift"; the "crystallization of a social formation."[29]

Press, pp. 90–119, pp. 105–106.

[26] William Walker (Feb. 2020): *On Nuclear Embeddedness and (Ir)Reversibility: A Working Paper*, Program on Science and Global Security, Princeton University, https://sgs.princeton.edu/sites/default/files/2020-02/walker-2020.pdf, accessed: 31/5/2024.

[27] Paul Starr (2019): *Entrenchment. Wealth, Power and the Constitution of Democratic Societies*, New Haven: Yale University Press.

[28] Walker, *On Nuclear Embeddedness and (Ir)Reversibility: A Working Paper*, p. 42.

[29] Ibid., p. 43.

Walker chooses to define 'entrenchment' to denote the "general process of becoming more resistant to change, as well as an entrenched condition that is still open to reversal, albeit with difficulty."[30] Of stronger degree than 'entrenchment' would be 'embeddedness', and the strongest degree would be 'permanence', suggesting irreversibility and irrevocability.[31] Though these gradations are helpful for Walker's framework, 'entrenchment' is used in the rest of the thesis to refer to all three conditions without discrimination.

Walker outlines six aspects characterizing at the *state* level (rather than *international* level) the crossing of the threshold to nuclear embeddedness – the threshold after which the prospect for a state's reversal of course back to non–nuclear-weapon status diminishes sharply.[32] In the following, I list these aspects along with my sketch of the contributions of the nuclear non-state OSINT sociotechnical network (as a mostly Western, mostly U.S. phenomenon) to these aspects. The sketched nuclear non-state OSINT functions will be elaborated on in the course of Chapter 4.

- *Production and operational estate formation.* Threshold-crossing entails the transition of a state from the mere development of nuclear weapons to their deployment. This necessitates a level of industrialization for the production of nuclear material and nuclear weapons and their means of delivery, as well as a level of operationalization for the integration of nuclear weapons into military structures. Among the elements of the threshold-crossing estate Walker also counts the intensified gathering of intelligence on the nuclear capabilities of adversaries.

  In this respect, the non-state OSINT community becomes a useful, non-redundant actor with unique functions to perform beyond the mere corroboration of state intelligence assessments. In order to appreciate this uniqueness, it's worth considering another estate element that Walker counts: "In each respect, activity is subject to considerable secrecy and state control over property rights and information flows."[33] Indeed, one function the non-state OSINT community serves is the production of intelligence that could be shared with domestic and international audiences, while protecting a state's classified intelligence sources and methods. In other words, the non-state OSINT community, inadvertently or consciously, becomes part of a state's nuclear secrecy regime.

- *Politico-military activation.*

[30] Walker, *On Nuclear Embeddedness and (Ir)Reversibility: A Working Paper*, pp. 43–44.
[31] Cf. ibid., p. 44.
[32] These six aspects are listed in ibid., pp. 10–12.
[33] Ibid., p. 11.

> Becoming a nuclear weapon state entails incorporation of nuclear deterrence and war-fighting into politico-military practices, doctrines and strategic thinking, including arrangement of the interplay with conventional forces, *requiring bureaucratic development and institutional adaptation inside and outside government, and establishment of appropriate civil-military relations*. It involves substantial reconfiguration of patterns and processes of interaction with foes, friends and allies within regions and the wider international system. [Emphasis added.][34]

In terms of the non-state OSINT network's contribution, instantiating the sub-aspect of politico-military activation in the italicized phrase are the calls in the U.S., prompted by renewed competition among nuclear powers (but also increasing nuclear safety and security risks internationally), for the overhaul of the U.S. intelligence community to incorporate and streamline across the intelligence agencies the use of open sources and methods for intelligence gathering, including by striking formal relationships with the non-state OSINT community and industrial players such as commercial satellite operators and imagery providers.[35] Calls and efforts to professionalize the non-state OSINT community are also a manifestation of the same sub-aspect.

- *Security dilemmas/paradoxes.* By this aspect, Walker is referring to the engagement of a state wishing to enhance its security in actions that may diminish rather than enhance its security. Non-state OSINT community findings elicit or accompany the embarking on domestic debates on current and future nuclear threats from adversarial states and on security requirements, e.g., the need for nuclear modernization or build-up to maintain nuclear deterrence. Non-state OSINT practices therefore help reinforce the acquisition and deployment dynamics underpinning the first two aspects, thus helping launch or reinforce a state's security dilemmas/paradoxes.
- *Identity formation.* By this aspect, Walker is referring to the consolidation of identities within ever larger networks of actors in a state around the belief that the possession of nuclear weapons serves their state's national interests. Nuclear weapons are incorporated into the state's national identity, perhaps as "symbols of power

[34] Walker, *On Nuclear Embeddedness and (Ir)Reversibility: A Working Paper*, p. 11.

[35] See, for example, Amy Zegart (2021): "Spies Like Us: The Promise and Peril of Crowdsourced Intelligence", in: *Foreign Affairs* 100.4, pp. 168–173, p. 173; Sandra Erwin (Apr. 17, 2023): "Satellite imaging industry responds to demand for intelligence fusion", in: *SpaceNews*, available at: https://spacenews.com/on-national-security-satellite-imaging-industry-responds-to-demand-for-intelligence-fusion/, accessed: 31/5/2024.

and advancement."[36]

I think it's unclear how non-state OSINT practices contribute to the formation of a nuclear-weapon state's *national* identity. However, to the extent that the practices are concentrated in the U.S. and the surveillance gaze is directed mostly outwards away from the U.S., looking out for and scrutinizing nuclear risks emerging abroad, the practices help consolidate the *international* identities of the U.S. as guarantor of international nuclear stability and as the vanguard of the international nuclear non-proliferation regime. After all, these roles for the U.S. require a global surveillance function that is rendered potentially more reliable and productive when executed by more and diverse surveillance actors. At any rate, non-state OSINT practices may contribute as a result of the intensification of U.S. selective, asymmetric surveillance to the entrenchment of the *international* nuclear order, domestic nuclear embeddedness being a fallout.

- *Construction of narratives, consolidation of belief.*

  > Threshold-crossing always involves the crafting by government of political and strategic narratives designed to justify possession and the practice of nuclear deterrence, assuage national and international audiences, signal to rivals, and enable politicians and bureaucrats to sing from the same hymn sheet. [...] At the same time, belief in the manageability of nuclear deterrence, in its value as a preventer of war and projector of power and prestige, and in its moral worth, is necessarily consolidated, to the extent of becoming dogma. [...][37]

  Outward-gazing non-state OSINT practices help consolidate narratives and beliefs about the dangerous or threatening Other, thus helping substantiate domestic narratives about the necessity of the possession of nuclear weapons and the practice of nuclear deterrence. Simultaneously, the fixation on nuclear risk in contemporary non-state OSINT practices suggests an instrumentalist view of technology and technical systems[38] – a view that encourages the illusion of control over hazardous nuclear practices, including nuclear deterrence, and overconfidence in their manageability.[39] Furthermore, nuclear risk practices provide a pretext for the deprioritization of nuclear disarmament.

[36] Walker, *On Nuclear Embeddedness and (Ir)Reversibility: A Working Paper*, p. 11.
[37] Ibid., p. 12.
[38] The instrumentalist view of technology will be explained in the next chapter in Section 3.1.
[39] Cf. Benoît Pelopidas and Kjølv Egeland (Jan. 2024b): "The false promise of nuclear risk reduction", in: *International Affairs* 100.1, pp. 345–360, pp. 354–357.

- *International recognition.* By this aspect and final step in threshold-crossing to nuclear embeddedness, Walker is referring to the recognition by the international community (especially great powers, especially the U.S.) of a state's possession of nuclear weapons and its practice of nuclear deterrence. The state is thereby no longer a nuclear "pariah." Today, there are nine nuclear-armed states: the five granted recognition as nuclear-weapon states by the Treaty on the Non-Proliferation of Nuclear Weapons (commonly known as the Nuclear Non-Proliferation Treaty (NPT)) (the United States, Russia, the United Kingdom, France, and China), Israel as an informally recognized nuclear-armed state, India and Pakistan as formally recognized nuclear-armed states, and North Korea as an as-yet unrecognized nuclear-armed state. Whatever contribution non-state OSINT practices make to the consolidation of a state's international recognition as a nuclear-armed state is probably a knock-on effect of their contributions across the other five aspects.[40]

This concludes my attempt at highlighting the contributions of the nuclear non-state OSINT network to Walker's aspects of state-level threshold-crossing to nuclear embeddedness. However, as parts of my commentary have shown, nuclear embeddedness isn't located exclusively at the state level. Walker dedicates a later section of his working paper to considerations about nuclear entrenchment being a consequence of the entrenched anarchic states system, conceding an entanglement between national and international factors. That is, Walker concedes that nuclear entrenchment is both an intra- and interstate phenomenon. The anarchic states system has led to the nuclear order or the need for managing deterrence relations among nuclear-armed states and preventing nuclear proliferation.[41]

Be that as it may, Walker's is a heuristic approach that doesn't leave enough room to grapple with the technological politics of nuclear non-state OSINT practices. His approach might therefore mislead one to think these practices are neutral tools or independent analytical variables. By contrast, the two approaches proposed in this thesis to understand the relationship between civil-society nuclear-activity monitoring and the entrenchment

[40] For completeness, Walker's note on the notion of 'change' in an entrenched system: "Starr correctly insists that entrenchment 'is not synonymous with complete stasis or inertia; it requires active reinforcement, renewal and resilience.' Embeddedness notwithstanding, change has occurred in many regards during the nuclear age, including in the quantity and quality of weaponry, strategic doctrine, international regulation, public attitudes and the perceived nature of problems. Indeed, change is built-in, not least by weapon-succession processes and pressures to respond to technological developments coming from inside and outside the military domain." Walker, *On Nuclear Embeddedness and (Ir)Reversibility: A Working Paper*, p. 13.

[41] See ibid., Section 3.

of the nuclear order – Winner's 'autonomous technology' and my approach based on Foucault's 'Panopticon' – do a better job at elucidating technological politics. They also provide a dynamical understanding deriving from the features of particular technological arrangements. This is an understanding that is not necessarily pegged to the state level of analysis, but also goes beyond the concept-aided analyses by Craig and Ruzicka ('nuclear nonproliferation complex'), Pelopidas ('nuclear eternity'), and Nordmann ('maintaining the working order of things').[42]

[42] Craig and Ruzicka, "The Nonproliferation Complex"; Pelopidas, "The Birth of Nuclear Eternity"; Nordmann, "Four Horsemen and a Rotten Apple: On the Technological Rationality of Nuclear Security".

3 Two Approaches

In this chapter, I explain the two approaches, Winner's 'autonomous technology' approach and the approach based on Foucault's 'Panopticon', that I use in Chapter 4 to elucidate the relationship between citizen monitoring of nuclear activities and the entrenchment of the nuclear order.

3.1 Autonomous Technology

In his framework, Langdon Winner employs certain terms that I re-use in this thesis. Those are 'apparatus' (a device that is the end-product of some technique), 'technique' (rational-purposive-productive skill, method, procedure, or routine), 'technology' (rational-purposive-productive social organization, e.g., factory, workshop, bureaucracy, army, etc.), and 'network' (a term that emphasizes the mixture aspect between apparatuses and fully present thinking and acting humans[1] – relatedly, 'large-scale system' or 'sociotechnical aggregate').[2]

"[Technological] structures, processes, and alterations enter into and become part of the structures, processes, and alterations of human consciousness, society, and politics."[3] Their influence has become practically invisible.[4] This observation is the entry point of Winner's critique of technology and his impetus for a theory of technological politics.

The following is a preliminary exposition of aspects of the autonomy of technical systems according to Winner. As Winner discusses, technical systems impose a new order, discipline, and pace.[5] While this is certainly one aspect of the autonomy of technical systems,

[1] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 242.
[2] These definitions are found in ibid., pp. 11–12.
[3] Ibid., p. 6.
[4] Cf. ibid., p. 6.
[5] The discussion can be found in ibid., pp. 191–208.

another one is how they restructure the relationship between the technical means and ends of human pursuits. In order to appreciate the restructured relationship, it's instructive to look at the instrumentalist view of technology. On this view, technologies are but mere means that are adaptable to human-set ends; the human element (be it an individual or society) enjoys full agency in directing the technologies. Winner argues against this instrumentalist view of technology:

> Beyond this [(the imposition of a new order, discipline, and pace)] lie cases in which technical systems, once built and operating, do not respond positively to human guidance. The goals, purposes, needs, and decisions that are supposed to determine what technologies do are in important instances no longer the true source of their direction. Technical systems become severed from the ends originally set for them and, in effect, reprogram themselves and their environments to suit the special conditions of their own operation. The artificial slave gradually subverts the rule of its master.[6]

Winner's position is not to be conflated with technological determinism in the strict sense, however.[7] He concedes that decisions involving technologies are always attended upon by human guiding elements such as wants, needs, and desires; goals, purposes, and motives; individual choices; cultural standards; political decisions.[8] Winner is nevertheless inspired by Jacques Ellul in *The Technological Society* (1954) in his contention that the desires, thoughts, decisions, and actions, though featuring prominently in processes of technological development, are "very thoroughly corrupted by circumstances which arise from modern man's adaptation to technique."[9] So, while the abovementioned human guiding elements are always present in processes of technological development, their relationship to technical means in an advanced technical order – with its conditions of "complex interconnection, technical rationality and the vast scale, concentration and interdependence of major enterprises"[10] – is fraught with problems that are obscured by the simplistic instrumentalist view of technology.

[6] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 227.

[7] According to Wyatt's four types of technological determinism – justificatory, descriptive, methodological, and normative – Winner's technological determinism qualifies as methodological and normative. The former seeks to understand the role of technology in contemporary social life, while the latter calls for technologies and technological change to be made more accountable. This seems to be Wyatt's characterization of Winner as well – see Sally Wyatt (2008): "Technological Determinism is Dead; Long Live Technological Determinism", in: *The Handbook of Science and Technology Studies*, ed. by Edward J. Hackett et al., 3rd ed., Cambridge, Massachusetts, and London, England: The MIT Press, pp. 165–180, pp. 174–175.

[8] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 227.

[9] Ibid., p. 227.

[10] Ibid., p. 228.

More aspects of the autonomy of technical systems will be revealed with the exposition of Winner's concept of 'reverse adaptation' as a mechanism that endows technical systems with a large measure of autonomy, with implications for society's ability to control them. He defines 'reverse adaptation' as "the adjustment of human ends to match the character of the available means."[11] Winner explicates this definition along two dimensions, a cultural one and a political one.

3.1.1 Cultural Dimension

Reverse adaptation so-defined could be understood in cultural terms as the dominance of instrumental concerns in figuring and realizing social ends. Those concerns act then to enforce instrumental motives, values, norms, and standards in the social sphere. Winner draws attention to the spillover into the social sphere of instrumental motives, values, norms, and standards that are typical of and adequate for technical processes. These are motives, values, norms, and standards of efficiency, which Winner defines as achieving "maximum output per unit input,"[12] speed, precise measurement or accuracy, rationality, which Winner conceives of not merely as "accommodation of means to ends," but crucially as "effective, logical ordering of technological parts,"[13] productivity, and technical improvement. Those instrumental motives, values, norms, and standards feature predominantly in advanced technical societies in figuring and realizing social ends such as nutrition, shelter, health, safety, comfort, mobility, education, comfort, etc. Winner describes the spillover of instrumental concerns from the technical to the social sphere as follows: "[T]he technological society tends to arrange all situations of choice, judgment, or decision in such a way that only instrumental concerns have any true impact. In these situations questions of 'how' tend to overpower and retailor questions of 'why' so that the two matters become, for all practical purposes, indistinguishable."[14]

What has become then of social ends, ideals, and commitments that have historically informed human choice, judgment, and decision? Winner echoes Ellul's observation that those have become increasingly abstract and implicit, unarticulated, and removed from questioning, thereby losing their potency in shaping and guiding human action. In their stead has set in a preoccupation with the search for effective technical means as well as ways of assessing the performance of these means. Thus, formerly inherently social

[11] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 229.
[12] Ibid., p. 229.
[13] Ibid., p. 242.
[14] Ibid., pp. 232–233.

choices are reduced to technical choices in terms of the available technical means. But, these are ready at hand along with instrumental standards – foremost among them efficiency – for the evaluation of alternative choices. Ultimately then, these standards effectively determine the choices formally and substantively.[15] In principle then, a machine could execute the selection on behalf of the human. "[T]he ends are restructured to suit the requirements of techniques of performance and of measurement. Thus, selections as to *what* is to be done and *how* proceed almost as if by clockwork."[16]

The sense of autonomy Winner ascribes to technology arises then from the social ends, ideals, and commitments no longer being formative and creative in social choice;[17] diminishing human agency implies a sense of "a self-generating, self-sustaining technical evolution."[18] The conception of autonomous technology suggests "a self-generating, self-perpetuating, self-programming mechanism."[19]

3.1.2 Political Dimension

The discussion of reverse adaptation thus far leaves unspecified how ends are developed for large-scale technical systems and more generally, for the activities pursued in advanced technological societies. As a reminder, Winner's large-scale systems (interchangeably referred to as networks or sociotechnical aggregates) encompass a mixture of apparatuses and thinking and acting humans. That is, the political question of *control* requires elucidation in the context of autonomous technology. Winner argues that "[b]eyond a certain level of technological development [of technical systems], the rule of freely articulated, strongly asserted purposes is a luxury that can no longer be permitted."[20] His reasoning is as follows. Large-scale technical systems are large, extensive, and complex. This implies a high degree of interconnection and more importantly, interdependence among the system's elements. But implied necessarily as well is a high degree of interconnection and interdependence with and among elements external to the system. It follows that if the system is to operate with any degree of certainty and reliability, the extension of control beyond the system's boundaries to the span of interdependencies becomes necessary.[21]

[15] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 233.
[16] Ibid., p. 235.
[17] Cf. ibid., p. 235.
[18] Ibid., p. 236.
[19] Ibid., p. 238.
[20] Ibid., p. 238.
[21] Cf. ibid., pp. 238–239.

But, Winner contends, organizing thought and action to achieve the extension of control mandates another technique – that of planning. Planning encompasses clear intention articulation, calculation, anticipation, foresight, forecasting, precautionary measures, etc.[22] "Under the logic that takes one from size, interconnection, and interdependence to control and planning, it can happen that such things as ends, needs, and purposes come to be dysfunctional to a system."[23] Ends, needs, and purposes may turn out to be a restraint on the system's operation, let alone its ability to grow. They become an obstacle to higher development levels (bigger size and higher interconnection and interdependence levels) for the system.[24] The end-setting process may "become an unacceptable source of uncertainty, interference, and instability,"[25] a threat in itself. "If the system must depend on a source that is truly independent in its ability to enforce new ends, then it faces the perils of dependency."[26] Faced with such a threat, the system may very well seek to "extend its control over the ends themselves."[27] The system may very well transform the ends into mere optimization variables in the plan and tailor them to its own needs.[28]

Winner lays out five behavioral patterns reverse adaptation can take in the context of the subversion of social ends in large-scale technical systems, where the social ends are absorbed into the system's control and planning processes that typically transcend its boundaries.[29] Importantly, these behavioral patterns are attributed to the whole sociotechnical aggregate, which might feature elements of the state – judicial, legislative, or executive. The role of the state in a paradigm of technological autonomy is an issue that Winner theorizes; the discussion is summarized in Section 5.1.1 given its relevance to the case under study where the role of states cannot be overstated. The five behavioral patterns of reverse adaptation are listed in the following, highlighting Winner's examples of state involvement where it presents:

1. *The system controls markets relevant to its operation.* This pattern manifests through the system undertaking vertical integration, controlling buying and selling conditions, and entering contracts, perhaps with the state.

2. *The system controls or strongly influences the political processes that ostensibly regulate its output and operating conditions.* This pattern manifests through the system

[22] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 239.
[23] Ibid., p. 241.
[24] Cf. ibid., p. 241.
[25] Ibid., p. 241.
[26] Ibid., p. 241.
[27] Ibid., p. 241.
[28] Cf. ibid., p. 241.
[29] The five behavioral patterns are outlined and examples listed in ibid., pp. 242–250.

influencing elections, legislation, and the content of law – generally, through the system "tailor[ing] political environments to suit [its] own efficient workings."[30] Public agency corruption presents itself as evidence for this behavioral pattern, for it isn't unheard of that the system pursues bribery of public agencies as a means to securing favorable conditions for its operation.

3. *The system seeks a "mission" to match its technological capabilities.* An example is the repurposing of Cold War military projects in the U.S. in the post-Cold War era. An evidence for this behavioral pattern is continued support for the National Aeronautics and Space Administration (NASA).[31]

4. *The system propagates or manipulates the needs it also serves.* This pattern ensues through the system controlling needs by producing a set of circumstances where the needs and what the system is able to produce coincide perfectly. Winner draws inspiration for this pattern and its examples from the critiques of mass culture and hyperconsumerism popular at his time of writing.

5. *The system discovers or creates a crisis to justify its own further expansion.* This pattern ensues through the system diagnosing crises, in the form of a threat or shortage, based on its own intelligence operations. An example is Cold War U.S. and U.S.S.R. arms racing motivated by the perception of a deterrence gap.

Winner points out that Patterns 4 and 5 may be paired in 'double reverse adaptation', constituting the behavioral pattern of *the propagation of need and the discovery of shortage*. This pattern arises when the system, in attempting to mitigate the discovered shortage using the available means, produces the very circumstances that lead to society's perception of shortage. His prime example for this paired behavioral pattern is that of power companies promoting their products and services through aggressive advertising that simultaneously manipulates and propagates the ineluctable modern need for ever more power-hungry luxury appliances while pointing to an ever-looming power crisis resulting from a shortage in energy supplies.[32]

What then are the implications of political reverse adaptation as they pertain to the controllability of large-scale technical systems? The systems no longer seem flexible nor re-

[30] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 244.

[31] Though representing the civilian arm of the U.S. space program launched during the Cold War, NASA had a legitimating role to play in the normalization of global overhead surveillance. This role and more generally, that of the interaction between the military and scientific spheres in advancing national security interests are discussed in Section 4.1.2.

[32] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 250.

sponsive to human guidance or "the command of the society or its political institutions."[33] Control seems no longer "one-directional and certain," no longer unidirectionally and certainly "leading from the source of social and political agency to the instrument."[34] The following passage captures the convergence of technological imperatives generated by and driving large-technical systems with the reverse adaptation of social ends:

> In the technological perspective megatechnical systems are seen to have definite operational imperatives of their own, which must be met. Society stands at the disposal of the systems for the satisfaction of their requirements. The systems themselves are anything but responsive and flexible. Their conditions of size, complexity, and mutual interdependence give them a rigidity and inertia difficult to overcome. Rather than respond to commands generated by political or social processes, such systems produce demands society must fulfill or face unfortunate consequences. Confronted with these imperatives—the system's need to control supply, distribution, and the full range of circumstances affecting its operations—the immediate and expressed needs of society may seem capricious. Frequently, therefore, requirements of successful technological performance mean that control must be exercised over agencies that were formerly themselves in control.[35]

Finally, a practical implication of Winner's framework of reverse adaptation is that footprints of reverse-adapted social ends can be found in laws, regulations, federal and state budgets and contracts, foreign policy, etc.[36] In Chapter 4, some of these footprints will be revealed in an attempt to understand the role of citizen monitoring of nuclear activities in the entrenchment of the nuclear order.

3.2 Panopticon

I introduced Michel Foucault's 'Panopticon' in the Introduction chapter. In particular, I clarified that I'm abusing the concept, abstracting it as a technology of disciplinary power from its role as foreseen by Foucault in *Discipline and Punish. The Birth of the Prison* in modeling power relations in the modern 19th century state. I will apply the concept in Chapter 4 to understand the role of citizen monitoring of nuclear activities in the entrenchment of the nuclear order.

[33] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 251.
[34] Ibid., p. 251.
[35] Ibid., pp. 251–252.
[36] Cf. ibid., p. 260.

As explained before, the geometric-architectural arrangement itself that underpins the panoptic surveillance apparatus gives rise to the core attributes of disciplinary power that Foucault associated with the 19th century disciplines, e.g., schools, hospitals, asylums, prisons, workshops. I will be explaining those attributes and demonstrating them as they apply to contemporary nuclear non-state open-source intelligence (OSINT) practices in the next chapter, so it bears listing them here without further clarification. Disciplinary power associated with the panoptic gaze is *automatic*, *knowable-but-unverifiable*, *efficient*, *economic and efficacious*, *productive*, and *disindividualized*. It's the attribute of disindividualization that has implications for the transparency of the panoptic disciplinary mechanism and its amenability to democratic control. A closer look at this attribute in the context of contemporary nuclear non-state OSINT practices will help shed light on possible pathways to the entrenchment of the nuclear order.

Of relevance as well to the analysis to come in the next chapter are the *instruments of disciplinary power*: hierarchical observation, normalizing judgment, and examination.[37] As my analysis in the next chapter shows, analogs of these can – with some exercise of the imagination – be discerned in the context of inter-state satellite-based surveillance. I will therefore explain the instruments of normalizing judgment and examination very briefly here, assuming hierarchical observation to be self-explanatory. Normalizing judgment is concerned with quantitative measurement, comparison, differentiation, hierarchization, homogenization, and exclusion. In short, it establishes a norm to which observed subjects are expected to conform.[38] As for examination, it combines the techniques of hierarchical observation and normalizing judgment with the objective of qualifying and classifying the examined subjects and then intervening to rectify their deviations from the norm based on the insights gleaned.[39] Performing both objectification and subjection functions on the examined subject,[40] examination thus constitutes the subject "as effect and object of power, as effect and object of knowledge."[41]

[37] Foucault details these instruments in Foucault, *Discipline and Punish. The Birth of the Prison*, pp. 170–194.
[38] Cf. ibid., p. 183.
[39] Cf. ibid., p. 184.
[40] Cf. ibid., pp. 184–185.
[41] Ibid., p. 192.

4 Nuclear Non-state OSINT and Entrenchment, Understood Through the Two Approaches

In this chapter, I apply the two approaches, Winner's 'autonomous technology' approach and the approach based on Foucault's 'Panopticon', to elucidate the relationship between citizen monitoring of nuclear activities – often referred to here as nuclear non-state open-source intelligence (OSINT) – and the entrenchment of the nuclear order.

4.1 Entrenchment, Understood Through 'Autonomous Technology'

4.1.1 Cultural Dimension

What are manifestations of the predominance of instrumental concerns in society's relationship with the nuclear non-state OSINT network? One can observe the predominance of instrumental concerns on two levels. First, the desire for the abstract, general end of security has been transformed to translate into wholesale subscription to the surveillance network with all its techniques, apparatuses, and sociotechnical organizations, with all that entails in terms of construction, maintenance, continued support, and extension.[1] Enabling and sustaining this relationship to the network are at least in part Winner's canonical instrumental values, norms, and standards of efficiency and productivity – since utilizing what is at hand allows for plug-and-play productivity at minimal cost.

[1] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 234.

Second, the analysts' appeal in their work to scientific modes of operation and scientific values, norms, and standards confers its own legitimacy – validity being a given – on the enterprise. In other words, part of the legitimacy of the enterprise derives from the legitimacy of the scientific enterprise. Some of those modes of operation and values, norms, and standards are hypothesis formulation, the collection of sufficient evidence in the form of data and auxiliary knowledge being derived from the tools of the trade (e.g., authentication tools, 3-D modeling tools), hypothesis testing in light of evidence and subsequent hypothesis acceptance and rejection, the pursuit of reliability in data interpretation, scientific openness in sharing analysis sources, methods, and findings, scientific reproducibility as a consequence, peer-review for the corroboration of results in possibility or actuality, knowledge accumulation, accounting for subjective and objective biases, impartiality, and objectivity. In a nutshell, at play are Winner's canonical instrumental values, norms, and standards of precise measurement or accuracy, rationality, productivity, and technical improvement.

4.1.2 Political Dimension

In this section, I sketch manifestations of the reverse-adaptation behavioral patterns in the nuclear non-state OSINT network. Though Winner foresees these behavioral patterns as attributable to the sociotechnical aggregate under consideration as a whole, the behavioral patterns here are sometimes attributable to individual elements or subsets of elements, and sometimes to the aggregate.

I believe this deviation from Winner's intended mode of application of the approach is necessary in view of the nature of the social end of primary concern in the case of the nuclear non-state OSINT network – ((inter)national) security. For Winner's approach to be applicable, there needs to be some sense of subversion of original social ends by a given large-scale technical system. A limiting, corner case then for which the approach – to my understanding – is inapplicable is if a powerful state is the most prominent actor across the behavioral patterns. There would then be little sense in speaking of the subversion of original social ends by the large-scale technical system. For the end of relevance for a powerful state within an anarchic system of states is national security – at least from the perspective of political realism in international relations. And the U.S. at least has certainly been capable of marshaling technical means in formidable fashion to realize that end.

As it happens, in the context of nuclear non-state OSINT practices, the role of a powerful state cannot be overstated. One need only consider the following aspects of a powerful

state's predisposition to launch, operate, and/or control remote sensing satellite projects, as an integral element of contemporary nuclear non-state OSINT practices:

- Large required capital investment
- Interest in jealous protection of and privileged access to 'national technical means'[2]
- Licensing and regulation of commercial satellite operators
- Conducting anti-satellite attacks

That being said, other actors in the nuclear non-state OSINT network wield great influence and their contribution to the entrenchment of the nuclear order cannot be discounted, as the ensuing discussion will reveal. All things considered, more will be said about the role of the state as envisioned by Winner's approach in Section 5.1.1.

The system controls markets relevant to its operation

Winner's working assumption from classical economics is that the market could/should be influenced a great deal by the purchasing decisions of actors, so that the products and services on offer along with their quantity and price could/should be regulated in reflection of demand. But the former examples illustrate how a powerful state wields considerable power over the commercial satellite operators and imagery providers, from the very condition of the possibility for their existence to their conditions of operation and accordingly their prospects for flourishing in international competition with their operator and provider peers across the world. Now, for the reverse-adaptation behavioral pattern in question to manifest, the market regulation dynamic should be seen to be subverted by a *technical system* such that products and services become available on the market of a certain kind, quality, and quantity determined by factors not reducible to the actions of independent agents partaking in supply–demand dynamics. In order to assess if such a subversion ensues, let us first consider some mechanisms through which a state exercises its power over the operating conditions of commercial satellite operators and imagery providers.

A state licenses and regulates commercial satellite operators. Regulation can take the form of shutter control, imagery export control, or government contracts restricting the public distribution of imagery it requests. Shutter control is when a government restricts

[2] 'National technical means' has traditionally been used to refer to state intelligence satellites and related capabilities.

commercial satellites from imaging certain locations within or outside the country's territory on national security grounds. The following concerns the state of affairs in the U.S.

"U.S. laws currently restrict the resolutions of American commercial satellites so that government satellites still have an advantage. As more foreign countries go into the commercial satellite business, however, these restrictions will confer less of an edge."[3] Also, "US laws currently restrict the resolutions of American commercial satellites, the locations they can capture with remote sensing, and the foreign nationals allowed to purchase their products."[4] While the U.S. government historically hasn't exercised full-fledged shutter control, an example where it virtually did, through financial rather than legal or regulatory means, is when it purchased all high-resolution imagery from Space Imaging, Inc., on Afghanistan in the first three months of the war from October to December 2011.[5] This contract-based mechanism of "dollar shutter control" granting the government exclusive image rights served to ensure operational security during the invasion as well as the capacity for narrative control.[6]

Another illustration of U.S. government regulation of commercial imagery is the 1996 Kyl–Bingaman Amendment. The Amendment limits the quality and availability of high-resolution satellite imagery of Israel (and by extension, the since 1967 occupied Palestinian territories and Golan Heights) produced by U.S. commercial companies. The resolution of the produced imagery should be no better than the highest resolution available from any commercial company outside of the U.S. The result of this Amendment was that the resolution of imagery of Israel was no higher than 2 meters until 2020, when the restriction was relaxed to 0.4 meters upon evidence having been presented that higher-resolution imagery had been available for years at a resolution higher than 2 meters from non-U.S. commercial sources.[7] Prior to the relaxation, the restriction had manifested, for example, as blurred imagery of Israel on public-access platforms such as Google Earth.

In view of the outlined mechanisms of state control, one can now ask what latitude en-

[3] Amy B. Zegart (2022): *Spies, Lies, and Algorithms. The History and Future of American Intelligence*, Princeton: Princeton University Press, p. 237.

[4] Zegart, "Understanding New Nuclear Threats: The Open-Source Intelligence Revolution?", p. 108.

[5] Cf. Witjes and Olbrich, "A fragile transparency: satellite imagery analysis, non-state actors, and visual representations of security", p. 530.

[6] Steven Livingston and W. Lucas Robinson (2003): "Mapping Fears: The Use of Commercial High-Resolution Satellite Imagery in International Affairs", in: *Astropolitics* 1.2, pp. 3–25, p. 12.

[7] See, for example, Zena Agha (Aug. 3, 2020): "Israel Can't Hide Evidence of Its Occupation Anymore", in: *Foreign Policy*, available at: https://foreignpolicy.com/2020/08/03/israel-cant-hide-evidence-of-its-occupation-anymore/, accessed: 31/5/2024.

tities other than states hosting commercial satellite operators and commercial imagery providers have in influencing the market such that one could speak at all of a subversive *technical system*, irreducible to the host states, controlling the market. The actors of relevance in posing this question are the commercial satellite operators and commercial imagery providers on the supply side, and on the demand side the consumers of those commercial actors' products and services, be they domestic or foreign media, domestic or foreign nationals (individuals or non-governmental organizations (NGOs)), or foreign governments. The task now then is to scope the ways in which actors, apart from the host states, could actually influence if surveillance ensues, what is surveilled, how it is surveilled, and how much it would cost.

For Winner, referring to John Kenneth Galbraith in *The New Industrial State*, indicators of market control, i.e., the reduction or elimination of the independence of action of the individual or social collectivity in order to influence market supply–demand dynamics are:[8] *a)* vertical integration usurping the source of supply or the outlet and thereby disabling transactions of bargaining over prices and amounts; *b)* the determination of the price asked or paid in transactions with smaller organizations and controlling the amounts sold; *c)* the agreement in advance through contracts (perhaps with the state) of the "amounts and prices to prevail in exchanges over a long period of time."[9]

Guided by those indicators, one can discern two means of commercial actor market control in the nuclear non-state OSINT case study, which I detail in the following, with their effects on the consumer side elaborated on afterwards:

1. The means here take the form of companies' complex pricing structures. A purchasing entity is bound by offered packages and if those are found to be unsatisfactory, the entity has to pick-and-choose or mix-and-match among multiple product or service providers. So, here the first and second means from above combine virtually to achieve the same effect of reducing or eliminating the possibility of bargaining over prices and amounts.

2. Commercial actors elect to enter into contracts with partners from their biggest markets. In the U.S., the biggest customers of satellite imagery are the government and the finance and agriculture sectors.

So, what are the actual or potential consequences for consumers of those two means of market control? For the navigation of complex pricing structures, consumers unavoidably have to possess a baseline of technical knowledge to optimize the cost-to-quality

[8] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 243.
[9] Ibid., p. 243.

trade-off. Resource-strapped NGOs or at least NGOs with little to no in-house expertise in things satellite imagery may at worst find themselves having to make do with archival satellite imagery on offer by the companies generated in response to former tasking requests by the biggest customers, which in the U.S. is the government itself. In short, NGOs are sometimes forced to rely on outdated data. It follows that NGOs don't enjoy unlimited freedom in selecting the areas and issues to cover. Moreover, when NGOs avail themselves of the companies' products and services, the companies are able to promote themselves, in direct proportion to the size of their impact on the NGOs' work, as having a diverse customer base with a broad array of interests. NGOs thereby inadvertently whitewash the companies' businesses.[10] Enjoying unabated flourishing business prospects, the companies face very little incentive to modify their business model.

As for the contracts freely entered into by commercial actors with partners from their biggest markets, those have a couple of effects on prospective smaller consumers. The first effect is that such prospective smaller consumers are crowded out. For the companies' resources aren't limitless and they may find themselves having to be selective about which smaller customers they could accommodate.[11] The second effect is that of the generation of situations of perceived conflict of interest, especially when the host country's government, simultaneously the legislator and regulator on matters data collection and dissemination, is the largest customer. The commercial actor may choose to align their interests with those of the government, or at least not deviate from them too much.

Companies may also seek to avoid such situations of conflict of interest through self-censorship, electing to withhold imagery when its dissemination might negatively impact the host government's interests. For example, despite the recent relaxation of the Kyl–Bingaman Amendment, practitioners have reported a culture of self-censorship regarding Israel – a culture extending even to other countries.[12]

[10] Cf. Witjes and Olbrich, "A fragile transparency: satellite imagery analysis, non-state actors, and visual representations of security", pp. 530–531.

[11] This is an insight gained from a workshop co-organized by the author in April 2023 titled "Societal Verification: Realizing Joseph Rotblat's Vision in the Age of Non-state Open-Source Intelligence"; the insight is documented in the workshop report: Sara Al-Sayed, Alex Glaser, and Zia Mian (2023): "Societal Verification of Nuclear Disarmament in the 21st Century – A Workshop Report", in: *Journal for Peace and Nuclear Disarmament* 6.2, pp. 365–375, p. 369 and pp. 370–371.

[12] Cf. Matt Korda (Dec. 10, 2018): *Widespread Blurring of Satellite Images Reveals Secret Facilities*, https://fas.org/publication/widespread-blurring-of-satellite-images-reveals-secret-facilities/, accessed: 31/5/2024.

The system controls or strongly influences the political processes that ostensibly regulate its output and operating conditions

Winner's salient insight informing this behavioral pattern is that large-scale technical systems "may employ their enormous size and power to tailor political environments to suit their own efficient workings."[13] The case presented here in demonstration of the occurrence of this behavioral pattern concerns the normalization of global surveillance from outer space. The story of how this normalization came about begins in the first decade of the Cold War. The conditions of possibility of today's global overhead surveillance capabilities trace their origin to the dawn of U.S. and U.S.S.R. space-based reconnaissance of one another's military activities using satellite technology.

Intelligence gathering, surveillance, and reconnaissance from outer space became possible with the development of satellite technology. The main technologies that needed to be in place were satellite launch technology where a rocket is used to bring the satellite to orbit; sensor technology to pick up signals from across the electromagnetic spectrum that could reveal the nature of the target of surveillance; signal processing technology to extract useful information from the captured signals that are typically corrupted with noise; communications technology to oversee reliable, efficient, and secure communication between satellites and ground control or receiver stations.

But not only technical, but legal elements as well needed to be in place for satellite reconnaissance to become a practice. For while there were established aspects of international aviation law in place by then, stipulating, for example, that each state has sovereignty over the airspace above its territory (so aircraft require permission to traverse a country's airspace), there was no analogous international legal regime at the time governing activities in space.

Thus, international acceptance needed to be generated for the notion of satellites orbiting the Earth and possibly surveilling state territories around the globe. Since there was no international law in place, a legal precedent needed to be set and domestic and international political challenges overcome to bring the desired developments about. As to be illustrated in the rest of this section, how space espionage became normalized is fundamentally a U.S. endeavor that owes its success to the legal precedence setting through virtually benign space applications, delicate navigation of the interaction between the civilian scientific and military spheres to guarantee the assertion of national security interests, and secrecy practices that were as much about the withholding of information

[13] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 244.

that would compromise the endeavor as about crafting and controlling a framing about peaceful versus military space applications for consumption by domestic and international audiences.

U.S. interest in pursuing space-based espionage began after the Soviets tested their first atomic bomb in 1949. U.S. political leadership feared a surprise Soviet attack that would undermine strategic stability. U.S. surveillance of Soviet forces, especially in view of the U.S.S.R.'s extreme secrecy, was crucial to preclude surprise attack. However, aerial reconnaissance using aircraft and balloons had its challenges. Since the aircraft or balloons would operate in Soviet skies, aerial reconnaissance would constitute a breach of Soviet territorial airspace. So aircraft and balloons couldn't overfly the U.S.S.R. without prior permission or expect to enjoy unhindered passage if they flew without permission and were detected. That is, they risked being attacked by the Soviet defense forces.

There was already by the early 1950s agreement in the context of RAND[14] investigations that "the most valuable, first-priority use of a satellite vehicle involved one strategic application: a platform from which to observe and record activity on the Earth."[15] In 1955, there were several proposals from civilian scientists and military officials calling for the development and launch of a scientific satellite as the U.S. contribution to the International Geophysical Year running from July 1957 to December 1958.[16] Scientific satellites are taken to serve purposes of Earth observation, meteorology and weather forecasting, outer space exploration, communications, etc. An example of a proposal is the two-volume report on surprise attack readiness measures, *Meeting the Threat of Surprise Attack*, issued on February 14, 1955; the report was written by civilian scientists in a panel convened by President Dwight D. Eisenhower and chaired by the then president of the Massachusetts Institute of Technology, James R. Killian, Jr.

[14] From the RAND website: "In May 14, 1948, Project RAND—an organization formed immediately after World War II to connect military planning with research and development decisions—separated from the Douglas Aircraft Company of Santa Monica, California, and became an independent, nonprofit organization. Adopting its name from a contraction of the term research and development, the newly formed entity was dedicated to furthering and promoting scientific, educational, and charitable purposes for the public welfare and security of the United States." RAND: *A Brief History of RAND*, https://www.rand.org/about/history.html, accessed: 31/5/2024.

[15] R. Cargill Hall (1995): "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space", in: *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Vol. I: Organizing for Exploration*, ed. by John M. Logsdon, Washington, D.C.: NASA SP-4407, pp. 213–230, p. 215.

[16] The International Geophysical Year was an international event aimed at promoting geophysical science and related scientific exchange. The event's forerunner was the International Polar Year, which had taken place twice – once in 1882–1883 and another time in 1932–1933.

The U.S. strategic rationale behind a scientific satellite was to set in international law the principle of 'freedom of space' and right of satellite overflight over any state. It was proposed that such a principle and right be derived from a legal conception of outer space analogous to the high seas.[17] The high seas are governed by the maritime legal principle of 'freedom of the seas' that guarantees free passage outside territorial waters. With the legality of satellite passage in place, the path would be paved to the development and deployment of military reconnaissance satellites and the challenges of aerial reconnaissance bypassed.

And so, the launch of a scientific satellite was supposed to set the precedent of 'freedom of the space' in international law. If a civilian satellite orbiting the Earth was legal, then so potentially would a military one be legal. Nevertheless, the civilian project was kept under wraps by the government and there was no attempt at launching an international debate so as not to jeopardize the strategic ambitions if the debate turned to military space activities.[18] When first publicly announced in July 1955, the scientific satellite program was promoted as benefiting science throughout the world, and the existence of any link between the program and military missile development was concealed (for the launch technology is essentially the same).[19] Afterwards, news was scant.

As things turned out, the U.S.S.R. beat the U.S. in setting the precedent of 'freedom of space' through the Soviets' launch of Sputnik 1 in October 1957. Though Sputnik 1 wasn't a reconnaissance satellite (it merely sent a radio signal back to a ground station on Earth to test communication capability), the technology behind the launch was regarded with trepidation by the U.S., for it is basically the same technology that could send nuclear weapons hurtling through space in the direction of the U.S., and until that point no rocket technology of the U.S. could transport a payload as big as Sputnik 1. The launch of Sputnik 1 led shortly thereafter to perceptions of a 'missile gap' in the U.S., which in turn led to controversy over the perceived complacency by the Eisenhower administration, when in fact the administration favored maintaining secrecy over its satellite plans over engaging in a missile build-up race.[20]

All the same, the launch of Sputnik 1 accelerated the simultaneous development in the U.S. of not only scientific satellites, but military reconnaissance satellites as well, and

[17] Curtis Peebles (1997): *High Frontier. The U.S. Air Force and the Military Space Program*, Washington, D.C.: Air Force History and Museums Program, p. 8.

[18] Cf. Peebles, *High Frontier. The U.S. Air Force and the Military Space Program*, p. 8; Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space", p. 224.

[19] Cf. Hall, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space", p. 223.

[20] Cf. Peebles, *High Frontier. The U.S. Air Force and the Military Space Program*, pp. 9–10.

the establishment of civilian and military space programs. The military space program, however, was kept under a veil of secrecy while the debate in international fora evolved as to acceptable space activity.

As far as scientific circles were concerned, the appetite there had already grown, invigorated by Sputnik 1, which scientists from different locations around the world were able to observe. For their part, Soviet scientists were able to track and study their orbiting satellite and make inferences about radio signal propagation and the properties of the atmosphere.[21] But satellites didn't only open up prospects for space and atmosphere science experiments and communications engineering experiments, but also remote sensing of signatures along the electromagnetic spectrum with applications ranging from cartography to geology to hydrology to land-use planning to agriculture to forestry. The scientific and civilian uses helped legitimate global overhead surveillance.[22]

The Explorer and Vanguard scientific satellites were launched in early 1958 (in February and March, respectively, after Sputnik 2 in November 1957 and a series of U.S. satellite launch failures) as the U.S. contribution to the International Geophysical Year, and the National Aeronautics and Space Administration (NASA) was created in July 1958, assuming the responsibility for civilian space activities, including scientific satellites.

Three U.S. National Security Council directives in 1958 and 1959 serve as evidence of U.S. meticulous efforts to shape the international political environment.[23] The first one called for establishing a "political framework which will place the uses of U.S. reconnaissance satellites in a political and psychological context most favorable to the United States." The second directive mentioned how reconnaissance satellites could usher in the implementation of President Eisenhower's "open skies" proposal for U.S.–U.S.S.R. mutual overhead (aerial and space) surveillance or "policing a system of international armaments control." The third directive described the military space missions that were considered to be peaceful uses of outer space. It also noted the fortuitous development in international law, namely, that the United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space (CUOPOS) now accepted the "permissibility of the launching and flight of space vehicles [...] regardless of what territory they passed over during the course of their flight through outer space." That is, the third directive wasn't issued in a vacuum, but rather took heed of CUOPOS debates and worked within their terms so that

[21] NASA Space Science Data Coordinated Archive: *Sputnik 1*, NSSDCA/COSPAR ID: 1957-001B, https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1957-001B, accessed: 31/5/2024.

[22] Cf. Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", p. 69.

[23] NSC 5814, "U.S. Policy on Outer Space," June 20, 1958; NSC 5814/1, "Preliminary U.S. Policy on Outer Space," August 18, 1958; NSC 5918, "U.S. Policy on Outer Space," December 17, 1959.

the U.S. wouldn't hand to the U.S.S.R. an excuse to attack a reconnaissance satellite and so that the U.S. could avert diplomatic protest from the international community against peacetime employment.

All in all, the three directives demonstrate the extent to which the Eisenhower administration prized the capability of surveillance from space and how the administration did its utmost not to jeopardize the effort to develop this capability. In fact, in the context of shaping the political environment in the aftermath of the launch of Sputnik 1, any military space capabilities that suggested offensive intention (such as "orbital nuclear weapons, satellite interceptors, space-based anti-ballistic missile systems, and lunar-based ballistic missiles"[24]) were to be confined to the realm of study[25] while surprise-prevention and defense support capabilities (such as "communications, missile early warning, meteorology, navigation, and the detection of nuclear detonations on Earth and in space"[26]) were framed as peaceful.[27]

The subsequent stage for U.S. satellite programs featured further efforts that helped along the normalization of global overhead surveillance. This stage saw the launch of the CORONA reconnaissance satellite program in 1959 (though with earlier beginnings, and ending in 1972) concurrently with the launch of civilian meteorological satellites. This stage was marked by the continuation of the policy of strict separation between military and civilian satellite programs. Moreover, strict secrecy measures were applied on CORONA operations, and a policy of keeping secret that satellites were used at all for reconnaissance was upheld for two decades.[28] These secrecy practices served to impress on the international community that CUOPOS principles were being adhered to while simultaneously setting the precedent for space-based remote-sensing.

Global overhead surveillance was legitimated even further via the civilian remote-sensing applications of apparently universal utility by President John F. Kennedy's administration's initiative in the early 1960s of "offering 'the free world' open access to meteoro-

[24]Peebles, *High Frontier. The U.S. Air Force and the Military Space Program*, p. 11.

[25]Peebles further notes that, "On October 20, 1958, ARPA Director Roy Johnson ordered the Air Force to stop using the 'Weapons System' designation (such as WS-117L) for military satellites, 'to minimize the aggressive international implications of overflight.'" ibid., p. 11 (ARPA stands for the Advanced Research Projects Agency, of the U.S. Department of Defense; ARPA was later named DARPA in 1972 for Defense Advanced Research Projects Agency.)

[26]Ibid., p. 15.

[27]Cf. ibid., p. 11.

[28]Cf. ibid., p. 14.

logical data"[29] from the Television Infrared Observation Satellite (TIROS) system. This initiative represented surveillance legitimization through an uncontroversial low-stakes application, since the TIROS meteorological data was of low resolution and didn't penetrate through atmospheric events to obtain land cover data, rather only weather data from the surrounding atmosphere.[30] "Foreign governments did not object to the imaging of weather systems over their territories since they gained the benefit of free data, thereby adding legitimacy to the norm of 'freedom of space.'"[31]

Finally, consolidating the norm of global overhead surveillance was NASA's Landsat program commencing in the early 1970s as a civilian space-based remote sensing initiative generating imagery of the entire globe.[32] It was one thing for the superpowers to generate imagery of foreign territory and retain it in classified form, and another thing for a civilian program to generate this imagery for public use. The latter was regarded by foreign governments as a violation of their territorial sovereignty.[33] Litfin states three steps through which widespread acceptability by the international community was paved. First, U.S. authorities argued NASA Earth-observation was in line with international law since it served peaceful applications – of environmental monitoring, for example, at a time when environmental affairs started garnering states' attention. Second, the U.S. assumed leadership in formulating the United Nations Principles on Remote Sensing and granted countries access to data gathered over their territory. Third, NASA set up training and assistance programs to provide developing countries with the resources to benefit from imagery of their territory, in the spirit of empowering the countries to assume stewardship of their natural resources. Of such appeal was the Landsat program for developing countries that they voiced their protest upon the privatization of Landsat in the 1980s by President Ronald Reagan's administration.[34]

Perhaps an analogy could be drawn between U.S. efforts to make global overhead surveillance palatable (with the objective historically of securing national security advantages but benefits evolving into achieving market dominance) and U.S. efforts to make nuclear technology palatable (with a similar original historical objective and evolution course for the benefits). The latter efforts played out in the context of the Atoms for Peace pro-

[29] Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", p. 69.
[30] Cf. ibid., pp. 69–70.
[31] Ibid., pp. 69–70.
[32] Cf. ibid., pp. 72–73.
[33] Cf. ibid., p. 73.
[34] Cf. ibid., p. 73.

gram.[35] Both cases represent stories of U.S. consolidation of international control over a technological capability, and in both cases success was ensured through U.S. norm-setting efforts in the international arena. Or, as Winner puts it, the success was achieved through the shaping of political environments to match the efficient workings of the underlying technical systems.

Interestingly, the exposition of the realization of reverse adaptation through the behavioral pattern considered here goes beyond Andrew Feenberg's invocation in *Technosystem. The Social Life of Reason* of Winner's 'reverse adaptation'. Feenberg invokes the concept in reference to the normalization of privacy violation – a normalization spurred by social media platforms and their surveillance function.[36] The exposition here reveals how reverse-adaptation dynamics in the global surveillance domain have in fact played out on a more expansive temporal and political terrain.

The system seeks a "mission" to match its technological capabilities

As for the third reverse-adaptation behavioral pattern, two developments could be sketched to demonstrate it insofar as it contributes to the autonomy of the large-scale technical system associated with nuclear non-state OSINT. One development that enabled satellite technology to expand beyond its roots in space espionage is the end of the Cold War, which "sent the world's largest military and intelligence establishments in search of alternative missions."[37] The U.S.S.R. had commercialized archival (past) spy satellite imagery by 1989, which was of a resolution higher than any that U.S. civilian Earth-observation satellites produced. By contrast, the U.S. military and intelligence firms decided to pivot

[35] The following quote is instructive: "Eisenhower gave a speech to the United Nations (UN) General Assembly proposing 'Atoms for Peace,' a program that would encourage widespread use of the miracle of the atom for civilian purposes, principally electricity generation. A plan both to enroll developing nations under the American aegis and to provide cover for – and spiritually redeem – the overt aggression and militarism represented by nuclear warheads, Atoms for Peace initiated a global advertising campaign with a traveling exhibition to developing nations worldwide. The program eventually built reactors in Iran, Israel, and Pakistan, opening markets for American businesses and attempting to one-up the Soviet Union in addressing the energy needs of international development," in Michael D. Gordin (2022): "The Consolidation of the Nuclear Age", in: *Cambridge History of America and the World. Volume 4: 1945 to the Present*, ed. by David C. Engerman, Max Paul Friedman, and Melani McAlister, Cambridge: Cambridge University Press, pp. 80–101, p. 92.

[36] Cf. Andrew Feenberg (2017): *Technosystem. The Social Life of Reason*, Cambridge, Massachusetts: Harvard University Press, p. 194.

[37] Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", p. 72.

to the commercial high-resolution Earth-observation satellite industry after the end of the Cold War. Though the initial investment in building and launching a satellite was high, it was declining, and fortuitous trends were in place, such as rising connectivity through the Internet, the proliferation of inexpensive personal computers, advances in data storage and processing, and the sprouting of lucrative markets for satellite imagery applications spanning "the agricultural sector, mineral exploration, the real estate industry, municipal utilities, and environmental monitoring."[38] The U.S. government started issuing licenses for commercial high-resolution Earth-observation satellites by 1993, and Space Imaging's IKONOS satellite was the pioneer U.S. commercial high-resolution Earth-observation satellite, returning its first images in 1999.[39] Space Imaging was originally founded by U.S. defense contractors Raytheon and Lockheed Martin.

The second development concerns the role of former government officials in today's nuclear non-state OSINT enterprise. Former government officials have nuclear and/or area and/or intelligence expertise. They have a low barrier to entry into nuclear non-state OSINT analysis and have extensive relationships with *a)* government, so they have access through contacts to the latest information on government interests, and may receive cues on where to target the surveillance gaze, and *b)* commercial satellite imagery providers, where some of those providers have origins in the military establishment, such as the U.S.-based Maxar,[40] and who themselves have an interest in vetting their customers as mentioned before as well as building stable, sustainable relationships. Understandably, former government officials would take on the recruitment, training, and mentoring of new and young generations of nuclear non-state OSINT analysts, where the former government officials would grant those junior analysts access to their resources and shape their practices.[41]

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Winner's fourth behavioral pattern for a reverse-adapted system is one where *the system propagates or manipulates the needs it also serves*. The way this pattern manifests for the nuclear non-state OSINT network is that security as a legitimate need becomes a pretext,

[38] Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", p. 75.
[39] Cf. ibid., pp. 74–75.
[40] The aforementioned commercial high-resolution Earth-observation satellite industry pioneer Space Imaging became GeoEye became DigitalGlobe became Maxar.
[41] Cf. Witjes and Olbrich, "A fragile transparency: satellite imagery analysis, non-state actors, and visual representations of security", p. 531.

and the transparency as generated by nuclear non-state OSINT practices is proffered up as crucial, if not indispensable, for generating security. The thinking goes: If the adversary is intransparent, then they are hiding something and that should be a cause for suspicion and anxiety. That is, the sense of security is perceived to be threatened by that which is hidden. The call for transparency is one where the transparency is that which is served up by nuclear risk reduction practices. Those are practices that are predisposed to issue demands for transparency, and then more and more of it. However, not unsurprisingly, the subsequently installed transparency-inducing practices turn up further risks, dangers, and threats, diminishing the sense of security further.

In other words, security comes to be perceived to be in perpetually short supply, which justifies the continued application and expansion of transparency-inducing practices. This dynamic effectively detracts from the autonomy of the otherwise legitimate need for security. It's in this sense of technical means controlling the needs rather than vice versa that one could speak of reverse adaptation.

But that the system discovers a threat to justify its own further expansion is precisely Winner's fifth behavioral pattern, *the system discovers or creates a crisis to justify its own further expansion*, where *threat* and *shortage* are two of the possible scenarios of crisis that Winner identifies and demonstrates via examples. As a matter of fact, the existence of a feedback loop between Pattern 4 and Pattern 5 is a possibility Winner admits. As mentioned in Section 3.1.2, he dubs pairings of the sort 'double reverse adaptation'.

The example Winner gives for the pairing between Pattern 4 and Pattern 5 is one for *the propagation of need and the discovery of shortage*, rather than *the propagation of need and the discovery of threat*. As mentioned in Section 3.1.2, his prime example for the paired behavioral pattern is that of power companies promoting their products and services through aggressive advertising that simultaneously manipulates and propagates the ineluctable modern need for ever more power-hungry luxury appliances while pointing to an ever-looming power crisis resulting from a shortage in energy supplies. In this example and overarching scenario of shortage, Winner's reference point seems to be mass culture and hyperconsumerism – after all, his prime examples for Pattern 4 – *the system propagates or manipulates the needs it also serves* – suggest this much. Mass culture and hyperconsumerism were the object of critique by the thinkers who inspired his own critique. In the scenario of shortage, needs are manipulated typically using advertising techniques informed by behavioral science and psychology. But what then of *the propagation of need and the discovery of threat*?

Winner is not oblivious to the self-reinforcing dynamics of arms racing driven by adversarial defense enterprises providing intelligence demonstrating a new threat posed by

one another's adversary. He cites as an example for Pattern 5 – *the system discovers or creates a crisis to justify its own further expansion* – the Cold War competition between the U.S. and U.S.S.R. for military supremacy:

> The Department of Defense, to cite one noteworthy example, keeps several such plot lines in various stages of preparation at all times. If public or congressional interest in new projects or impressive hardware fails, the latest "intelligence" is readily available to show that a "gap" has appeared in precisely the area in question. This practice works best when defense systems on two continents are able to justify their growth in terms of each other's activities. Here one can see firsthand one of nature's rarities: the perfect circle.[42]

While this Pattern 5 example clearly simultaneously qualifies as one of double reverse adaptation through *the propagation of need and the discovery of threat*, I would like to argue that in the context of the contemporary nuclear non-state OSINT network, it makes more sense to speak of the propagation of need and the discovery of *risk*. This brings me to the final section of my analysis using Winner's 'autonomous technology' approach, where I explain the modified paired reverse-adaptation behavioral pattern as it manifests in the nuclear non-state OSINT network.

The system propagates or manipulates the needs it also serves *and* the system discovers or creates a risk or a host of risks to justify its own further expansion

The formula for double reverse adaptation here that I propose is the following: *By attempting to mitigate risk using the available means, the system produces the very circumstances that lead to society's perception of risk.* I argue here that 'risk' in contrast to 'threat' is the better lens to understand system autonomy in the context of the contemporary nuclear non-state OSINT network. But what sets 'risk' apart from 'threat'? What role do nuclear non-state OSINT practices play in nuclear risk discourse? How does this role give rise to double reverse adaptation? I will tackle these questions in the rest of this section, concluding with some brief remarks on the evolution of the nuclear non-state OSINT movement from practicing contentious politics to its co-optation by governments.

On risk. Information obviously plays a constitutive role in the intelligence sector – nuclear or otherwise, state or non-state. But what information is of nuclear intelligence value and what is the connection to nuclear risk?

[42] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, pp. 249–250.

An answer to these questions could be gleaned by first looking at a list of nuclear concerns typically on a U.S. policymaking agenda:[43]

- Proliferation (Iran, North Korea, Syria)
- India-Pakistan nuclear escalation
- Middle East conflicts and wars and Israel's nuclear status
- Eroding U.S. extended nuclear deterrence in Europe and Asia
- Nuclear modernization by Russia and China
- Nuclear terrorism
- Nuclear accidents
- Risk of nuclear war from miscalculation, misperception, or by accident, launched by the U.S. or others

… and also the following categories of nuclear intelligence:[44]

- Understanding capabilities of nuclear-armed states
- Understanding proliferation to non–nuclear-weapon states and non-state groups
- Understanding nuclear accident risks
- Preventing strategic surprises

Nuclear intelligence analysts contribute intelligence products in the listed categories in relation to the listed concerns of a threatening or dangerous nature. Information is gathered and analyzed to answer intelligence queries, up to a certain level of confidence depending on the sources and methods used to obtain and analyze the information. Where there is uncertainty, one speaks of the probability of a certain nuclear event of concern occurring in the future. In risk studies, 'risk' is taken to be the product of the probability of a certain dangerous or threatening event occurring in the future and its anticipated impact. A nuclear event is typically taken to be high risk in acknowledgment of its devastating anticipated impact, regardless of its probability of occurrence, as long as it's not nil (which it almost surely isn't).

Nuclear non-state OSINT analysts work with open sources and methods and lack in their modestly sized but growing profession quality control mechanisms, including standards, to ensure high levels of certainty in intelligence assessments. That is due in part to the lack thus far of widely available and accessible formal training.[45] The open and informal

[43] This list is adapted from Zegart, *Spies, Lies, and Algorithms. The History and Future of American Intelligence*, p. 227.
[44] This list is from ibid., p. 228.
[45] Cf. ibid., pp. 237–238.

nature of the profession puts a low premium on erroneous intelligence assessments, for there is a perceived lack of accountability. On the other hand, the reputational cost of erroneous intelligence assessments is regarded as implanting in the analysts an intrinsic motivation for upholding high quality standards, albeit on a voluntary basis. Moreover, working with open sources and methods is held up as an argument for the analysis being reproducible and open to correction and improvement. The transparency itself of sources and methods and of practice is therefore cast as a quality safeguard. And then this safeguard is outwardly projected and elevated to a categorical imperative to be universally upheld by surveillants and surveilled alike?

Be that as it may, nuclear non-state OSINT analysts' intelligence assessments come with high uncertainty attached to them, compounded all the more by the fact that some of the relevant details around nuclear threats or dangers are normally cloaked in secrecy and/or are highly contingent and are thus of limited knowability. And yet, this very uncertainty and unknowability catalyzes further intelligence queries. Playing out in public discussion spaces, the cycle of speculation, query formation, and sleuthing for answers proceeds at a frantic pace, the one cycle fueling the next and multiple other cycles in a productive frenzy. Naturally, public demands on domestic and intergovernmental decision- and policymakers follow in the heels of the intelligence findings, calling for action towards further nuclear risk reduction measures to restore a sense of security continuously undermined by a seemingly perpetual nuclear threat or danger.

The cycles so-described make up a nuclear risk practice. At one end are the *nuclear risk assessment activities* that nuclear non-state OSINT analysts engage in and promote, and at the other end are *nuclear risk reduction measures* negotiated and agreed in domestic, bilateral, or multilateral political fora. The cycles capture then the mutually constitutive relationship between security and risk practices, where the latter could be defined as "a family of ways of thinking and acting, involving calculations about probable futures in the present followed by interventions into the present in order to control that potential future."[46] Importantly, the cycles demonstrate the role of uncertainty and the unknowable in furnishing this relationship between security and risk, and also in elevating risk to a contemporary condition in the manner captured in writings like Ulrich Beck's *Risk Society: Towards a New Modernity* (1992).

The guest editors of the 2008 *Security Dialogue* Special Issue "Security, Technologies of Risk, and the Political" distinguish between risk- and threat-based perspectives to security as follows. "Risk-based perspectives to security differ considerably from their threat-based

[46]Nikolas Rose (2001): "The Politics of Life Itself", in: *Theory, Culture & Society* 28.6, pp. 1–30, p. 7.

counterparts in how they approach the question of security and in the policy prescriptions and governmental technologies they instantiate,"[47] but also in their relation to the future.[48] Resources in risk-based perspectives are directed to contingency management practices, so risks are implicitly embraced, while simultaneously precautionary measures are adopted against contingencies. By contrast, in threat-based perspectives resources are directed to threat management, including elimination.[49]

Winner himself tackled the difference between threat, danger, or hazard and risk in *The Whale and the Reactor. A Search for Limits in an Age of High Technology*. Whereas a threat, danger, or hazard forces identifying, studying, and remedying the threatening, dangerous, or hazardous circumstance, possibly including its elimination,[50] a risk forces studying, weighing, comparing, and judging the situation, launching a protracted process where action ends up being deferred or paralyzed.[51]

It's now timely to revisit my proposed formula for double reverse adaptation: *By attempting to mitigate risk using the available means, the system produces the very circumstances that lead to society's perception of risk.* So far, the emphasis has been on the operative mechanism for double reverse adaptation being *nuclear risk assessment practices*, as available means, turning up more and more risks, owing to the issues of the uncertainty and limited knowability associated with the referent of risk. Implicit in the discussion thus far though has been the role of the *nuclear risk reduction approach to the nuclear predicament* in fostering the paired behavioral pattern in question.

Granted, nuclear risk assessment practices are an essential pillar of the nuclear risk reduction approach. As such, the nuclear risk reduction approach tends to overzealous risk identification, which in turn leads to a heightened sense of risk. And one should also note that the nuclear risk reduction measures promoted by the nuclear risk reduction approach are interventions in the present to guard against a future nuclear threat or danger, and as interventions they imbue the present with a sense of proliferant risk. But I'm wondering whether that is all one can discern as double reverse adaptation in the case under study. Might there not be a broader set of practices, in which the nuclear risk reduction approach is couched, that are appealed to and that are themselves reverse-adapted? I

[47] Claudia Aradau, Luis Lobo-Guerrero, and Rens van Munster (2008): "Security, Technologies of Risk, and the Political: Guest Editors' Introduction", in: *Security Dialogue* 39.2–3, pp. 147–154, p. 148.
[48] Cf. ibid., p. 149.
[49] Cf. ibid., p. 149.
[50] Cf. Langdon Winner (1986): *The Whale and the Reactor. A Search for Limits in an Age of High Technology*, Chicago: The University of Chicago Press, pp. 142–143.
[51] Cf. ibid., pp. 143–144.

would like to argue then that there's an *overarching* way by which the nuclear risk reduction approach propagates or manipulates the need for security, and that's the sense in which the approach is paradigmatic of today's fraught nuclear status quo.

The nuclear risk reduction paradigm. The end of the Cold War marked the beginning of an era when the security dynamics began to be dominated by poverty, global warming, organized crime, terrorism, and nuclear proliferation. It was also the era in which major states and international organizations, such as the United Nations, the North Atlantic Treaty Organization, and the European Union, started referring to the post-Cold War security environment in terms of 'risks' rather than 'threats' or 'dangers',[52] in recognition of the complexity of the reigning security dynamics.

In the nuclear context, since the end of the Cold War, the nuclear risk reduction paradigm has manifested prominently in nuclear nonproliferation debates, with the rising valid concern about clandestine nuclear weapons programs in states that are party to the Nuclear Non-Proliferation Treaty (NPT), [53] as well as concerns about the acquisition of nuclear materials and technology by non-state actors in the throes of the "War on Terror" precipitated by the 9/11 attack on the World Trade Center. But apart from risk practices concerned with the management of nuclear proliferation risks, the nuclear risk reduction paradigm manifests itself as well in nuclear arms control and disarmament debates.

One way the paradigm manifests itself in those debates is through advocacy by powerful actors in the nuclear order for the nuclear risk reduction approach as a conservative and an incremental, ameliorative approach to realizing the complete nuclear disarmament called for in Article 6 of the NPT, which reads:

> Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.

While advocacy for the approach by powerful actors in the nuclear order recognizes the return of great power competition, this time among the U.S., Russia, and China, and also

[52] Cf. Aradau, Lobo-Guerrero, and van Munster, "Security, Technologies of Risk, and the Political: Guest Editors' Introduction", p. 147.

[53] There have been eight cases of non-compliance of states with their safeguards agreements with the International Atomic Energy Agency: Iraq (in 1991), North Korea (in 1992), Romania (in 1992), Iran (in 2002), Libya (in 2003), South Korea (in 2004), Egypt (in 2004–2005), and Syria (in 2007); the North Korea, Iran, and Syria cases are still ongoing.

recognizes that the current security environment isn't particularly conducive to progress on the part of nuclear-armed states on nuclear disarmament, advocacy efforts gain in vigor seemingly in direct proportion to the rising prominence in multilateral fora of nuclear disarmament calls by non–nuclear-weapon states. These calls have found their strongest articulation yet in the Treaty on the Prohibition of Nuclear Weapons (TPNW) that entered into force in 2021 and is currently signed by 93 states and ratified by 70 states. No nuclear-armed state has signed the TPNW, and neither has any state relying on U.S. extended nuclear deterrence.

The nuclear risk reduction approach is typically promoted in domestic, bilateral, and multilateral nuclear weapons debates as an attempt at finding common ground and cultivating trust between the two stakeholder camps holding divergent views on nuclear weapons, the deterrence and disarmament camps. The deterrence camp is the group of states that derive their security from nuclear deterrence whereas the disarmament camp is the group of states that believe that security rather derives from nuclear disarmament. Engaging with the nuclear risk reduction approach requires minimal consensus, namely, on the elementary desirability and feasibility of nuclear risk analysis and manageability.[54] As long as the goal of a nuclear-weapon–free world is out of reach for the foreseeable future, there is – as suggested by the approach's proponents – a shared interest by all, who might otherwise disagree about the primacy of disarmament, in reducing the risk of nuclear weapon use insofar as the risk is inherent in their possession. The approach is promoted with the promise that nuclear disarmament steps might follow if nuclear risks are successfully managed and minimized.

However, as Pelopidas and Egeland contend in "The false promise of nuclear risk reduction", the nuclear risk reduction approach is replete with indeterminacy; the approach lends itself therefore to contestation by stakeholders on fraught issues such as the identification and characterization of risks, ranking them with respect to their gravity, and the manner of addressing them and the implications.[55] Indeterminacy also plagues the measurement of the effects of proposed nuclear risk reduction measures and carries over to the verification of achieved progress. It should come as no surprise then that seemingly any and all nuclear-weapons policies – short of deliberately bringing about a nuclear apocalypse and including contradictory policies – could be justified by the approach as reducing nuclear risk; different stakeholders would evaluate differently nuclear-weapons policies ranging from robustifying crisis communication hotlines among nuclear-armed adversaries to nuclear declaratory policies by states that they wouldn't respectively be the

[54] Cf. Pelopidas and Egeland, "The false promise of nuclear risk reduction", p. 347.
[55] Cf. ibid., pp. 357–358.

first to use nuclear weapons in conflict (no–first-use policies) to taking nuclear weapons off high-alert status (nuclear de-alerting policies) to extending nuclear-sharing arrangements or widening the scope of extended nuclear deterrence umbrellas to modernizing or building up nuclear weapons programs to resuming explosive nuclear weapons testing following a *de facto* two-decade moratorium.[56]

The indeterminacy issues of the nuclear risk reduction approach lead in turn to prospective challenges in the assignment of accountability for the consequences of the implementation of proposed nuclear risk reduction measures. And yet, prospective accountability challenges coupled with the approach's limited ability to guide or orient policy provide a potential "blank cheque"[57] for powerful status-quo nuclear actors to assert their interests through various means.[58] It's *this* aspect of Pelopidas and Egeland's contention with the nuclear risk reduction approach that I argue establishes the connection to reverse adaptation by way of the sense of fallback on means supported by and reinforcing the dominance of the nuclear deterrence camp. This can further be brought into sharp focus by the authors' insight that the ceiling of ambitions of the nuclear risk reduction approach is set by the requirements of nuclear deterrence – especially extended nuclear deterrence[59] : "After all, nuclear deterrence often relies on what the founder of the nuclear risk reduction school, Thomas Schelling, called a 'threat that leaves something to chance', namely the deliberate manufacture and exploitation of nuclear risk."[60] More precisely, Schelling's articulation of nuclear deterrence refers to the credible threat by a nuclear-armed party of catastrophic escalation while at the same time the party signals resolve to prevent it. As such, nuclear deterrence is already about risk taking, and helps "normalize enormous risks."[61]

In a nutshell, Winner's reverse adaptation displays itself, culturally and politically, first and foremost at this overarching paradigmatic level, instituted by nuclear risk – a level transcending civil-society nuclear-activity monitoring practices. The pragmatism branding of the nuclear risk reduction approach serves then as a mere pretext for "nuclear politics without politics."[62]

Winner, for his part, also confirms the general tendency of risk approaches to draw in

[56] Cf. Pelopidas and Egeland, "The false promise of nuclear risk reduction", p. 358.
[57] Ibid., p. 357.
[58] Cf. ibid., p. 359.
[59] Cf. ibid., p. 360.
[60] Ibid., pp. 347–348.
[61] Ibid., p. 351.
[62] Benoît Pelopidas and Kjølv Egeland (Feb. 2024a): *Analysis of the Nuclear Risk Reduction Agenda*, https://blog.oup.com/2024/02/analysis-of-the-nuclear-risk-reduction-agenda/, accessed = 31/5/2024.

groups with different, if not opposite, positions on fundamental issues – at the expense of achieving genuine progress. Indeed, in the aptly-titled chapter in *The Whale and the Reactor. A Search for Limits in an Age of High Technology*, "On Not Hitting the Tar-Baby", he articulates a warning to activists resorting to a risk approach – or any wide-consensus approach, for that matter – as a political strategy, as a "conceptual Trojan horse"[63] :

> [I]t is sometimes used as a conceptual Trojan horse by those who have more challenging political agendas they hope to smuggle in. But victories won in this way are in other respects great losses. For they affirm in our words and in our methodologies that there are certain human ends that no longer dare be spoken in public. Lingering in that stuffy Trojan horse too long, even soldiers of virtue eventually suffocate.[64]

Nuclear non-state OSINT movement evolution. The discussion thus far has clarified the role nuclear non-state OSINT practices play in nuclear risk discourse and how this role gives rise to double reverse adaptation according to the formula: *By attempting to mitigate risk using the available means, the system produces the very circumstances that lead to society's perception of risk.*

In Section 2.2, some forerunner examples to today's nuclear non-state OSINT efforts were outlined, and the politics underlying the U.S. examples from the period towards the end of the Cold War were sketched. In light of the material presented in this thesis report, one can discern an evolution of the nuclear non-state OSINT movement. From its origins in anti-secrecy politics insofar as secrecy pertains to U.S. government practices surrounding nuclear weapons issues perceived by U.S. citizens as requiring democratic consent, the movement has evolved towards the vilification of foreign nuclear secrets, condoning the secrecy exercised by foreign governments, perhaps in the hope of eliciting certain policy and public responses. If historical anti-secrecy discourse and practices were purposive and liberal in orientation and modeled contentious politics, the contemporary form seems to fetishize an unreasonable ideal of global transparency.[65]

Challenges of nuclear non-state OSINT community's global transparency demand. In way of conclusion of my illustration of double reverse adaptation as it manifests in the nuclear non-state OSINT network, I summarize some of the challenges of the nuclear non-state

[63] Winner, *The Whale and the Reactor. A Search for Limits in an Age of High Technology*, p. 142.
[64] Ibid., p. 54.
[65] For a confirmation of this observation, see Wellerstein, *Restricted Data. The History of Nuclear Secrecy in the United States*, p. 395.

OSINT community's demand for global transparency, apart from the demand's role in amplifying nuclear risk discourse, which I hope has been sufficiently clarified.

In Section 2.3, I outlined some of the satellite capabilities useful for nuclear-activity monitoring and the extent of geographical, temporal, and spectral coverage possible today. That was a sketch of the *possible* in terms of global transparency – what is *actual*? The growth in internet connectivity, publicly available data and tools, and cheap ubiquitous sensing from mobile cameras to commercial satellites has contributed to the growing capabilities and role mostly in the U.S. and to a lesser extent Europe of civil-society groups in monitoring nuclear activities globally. Domestic politics and media shape the orientation of civil-society efforts in tandem with the technical and financial capacity concentration, rendering the gaze asymmetric and selective, thus non-global. But as demonstrated earlier in this chapter, there are techno-political impediments as well, especially in the context of commercial satellite imagery.

Another challenge of the nuclear non-state OSINT community's demand for global transparency is government co-optation. From a government perspective, the benefit of nuclear non-state OSINT is that relatively robust information on foreign nuclear dangers or threats can be shared with the public, policymakers, other governments, and international organizations (such as the International Atomic Energy Agency (IAEA)) thereby justifying government (or IAEA) policies – all while keeping the secrecy around government intelligence sources and methods intact.[66] The following are two instructive quotes on a partnership that was struck in 2018 between the U.S. National Geospatial-Intelligence Agency (NGA) and a think tank in Washington, D.C., conducting OSINT on North Korea:

> While current information sharing is informal and discretionary, in 2018, the Center for Strategic and International Studies, a Washington-based think tank, and the National Geospatial-Intelligence Agency, one of the eighteen agencies of the Intelligence Community, took a step toward more formalized arrangements, announcing a partnership to "produce unclassified reporting on issues of importance in North Korea."[67]
>
> The U.S. government is beginning to explore ways of collaborating with these institutions. One such partnership is between CSIS and NGA. This collaboration reflects

[66] Cf. Zegart, *Spies, Lies, and Algorithms. The History and Future of American Intelligence*, p. 240.

[67] The quote is from ibid., p. 241, citing Center for Strategic and International Studies: *CSIS Korea Chair Announces Research Partnership with National Geospatial-Intelligence Agency (NGA)*, https://www.csis.org/news/csis-korea-chair-announces-research-partnership-national-geospatial-intelligence-agency-nga, accessed: 31/5/2024.

> the realization that NGOs and the US government can do a better job of analyzing threats in cooperation with each other as opposed to proceeding independently, and is driven by the Intelligence Community's (IC) goal to provide greater transparency that enhances public understanding and promotes collaboration with those outside the IC. Moreover, if NGOs like CSIS can conduct expert analysis without using classified data, their analysis can be more easily shared with allies and even adversaries.[68]

Effectively, what could be celebrated as 'public technical means'[69] is becoming enlisted as national technical means.[70] The consequences of such government co-optation of the nuclear non-state OSINT community are twofold. First, the community's practices are thereby used to legitimate government policies. Second, the U.S. nuclear secrecy regime along with the power it confers avert challenge.

This concludes my analysis using Winner's 'autonomous technology' approach of the relationship between citizen monitoring of nuclear activities and the entrenchment of the nuclear order.

4.2 Entrenchment, Understood Through 'Panopticon'

In attempting to understand the connection between civil-society nuclear-activity monitoring and the entrenchment of the nuclear order through Foucault's lens of panopticism, this section will lean on Litfin's chosen dimensions to analyze the impact of the advent of commercial high-resolution Earth-observation satellites on international relations: the disciplinary gaze of satellites that are predisposed to promoting control through surveillance; the subject-constitutive quality of disciplinary power that modifies the self-understanding and identities of the subjects in the entailed power/knowledge relations; the shift in the institutional locus of disciplinary power resulting from the proliferation of commercial high-resolution Earth-observation satellites.[71]

[68] Pia Ulrich et al. (Jan. 25, 2019): "Public and National Technical Means in the Digital Age: The implications for GEOINT in the monitoring of international nonproliferation agreements", in: *Trajectory*, available at: https://trajectorymagazine.com/public-and-national-technical-means-in-the-digital-age/, accessed: 31/5/2024.

[69] See Christopher W. Stubbs and Sidney D. Drell (Dec. 2013): "Public Domain Treaty Compliance Verification in the Digital Age", in: *IEEE Technology and Society Magazine* 32.4, pp. 57–64.

[70] As a reminder, 'national technical means' has traditionally been used to refer to state intelligence satellites and related capabilities.

[71] Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance".

I rely on Litfin for two reasons. On the one hand, her dimensions capture parsimoniously the salient aspects of panopticism relevant to analyzing the impact of commercial high-resolution Earth-observation satellites. On the other hand, Litfin's analysis of a shift in the institutional locus of disciplinary power heralded by the proliferation of commercial high-resolution Earth-observation satellites begs re-assessment for two reasons. First, it is two decades since the article was published. It has taken that long for a nuclear non-state OSINT community shaped fundamentally by the proliferation of commercial satellite imagery to come into its own. Second, the surveillance networks contemporary to her time of writing that she considered were those focused on human rights and the environment as issue areas, not the nuclear weapons field.

The following is an exposition of the panoptic features of contemporary nuclear non-state OSINT practices along the three aforementioned dimensions and my attempt at drawing connections to the entrenchment of the nuclear order.

4.2.1 Satellites' Disciplinary Gaze

Disciplinary power attributes

Analogously to the Panopticon, the power attaching to any Earth-observation satellite, commercial or governmental, is *automatic*, *knowable-but-unverifiable*, *efficient*, *economic and efficacious*, *productive*, and *disindividualized*. These attributes are demonstrated in the following.

Though relevant parties on the Earth know they are potentially being observed by an orbiting Earth-observation satellite, they have no or very few means of verifying that they are in fact being observed. For a satellite's imaging sensor may be turned on all the time or only some of the time, depending on its tasking; if a satellite hasn't been tasked to image a certain territory along its orbital path, its imaging sensor may very well be turned off in order to save battery power. Therefore, the presence of the satellite gaze is *knowable*, albeit practically *unverifiable*. Just as for the inmate in the Panopticon, induced in the observed state is "a state of conscious and permanent visibility that assures the automatic functioning of power."[72]

The *automaticity* in the functioning of satellite power implies *economy, efficacy, and efficiency*, since the observing party draws the gain from the power relation – deterring the observed party from sanctioned behavior – without setting up a constant, expensive,

[72]Foucault, *Discipline and Punish. The Birth of the Prison*, p. 201.

surveilling presence, let alone staging violent interventions for subjugation. Once the panoptic spatial-technical arrangement is in place, the effects ensue spontaneously and hold up permanently, with the surveilled party effectively executing the power relation upon itself.[73]

Before demonstrating the remaining attributes of disciplinary power as they apply to Earth-observation satellites, a word is in order about the limitations of the application of the Panopticon as a "diagram of a mechanism of power"[74] to the domain of international relations. Bentham's Panopticon's architectural aspect of separating observed entities to prevent collusion and mutiny is perhaps metaphorically inadequate, if not irrelevant, in the context of an anarchic world order composed of sovereign states that can freely enter into alliances. The envisioned realm of application of the Panopticon is rather the disciplines, e.g., schools, hospitals, asylums, prisons, workshops. In those disciplines, the objective of the panoptic schema is to impose a task or behavior on multiple individuals, for the sake of producing a healthy, productive, norm-abiding workforce. For disciplinary power, far from being repressive, is conceived to be generative, potentially amplifying the effects of the functions into which the panoptic schema is integrated, be they hierarchical observation, normalizing judgment, or examination.[75]

And yet, despite the differences, a sense of productivity can be found as well in the context of inter-state satellite-based surveillance. For even if inter-state power-relations don't exhaust themselves in the surveillance functions of hierarchical observation, normalizing judgment, or examination, satellites' disciplinary power here – similarly to disciplinary power in the Panopticon – is non-repressive and *productive*. From the perspective of 'global transparency' advocates, satellites' disciplinary power is generative of a greater and greater sense of security – by helping manage nuclear risks.

That being said, in the international arena one still encounters analogs of the instruments of disciplinary power: hierarchical observation, normalizing judgment, and examination. For example, these instruments play out in inter-state satellite-based surveillance as follows. Hierarchical observation is granted by the spatial-technical arrangement of the surveillance apparatus. An imagery analyst is able to observe and track nuclear activities and make reliable assessments over the span of the nuclear-fuel cycle and beyond. Normalizing judgment arises from the capability to measure, compare, differentiate, etc., and from suggesting criteria for "suspicious" nuclear activity. At the very least, normalizing judgment establishes that covertness is reprimandable. Examination ensues by qualifying

[73] Cf. Foucault, *Discipline and Punish. The Birth of the Prison*, pp. 202–203.
[74] Ibid., p. 205.
[75] Cf. ibid., pp. 205–207.

and classifying observed targets. But more interesting in view of knowledge/power relations is the manner in which examination ensues by observing the target learn from cover slip-ups by adopting more sophisticated detection countermeasures of camouflage, concealment, and deception, improving their weapons capabilities and military and defense strategies, or using the futility of covertness to their advantage – for signaling purposes, for example. Much has been learned about North Korea's supreme leader Kim Jong Un in this manner, for example,[76] and the lessons learned incentivize catch-up dynamics to develop better detection techniques to restore the intelligence advantage or better weaponry and military and defense strategies to restore the military and defense advantage.

The final attribute of satellite disciplinary power is that the power is *disindividualized*. That is, it doesn't matter what entity, be it an individual or group, assumes the role of observer nor what the motive is; any entity or even multiple heterogeneous entities could operate the panoptic machine to achieve the same effect. For the spatial-technical arrangement itself induces and sustains the power relation. It's the arrangement itself that inscribes the dissymmetry between the observer and the observed such that the observer can see everything whereas the observed cannot see the observer.[77] Furthermore, and of particular poignancy in the context where non-state OSINT actors have entered the arena once the preserve of governments, "[t]he more numerous those anonymous and temporary observers are, the greater the risk for the inmate of being surprised and the greater his anxious awareness of being observed"[78] – only 'anonymity' doesn't apply to the non-state OSINT community, which thrives on openness, and 'observed party' should be substituted for 'inmate'.

Importantly, the implication of the multiplication and the diversification of the observers when the gaze is selectively and repetitively directed from particular states towards particular other states is the normalization of observer *state* secrecy while the observed states become vilified for their own secret-keeping. Not only is this an expression of the normalizing judgment of the satellite disciplinary gaze, but this also reveals the impotency of non-state OSINT practices in challenging the broader secrecy regime and the power it confers. It should come as no surprise then that observer states tolerate non-state OSINT from the perspective that they could maintain secrecy around their own intelligence capabilities, be it sources or methods, as explained previously.

[76] A leading group performing non-state OSINT analysis on nuclear activities in North Korea is located at the James Martin Center for Nonproliferation Studies of the Middlebury Institute of International Studies at Monterey.

[77] Cf. Foucault, *Discipline and Punish. The Birth of the Prison*, p. 202.

[78] Ibid., p. 202.

Disindividualization is not unconnected to the next aspect, and presents yet another entry point to understanding entrenchment dynamics as facilitated by the spread of surveillance practices.

System transparency and democratic control – a veneer?

Disindividualization allows not only any entity or multiple entities to operate the disciplinary satellite gaze with differing motives across the entities, but also different levels of observation for the entities[79] that induce different functions for the entities and different forms of relationships among them to emerge, with different implications for entrenchment. If one assumes two entities operating the panoptic mechanism, state intelligence and non-state OSINT, one can picture two possible constellations determined by the observation levels of the entities:

1. *Non-state and state intelligence occupy the same observation level in the Panopticon.* Here, non-state OSINT analysts pursue their own intelligence questions. Their motive might be simple agency exercise, relevance seeking, or political agenda promotion. There might or might not be interaction with state intelligence. The interaction, if it exists, might be direct or indirect. Possible entrenchment pathways include the amplification of nuclear risk discourse, the deprioritization of nuclear disarmament, state co-optation of NGOs, and the concealment of state secrets and secrecy regime persistence – all aspects that have been outlined earlier in this chapter.

2. *Non-state OSINT analysts have second-order observation privileges, observing the state observers occupying the first observation level.* Here, non-state OSINT analysts perform an oversight function; they verify state intelligence claims, placing accountability demands in case of falsity. Their motive is democratic accountability; there is strength to be gained in the number of verification pathways and the diversity of the employed sources and methods. Notably, information gained from commercial satellite imagery can be supplemented with information gained from social media to obtain complete, reliable, cross-validated, shareable, reproducible evidence. The pathway to entrenchment seems unclear. But in actuality, this constellation deviates in one important respect from the conception of the Panopticon, since the Panopticon's architectural arrangement precludes the first-order observer(s) retaining secrets from the second-order observer(s). But state intelligence, as a first-order

[79] Cf. Foucault, *Discipline and Punish. The Birth of the Prison*, p. 204.

> observer, probably always maintains an intelligence edge over non-state OSINT analysts through exclusive sources and sophisticated methods. Perhaps then this constellation is the vision entertained by *The Economist* of the "people's panopticon" (see Chapter 1) for a day when governments the world over relinquished secrecy and open societies became the norm.

At any rate, both constellations indicate a sense of the democratization of the panoptic mechanism – for good or ill. Some useful evidence for the connection between this democratization and the entrenchment of the nuclear order can be gleaned from work by Lin-Greenberg and Milonopoulos. The authors empirically studied through public surveys the impact of the disclosure of commercial satellite imagery on U.S. citizens' attitudes towards U.S. foreign policy in a hypothetical nuclear crisis.[80,81] Their study revealed the following. When non-state OSINT analysts' findings concerning a rival or an adversarial state contradict U.S. government intelligence, U.S. citizens are less likely to support their government's foreign policy. When non-state OSINT analysts' findings concerning a rival or an adversarial state align with U.S. government intelligence, U.S. citizens are slightly more likely to support their government's foreign policy. When non-state OSINT analysts' findings reveal information about a rival or an adversarial state that hasn't been publicly disclosed before, "the public is more supportive of using force to punish the rival."[82] But bearing in mind the dynamics outlined in this chapter[83] undercutting the possibility of serendipitous findings, it becomes clear how perceived transparency and democratic control of the panoptic mechanism aren't sufficient safeguards against the entrenchment of the nuclear order. This bleak assessment stands in contrast to Foucault's optimism regarding the fate of panoptic institutions in view of their full transparency and amenability to democratic control when he wrote:

> There is no risk, therefore, that the increase of power created by the panoptic machine may degenerate into tyranny; the disciplinary mechanism will be democratically controlled, since it will be constantly accessible 'to the great tribunal committee of the world'. This Panopticon, subtly arranged so that an observer may observe, at a glace, so many different individuals, also enables everyone to come and observe any of the observers. The seeing machine was once a sort of dark room into which individuals

[80] Erik Lin-Greenberg and Theo Milonopoulos (2021): "Private Eyes in the Sky: Emerging Technology and the Political Consequences of Eroding Government Secrecy", in: *Journal of Conflict Resolution* 65.6, pp. 1067–1097.

[81] Lin-Greenberg and Milonopoulos's case studies for additional support for their public survey findings are North Korea's nuclear program, Beijing's militarization in the South China Sea, and Uyghur internment in Xinjiang.

[82] Ibid., p. 1069.

[83] Some more of these dynamics are outlined in the next section (Section 4.2.2).

> spied; it has become a transparent building in which the exercise of power may be supervised by society as a whole.[84]

4.2.2 Subject Constitution Through the Satellite Gaze

Panoptic disciplinary power has a subject-constitutive quality; it modifies the identities and self-understanding of the subjects in the entailed power/knowledge relations. I would like to update two aspects of Litfin's analysis along this dimension.

First, Litfin demonstrated this quality convincingly when she considered the evolution of the U.S.–U.S.S.R. relationship in response to satellite technology advances that enabled mutual transparency during the Cold War. However, while it may be true that this mutual transparency nudged the U.S. and U.S.S.R. towards collective identity formation and 'common security' arrangements (while cementing the role of remote sensing in not only preventing a surprise nuclear attack, but also in monitoring arms control verification agreements), Litfin's prediction that the dynamic would be sustained and replicated elsewhere hasn't been realized. And this despite her acknowledgment that the emergence of new surveillance networks involving non-state actors and new states through the diffusion of Earth-observation satellite technology hasn't quite left the confines of a disciplinary power paradigm. In fact, in light of my argument thus far connecting the panoptic mechanism to the entrenchment of the nuclear order, it's precisely because of the tension between state power and democratic control in panoptic arrangements that Litfin's prediction hasn't borne out.

In way of demonstrating the failure of the prediction, one may stick with the context of U.S.–Russia agreements on nuclear weapons and their supposed mutual desire to maintain strategic stability. The only standing nuclear weapons treaty is the New Strategic Arms Reduction Treaty (New START), which was signed in 2010 and will expire in 2026; as of the time of writing, discussions to extend it haven't achieved progress. Since the end of the Cold War, the nuclear weapons treaty regime has gradually eroded, despite increasing transparency. The U.S. and Russia withdrew from the Treaty on Open Skies in 2020 and 2021, respectively, the U.S. withdrew from the Intermediate-Range Nuclear Forces Treaty in 2019, and the U.S. had signed but never ratified the Comprehensive Nuclear-Test-Ban Treaty, while Russia deratified it in 2023.

[84] Foucault, *Discipline and Punish. The Birth of the Prison*, p. 207.

In fact, it's on account of the increasing transparency and connectivity enabled by U.S. commercial satellite constellations such as Maxar's for imaging and SpaceX's Starlink for communications, respectively, that Russian President Vladimir Putin has been insinuating in speech and action that both constellations might be legitimate targets for attack as civilian infrastructure playing a key role in aiding Ukrainian fighting forces in the current Russia–Ukraine war.[85]

Now, I come to the second aspect of Litfin's analysis requiring an update. Beyond the shift in the understanding of Self and Other among states, and beyond the commercial high-resolution Earth-observation satellite industry gaining in geopolitical relevance and shaping power relations, Litfin also correctly predicted that NGOs and journalism outlets would undergo shifts in their respective identities and in their relationship to governments and publics. However, one notable actor in the non-state OSINT network that underwent an identity shift but didn't feature in her predictions was the International Atomic Energy Agency (IAEA). In the remainder of this section, I argue that the IAEA, as a subject that has partially been reconstituted by the proliferation of non-state OSINT practices, contributes in its own right to the entrenchment of the nuclear order.

Writing two decades after Litfin and as the nuclear non-state OSINT community came of age, Lawrence considered the impact of the proliferation of commercial high-resolution satellite imagery on four stakeholders: the commercial remote sensing industry, the non-state OSINT community, print and television journalism, and the IAEA.[86] Lawrence describes how the IAEA has evolved over the last two decades from its role as the world's nuclear material accountant to the world's nuclear proliferation detective – a role captured quite adequately by its popular contemporary nickname 'the United Nations nuclear watchdog'. This evolution didn't ensue independently of the very technological developments that led to the rise of the nuclear non-state OSINT community.[87] Lawrence describes the redeeming role of commercial high-resolution satellite imagery for the IAEA in the early 2000s.

[85] See, for example, Permanent Mission of the Russian Federation to the United Nations (Oct. 26, 2022): *Statement by Deputy Head of the Russian Delegation Mr. Konstantin Vorontsov at the Thematic Discussion on Outer Space (Disarmament Aspects) in the First Committee of the 77th Session of the UNGA*, https://russiaun.ru/en/news/261022_v, accessed: 31/5/2024.

[86] Lawrence, "Heralds of global transparency: Remote sensing, nuclear fuel-cycle facilities, and the modularity of imagination".

[87] The IAEA's evolution, as it tracks more general developments beyond the proliferation of commercial satellite imagery and other open sources relevant for the IAEA's nuclear safeguards analysis, has been the subject of study in Anna Weichselbraun (2020): "From Accountants to Detectives: How Nuclear Safeguards Inspectors Make Knowledge at the International Atomic Energy Agency", in: *Political and Legal Anthropology Review* 43.1, pp. 120–135.

Prior to that, the organization's reputation had suffered a blow since its failure to discover clandestine nuclear weapons programs in Iraq and North Korea in the 1990s, and it subsequently had to strengthen its mandate and adapt its processes for the effective and efficient verification of its nuclear safeguards agreements with non–nuclear-weapon states. This was to ensure that no nuclear material, whether declared or *undeclared* in a nuclear safeguards agreement, is diverted to nuclear weapons or other nuclear explosive devices. In order to meet this challenge, the improved safeguards verification process would ensue by drawing on a broader range of information than is typically available through on-site inspections at declared nuclear facilities in order to assess the compliance of the non–nuclear-weapon state *as a whole* with its nuclear safeguards agreement. Thanks to this innovation, instituted as the 'state-level concept', aspects of the investigative practices of the IAEA and the non-state OSINT community have in fact become very similar over time, if not coupled.

I outlined some examples of the similarities in previous work.[88] An example of coupling can be gleaned from the cycle that sustains the "clandestineness narrative"[89] about the states targeted by the non-state OSINT analysts' "selective gaze."[90] The narrative could be described as operating in repeating and consolidating cycles starting with a national foreign policy concerning a rival or an adversarial state (or a tip to the non-state analysts in some cases), to the non-state analysts' acquisition of images from commercial providers, to the analysis using imagery and other open sources, to breaking a news story through public media channels, to the triggering of discussions in international political fora and the launch of calls for investigation, and finally to the release of an ambiguous result from the investigation – the results being framed as a stylized set of questions affirming the clandestineness narrative and prompting a new cycle of activity culminating in more questions.[91]

As such, IAEA and non-state OSINT practices are crucial elements of the technological underpinnings of the 'nuclear nonproliferation complex'. The practices are a manifestation of unbounded expansion in surveillance capacities and the scope of surveillance – a

[88] Sara Al-Sayed (2022): "Revisiting Societal Verification for Nuclear Non-proliferation and Arms Control: The Search for Transparency", in: *Journal for Peace and Nuclear Disarmament* 5.2, pp. 496–506.

[89] Lawrence, "Heralds of global transparency: Remote sensing, nuclear fuel-cycle facilities, and the modularity of imagination", p. 509.

[90] Delf Rothe and David Shim (2018): "Sensing the ground: On the global politics of satellite-based activism", in: *Review of International Studies* 44.3, pp. 414–437, p. 425.

[91] This is an insight gained from a workshop co-organized by the author in April 2023 titled "Societal Verification: Realizing Joseph Rotblat's Vision in the Age of Non-state Open-Source Intelligence"; the insight is documented in the workshop report: Al-Sayed, Glaser, and Mian, "Societal Verification of Nuclear Disarmament in the 21st Century – A Workshop Report", p. 370.

manifestation adequately captured by the Panopticon, with nearly universal buy-in from the international community and no institutional alternative to uphold nuclear nonproliferation.

That being said, it's worth noting that over the last decade, states, including Russia, have raised concerns about the state-level concept, prompting questions – sometimes valid, sometimes disingenuous – about safeguards objectives, the constitution of safeguards-relevant information, and the role of different IAEA bodies, suspecting politicization to be running across them.[92] All things considered, this challenge regarding matters touching on the IAEA's credibility and legitimacy threatens to erode the effectiveness of the nonproliferation regime.

4.2.3 Institutional Locus of Disciplinary Power

Litfin notes that "[t]he diffusion of satellite imagery among non-state actors represents a real shift in the institutional locus of disciplinary power,"[93] while underscoring that such diffusion should not be conflated with the disempowerment of states, but is to be understood as the end of state monopoly on space espionage and on the derivative privileges.[94] In light of contemporary nuclear non-state OSINT practices, I contest the degree and quality of that shift in view of the nature of secrets being unraveled as well as the legitimation mechanisms for state power or more intrusive IAEA practices that the nuclear non-state OSINT community finds itself implicated in.

First, recalling to mind Lawrence's 'clandestineness narrative', those nuclear secrets are often not quite secrets, but constructed as such. Second, any analysis of a shift in the institutional locus of disciplinary power should grapple with coupling phenomena entailed by the community's role in legitimating state power or a more intrusive role for the IAEA, as outlined in Section 4.2.1 and Section 4.2.2 as well as earlier in this chapter. The legitimation mechanisms the nuclear non-state OSINT community are implicated in include the amplification of nuclear risk discourse and the concealment of state secrets. All while evincing a veneer of democratic agency undercutting state power – a veneer that might confer further legitimacy rather than detract from it.

[92] See, for example, Laura Rockwood (Aug. 2014): "The IAEA's State-Level Concept and the Law of Unintended Consequences", in: *Arms Control Today*, available at: https://www.armscontrol.org/act/2014-08/iaea's-state-level-concept-law-unintended-consequences, accessed: 31/5/2024.

[93] Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", p. 68.

[94] Cf. ibid., p. 85.

So, while Litfin affirms that the diffusion of satellite imagery is still "symptom, expression, and reinforcement of modernity's dream of knowledge as power," simultaneously decentralizing surveillance as well as universalizing it,[95] her assertion of the diffusion and universalization of disciplinary power obscures those coupling phenomena that result in and help illuminate nuclear entrenchment.

[95] Litfin, "Public Eyes: Satellite Imagery, the Globalization of Transparency, and New Networks of Surveillance", p. 85.

5 Concluding Remarks and Summary

Winner's 'autonomous technology' approach and the approach based on Foucault's 'Panopticon' reveal similar basic aspects about the nuclear non-state open-source intelligence (OSINT) sociotechnical aggregate under study. All these aspects help elaborate the connection between nuclear non-state OSINT practices and the entrenchment of the nuclear order: a sense of autonomy and automatism, a near-totalizing sense of technologically-enabled control over societal agencies that should typically be in control, and a sense of self-perpetuation and -reinforcement of technical mechanisms in the navigation of fundamentally political concerns.

However, there are distinctions between the two approaches as well. This final chapter outlines some of the main aspects of distinction between the two approaches and some of the implications of the distinctions for the analysis of the case under study. Especially Winner's agency conceptualization will be foregrounded and connections will be made to contemporary forward-looking proposals for a potentially emancipatory vision of citizen monitoring of nuclear activities. Finally, the chapter concludes with a summary of the key points of my analysis in this thesis project.

5.1 Approach Distinctions

5.1.1 Role of the State

For the approach based on Foucault's Panopticon, I should underscore (as I did in the Introduction chapter) that I'm abusing the concept, abstracting it as a technology of disciplinary power from its role as foreseen by Foucault in *Discipline and Punish. The Birth of the Prison* in modeling power relations in the modern 19th century state. Of relevance then to the illumination of the role of the state in Foucault's Panopticon as applied to the context of skewed global surveillance arrangements is the attribute of disciplinary

power of disindividualization, which was elaborated on in Section 4.2.1, along with the implications for the relationship between democratic governance systems and non-state OSINT practices and other farther-reaching consequences.

As for Winner's approach, the question of the role of the state has implications for whether "a change in the identities or ideologies of those 'in control' matters."[1] Winner's reference point for the exploration of this role is 'centralization' or 'centralizing tendencies' that the classical literature of his day observed or predicted in the evolution of large-scale systems or a multiplicity thereof. The 'centralization' thesis has many manifestations, one of which is that the center (of planning and control or of decision-making) could be no other than a powerful state with no shortage of means at its disposal to facilitate their ever growing interconnection and integration (a growth necessitated by force of "technical rationality, efficiency, and the economies of scale"[2]) and to allow for the seamless, frictionless operation of the parts.

Winner concedes a degree of centralization within and across large-scale systems to be necessary for them to operate certainly and reliably, and he doesn't exclude a facilitating role for the state to that end. Nevertheless, he contends that "[a] multiplicity of reverse-adapted large-scale systems would, in all likelihood, have the inclination and power to oppose comprehensive centralization."[3] Indeed, reverse adaptation interrupts the progression towards comprehensive centralization, dispersing power instead to the systems and/or the configuration of technological conditions.[4]

From this perspective, the question of a 'center' (and the identity of its occupants and their interests) is rendered irrelevant. The quality of the decisions made by rational figures in positions of power and authority is what is important from this perspective. Confronted with an accurate snapshot of the state of affairs at a given point in time, the rational figure in central positions makes decisions that carry "an aura of indelible pragmatic necessity."[5] "These decisions, involving substantial commitments of society's resources, are not necessarily based upon the inherent desirability of consciously selected, independent ends. Rather, such decisions cope with necessities arising from an existing configuration of technical affairs."[6] Effectively then, "[t]he direction of governance by

[1] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 242.
[2] Ibid., p. 252.
[3] Ibid., p. 255.
[4] Cf. ibid., pp. 261–262.
[5] Ibid., p. 259.
[6] Ibid., p. 258.

technological imperatives and reverse adaptation runs *from* megatechnical systems *to* the state." [Emphasis Winner's][7]

In this thesis project, the nuclear non-state OSINT network was treated as a large-scale technical system comprising civil-society as well as state elements, and national as well as international and transnational structures – to say nothing of diverse technical cultures. Undoubtedly, such a heterogenous large-scale technical system enjoys different levels and degrees of centralization across its interconnected parts, not the least at the state level. However, as I hope to have shown in this work, Winner's approach compels us at the very least to dispense with the notion of a monolithic state, or even monolithic defense or intelligence communities. Suffice it to consider in the U.S context, for example, the role of inter-service rivalry in the early evolutionary course of the military satellite enterprise,[8] or the different attitudes within the U.S. intelligence community, comprising 18 agencies, towards open sources and methods, ranging from tolerance to skepticism, and how such division has prompted calls for reform.[9]

5.1.2 Role of Social Values, Norms, and Ends

Foucault's panoptic instrument of normalization meets its limits in the global surveillance context at the anarchic nature of the states system. That is not to stay there is no salience to the idea that norms do emerge amidst anarchy and play a governance role. At any rate, Winner's 'reverse adaptation' approach allows for a more fine-grained analysis of the technical, cultural, social, economic, political, legal, and administrative processes at work undermining the once influential role of social values, norms, and ends in shaping and guiding human action.

5.1.3 Agency Conceptualization

Juxtaposing my analysis of nuclear non-state OSINT practices using Foucault's Panopticon with other areas of Foucault's thought, particularly on biopower and biopolitics, one can make two observations. First, the risk practices the nuclear non-state OSINT community

[7] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 261.
[8] See, for example, Peebles, *High Frontier. The U.S. Air Force and the Military Space Program*.
[9] See, for example, Zegart, "Spies Like Us: The Promise and Peril of Crowdsourced Intelligence", p. 173.

engages in are compatible with a liberal art of government; risks are embraced and simultaneously precautionary measures are adopted against contingencies.[10] Second, free initiative and unexpected alliances are foreseen under a neoliberal art of government.[11] In a nutshell, if the analysis of nuclear non-state OSINT practices based on Foucault's Panopticon is all doom and gloom, other parts of Foucault's thought could be read as celebrating the practices. However, it is beyond the scope of this thesis project to explore this point further.

As for Winner, in view of the autonomy of reverse-adapted large-scale technical systems, individual and societal control over the ends of the systems seems forever elusive. "[T]he possibility of directing technological systems toward clearly perceived, consciously chosen, widely shared aims becomes an increasingly dubious matter."[12] So where could individual or group agency arise? On the issue of *moral agency*, another consequence of the complexity of large-scale technical systems according to Winner is the ambiguity around the moral agency of those in the sociotechnical aggregate. Winner argues that a large-scale technical system, by virtue of its complexity, is capable of generating any number of extenuating circumstances that could mitigate the culpability of anyone within the system in an unfortunate event brought about by the system and thus those circumstances could with validity absolve everyone from any responsibility.[13]

In the new ethical context ushered in by autonomous technology, where the idea itself of responsible action is foggy, the awkwardness comes to light of efforts to raise awareness among professionals in the sociotechnical aggregate of the ethical implications of their work or of efforts to impart ethical training to the professionals.[14] I will return to the aspect of ethics in the nuclear non-state OSINT community later.

In the same vein, Winner views with skepticism 'technology assessment' initiatives in terms of risks/safeguards or costs/benefits, regarding those initiatives as "technology as legislation" to which his critique of autonomous technology extends. The technology assessment initiatives he has in mind are those relying on a calculation paradigm for risk assessment, an economics paradigm for costs calculation, and equity-seeking politics for the equitable distribution of benefits, costs, and risks ignoring power asymmetries among

[10] See Michel Foucault (2007): *Security, Territory, Population: Lectures at the Collège de France, 1977–1978*, ed. by Michel Senellart, trans. by Graham Burchell, New York: Palgrave Macmillan, Lecture 3 (25 January 1978).

[11] For Foucault's treatment of neoliberalism, see Michel Foucault (2008): *The Birth of Biopolitics: Lectures at the Collège de France, 1978–1979*, ed. by Michel Senellart, trans. by Graham Burchell, New York: Picador.

[12] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, pp. 295–296.

[13] Cf. ibid., pp. 303–304.

[14] Cf. ibid., pp. 304–305.

stakeholder groups and obscuring negative externalities.[15] As such, "technology as legislation" – where rules, regulations, and practices may themselves be reverse-adapted[16] – is symptom, expression, and reinforcement of the reality of technical forms pervading virtually all aspects of human life and activity and shaping their form and content.

Winner does sketch some proposals that anticipate contemporary ones in the nuclear non-state OSINT field and the arms control and disarmament field more generally. Three of Winner's proposals are worth discussing briefly as well as their connection to nuclear non-state OSINT and arms control and disarmament.[17]

1. *Participatory design involving those standing to be impacted.* This proposal came up at a workshop co-organized by the author in April 2023 titled "Societal Verification: Realizing Joseph Rotblat's Vision in the Age of Non-state Open-Source Intelligence"; the proposal is mentioned in the workshop report[18] and I quote it here:

   > [A]nother means to promoting trust is granting agency to the communities directly impacted by the nuclear weapons complex, from the mining of nuclear material to nuclear waste disposal. It is pivotal to trust-building to involve these communities in nuclear-activity monitoring practices, so they have ownership over the process and outcomes. For a start, those communities could be engaged in speculative exercises where a nuclear-weapons–free future in their particular contexts is to be imagined along with possible pathways to achieving it. This could include the role of societal verification and its operationalization – i.e., what indicators for disarmament to look out for and how to monitor them – while accounting for constraints (including legal and ethical) unique to each context. In addition to political mobilization at the grassroots level, such an effort could pave the way to mitigating the imbalance in the current monitoring environment.

2. *Physical and intellectual accessibility of designs, high degree of flexibility and mutability, and low likelihood of generating dependencies.* This proposal could be integrated into the workshop proposal just quoted. The aim would be to guard against resignation, complacency, forgetfulness (technology is "license to forget"[19]), and somnambulism sneaking in.[20] Exposing dependency potentials would leave room

[15] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, pp. 317–319.
[16] Cf. ibid., p. 320.
[17] Winner's three proposals appear in ibid., pp. 326–327.
[18] Al-Sayed, Glaser, and Mian, "Societal Verification of Nuclear Disarmament in the 21st Century – A Workshop Report", p. 373.
[19] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 315.
[20] Cf. ibid., p. 324.

for reversibility and push back against technological determinism by challenging technological instrumentalism.[21]

However, I think an exposition of dependencies could be an impetus for a more holistic approach to addressing complex issues – space security, for example. A more holistic approach to space security is one transcending the state-security focus that has traditionally marginalized human concerns. In the context of the United Nations discussions on "The Prevention of an Arms Race in Outer Space", more and more states are calling for augmenting the approach traditionally centered on state security and strategic stability to take human-security concerns into account, in recognition of the integral role space systems have come to play in supporting critical civilian infrastructures, from communication to navigation to land-use planning to resource monitoring to disaster and conflict management. So, how could this tendency be capitalized upon to drive innovative thinking on arms control and disarmament? Could this development be used to empower non-traditional stakeholders to take part in paving the way to progress?

3. *Appropriateness considerations.* Here, ethics, politics, technics come together, for a conception of the next stage of maturity for modern civilization as one where society recovers its powers of selectivity and could resist temptations, avoiding entrapment by technological imperatives that lead to actions of narrow utility, but much broader implications.

   Indeed, I think one should launch opportunities to prompt the questioning of the political project of nuclear non-state OSINT beyond the vilification of foreign secrecy. Moreover, one should critique the current nuclear non-state OSINT ethics discourse. I dedicate the next paragraphs to sketching the state of this discourse and pointing out one crucial challenge before concluding this section with notes on Winner's 'epistemological Luddism'.

From 2019 to 2022, the Stanley Center for Peace and Security convened stakeholders in an initiative to look at ethical issues in nuclear non-state OSINT through a series of activities. According to the Center's report "Feeling the Burden",[22] ethical considerations in nuclear non-state OSINT practices are prompted by the nuclear non-state OSINT analysts' perception of potential harm to an individual, organization, society, institutions, or international stability as a result of their actions, be they the dissemination of findings

[21] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 324.

[22] Benjamin Loehrke et al. (Jan. 2022): *Feeling the Burden: Ethical Challenges and Practices in Open Source Analysis and Journalism*, Stanley Center for Peace and Security, https://stanleycenter.org/publications/ethics-osint-analysis-journalism/, accessed: 31/5/2024.

or of analysis of evidence. The harm may play out on four fronts: diplomacy, conflict, and crises; unintended consequences; privacy; interaction between analysts and journalists. Perceiving potential harm, the actor is then confronted with the task of ethical decision-making in order to determine what ought to be done in a certain instance.[23]

The report's insight is that the ethical decision-making process culminates often in choosing the right course of action under the circumstances, e.g., choosing to publish findings or analysis versus withholding them; choosing what to reveal and what to conceal about one's sources and methods; choosing to deliberate the decision with either collaborators in joint analytical-journalistic relationships or government officials versus acting autonomously.

However, I think the supposedly ethical aim of not inflicting harm on "international stability" reveals the lack of critical reflection in the community's preliminary attempt at imparting ethics to its practices. Benevolence towards international stability implies a recognition of international stability as a good worth preserving, promoting, endorsing, fostering, amplifying, etc. But international stability is itself an ambiguous and contested notion.[24]

Finally, I conclude with some notes on Winner's 'epistemological Luddism', fundamental as it is to his conceptualization of agency in the technical order. It refers to a method of inquiry to launch the long, laborious process to recover autonomy and self-determination for individuals and collectives. It takes seriously the fact that, faced with reverse-adapted large-scale technical systems, merely proposing "nonmanipulated, consciously, and prudently articulated ends"[25] – if that were possible – still leaves one clueless as to how to go about finding new appropriate means to achieve those ends, let alone how to go about producing those means, for there are "already technologies occupying the available physical and social space and employing the available resources."[26]

Epistemological Luddism differs from Luddism, holding it to be untenable. Luddism refers to an 1810s movement by Englishmen who saw their wages driven down or were altogether thrown into unemployment as a consequence of the increasing mechanization

[23] Cf. Loehrke et al., *Feeling the Burden: Ethical Challenges and Practices in Open Source Analysis and Journalism*, pp. 5–8.

[24] For some thoughts on the contrast between the use of open sources in the nuclear realm versus in international criminal, human rights, or humanitarian investigations, see Al-Sayed, Glaser, and Mian, "Societal Verification of Nuclear Disarmament in the 21st Century – A Workshop Report", p. 372.

[25] Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 330.

[26] Ibid., p. 329.

of the textile industry. In protest, they went about smashing machines that they believed neither improved the quality of manufactured products nor improved work quality.[27]

As an intervention in a contemporary technical form, epistemological Luddism would seek to examine: *a)* the kinds of human dependency and regularized behavior implicated; *b)* the patterns of social activity imprinted upon human relationships; *c)* the everyday life shapes; but it could also seek to examine *d)* the connection between the contemporary technical form and human needs and ends.[28] Winner suggests experiments in individuals or groups extricating themselves from particular apparatuses or techniques and the disconnection of crucial links in the system.[29] Applied to the nuclear non-state OSINT context where the community is still seeking its bearings, I believe Winner's method of inquiry merely points the way to speculative exercises, to thought experiments in educational and training spaces bringing together current and prospective stakeholders.

5.2 Summary

This thesis project was concerned with understanding the relationship between citizen monitoring of nuclear activities and the entrenchment of the nuclear order. In order to illuminate this relationship, I used two approaches: Winner's of 'autonomous technology' and an approach based on Foucault's 'Panopticon'. The two approaches are non-heuristic and not bound to the state level of analysis, in contrast to the approach used by Walker in analyzing nuclear entrenchment.

Furthermore, by elucidating phenomena of self-generation, self-perpetuation, and self-reinforcement enabled by technologies and technical systems, the two approaches offer a dynamical understanding of the impact of nuclear non-state OSINT practices on the entrenchment of the nuclear order. I have argued that the two approaches elucidate entrenchment phenomena in their own unique ways, with the important caveat that the approach based on Foucault's Panopticon is more specific to entrenchment phenomena in connection with surveillance arrangements. Winner's 'autonomous technology' approach does so through the analysis of the fate of social ends in advanced technological societies that enjoy an abundance of technical means of narrow utility but with much broader implications; the social ends are adjusted to match the character of the available means in the process Winner refers to as 'reverse adaptation'. By contrast, the approach based

[27] Cf. Winner, *Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought*, p. 331.
[28] Cf. ibid., pp. 331–332.
[29] Cf. ibid., pp. 331–332.

on Foucault's Panopticon elucidates entrenchment by drawing attention to democratic legitimation mechanisms in the modern democratized surveillance apparatus. Finally, the two approaches overcome technological instrumentalism and technological determinism and grapple with technological politics.

I summarize the key points of my analysis in the following. At first glance, it might seem awkward attempting to apply the 'reverse adaptation' lens to a large-scale technical system like the nuclear non-state OSINT network with diverse actors and multiple instances of control at various levels and with powerful states being key actors, and that in an anarchic international order where the national interests of powerful states play an outsize role in international security issues. However, a closer look at the individual elements of the system or subsets of elements reveals myriad reverse-adaptation behavioral patterns at work. That is, the feature of extension of control underpinning political reverse adaptation holds of individual elements or subsets of elements and at different levels. If anything, the analysis of the manifestations of reverse-adaptation behavioral patterns across the nuclear non-state OSINT network yields a nuanced and dynamic picture that does away with monolithic understandings, helping to grasp nuclear entrenchment as the complex phenomenon that it is.

Reverse adaptation was demonstrated in market control by commercial satellite operators and imagery providers influencing supply-demand dynamics. The companies' complex pricing structures for products and services and their contracts with governments act to reduce or eliminate the independence of action of the consumers of commercial satellite imagery be they domestic or foreign media, domestic or foreign nationals (individuals or non-governmental organizations), or foreign governments.

Reverse adaptation was also demonstrated in the shaping by the U.S. government of not only the domestic, but the international political environment as well during the Cold War to normalize global surveillance from outer space to accrue military gains. The U.S. government efforts capitalized on domestic and worldwide interest in the civilian and scientific applications of Earth-observation satellite technology. Those efforts mobilized large-scale political, diplomatic, normative, legal, administrative, financial, and scientific-technical resources over decades to achieve the desired ends, with far reaching implications extending into the present.

Reverse adaptation was also demonstrated in the repurposing of the Cold War military and intelligence industry for the post-Cold War era, as well as in the amplification of nuclear risk discourse by the nuclear non-state OSINT community's nuclear risk practices, those ending up justifying the nuclear status quo. I argued at length that 'risk' is a better lens than Winner's 'threat', thus establishing continuity with critical nuclear security

scholarship that for its part elevates nuclear risk reduction to the governing paradigm of the contemporary nuclear order.

I have demonstrated that the nuclear non-state OSINT movement has evolved to one fixated on the vilification of foreign secrecy. The contemporary community's practices are also lending themselves to government co-optation. The co-optation mechanism derives from governments benefiting from nuclear non-state OSINT to keep their capabilities undisclosed, their secrets unjeopardized. But then the nuclear non-state OSINT practices thus shield the nuclear secrecy regime from challenge and contribute to its preservation. Finally, I have shown that the contemporary attempt by the nuclear non-state OSINT community to inject ethical considerations into its practices is uncritical; indeed, the attempt qualifies as an instance of Winner's "technology as legislation."

Since the approach based on Foucault's Panopticon is confined in its realm of application to the institutions fundamentally concerned with surveillance, analysis using the approach doesn't model much beyond the relationship between and within the community of surveillants and the community of the surveilled parties. The approach readily provides analogs for the instruments of disciplinary power in the 19th century disciplines that are applicable to the context of inter-state satellite-based surveillance. However, in contrast to Winner's approach, the approach doesn't capture the role of other institutions such as the market. Nor does it capture the role of discourses such as those of nuclear nonproliferation or nuclear deterrence; it does, however, capture aspects of the transparency discourse – which isn't surprising since the panoptic surveillance apparatus is concerned first and foremost with rendering the surveilled subjects transparent and enjoys the transparency of the embedded surveillance operations.

Even so, the approach's insight that maximal transparency is sufficient for security (the very insight capitalized upon by *The Economist* in promoting the vision of the "people's panopticon") proved to be a springboard for fruitful analysis: Since the antecedent of maximal transparency never obtains in the nuclear realm due to the uncertainty around and limited knowability of nuclear issues, one comes to the sobering realization that one cannot but contend with the perennial tension between citizen and state – the tension that is put to productive use by governments in the case of nuclear non-state OSINT to shore up democratic legitimacy for state policies. From there one could work one's way to nuclear risk discourse, practices, and institutions to recover much about nuclear non-state OSINT that is initially obscured by Foucault's Panopticon.

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