The Price Paid by Pacific-Indigenous Islander Nations for Science

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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STS Research Paper

Introduction

Research and development to advance scientific progress has always been an inseparable part of society. During the 20th century especially, American desire to maintain a competitive edge in technologies, especially weapons, has led to research and development with little regard for how these technologies may impact society. Today, newer weapons technologies that are less permanent and destructive than nuclear weapons have been the focus of the largest world powers (FAS, 2020). Historically, most world powers have prioritized all forms of scientific research as a means to maintain political power and stability. For example, whilst the United States was developing anti-missile systems and defenses, both China and Russia invested heavily into hypersonic flight vehicles. Now, The U.S. is heavily investing in their own hypersonic capabilities and is, as a result, also providing incentives for defense contractors to increase their aerospace workforce (U.S.D.O.D., 2022).

In this paper, I describe how brash and reckless decisionmaking of state-sponsored research and development in indigenous societies manifests as a modern form of Colonialism, or Neo Colonialism. Coupled with initiatives to conduct research and development for the advancement of technologies is the potential abuse of these technologies and disproportionate negative impacts on communities of color. I address these impacts and how the reckless research and development conducted in use by American institutions of power continue to reinforce patterns of discrimination and negligence towards indigenous communities. Furthermore, I will describe how external institutions of power exploit independent States with indigenous majorities primarily through political and financial means as a form of Neo-Colonialism.

A case study approach is taken in which instances where technical research and development in American-occupied territories resulted in harmful impacts on local communities. These case studies consist of analysis of the construction of the Mauna Kea Observatory in Hilo, Hawaii, and the U.S. Naval nuclear weapons test in the Bikini Atoll. Each case study will address how different manifestations of technology may impact the communities in which they interface with. In the next section, I describe the STS framework to be employed, SCOT, and how it will help to inform solutions to the issues being presented. Following the introduction to SCOT, I define Neo Colonialism and how current employment of technologies in indigenous

communities from external powers are evidence of this idea. Finally, different case studies will be analyzed through the lens of the SCOT framework

STS Method

In any high-performance application of engineering, testing and evaluation of designs is essential to ensure the safety and well-being of both the public and the individuals involved in the research and development of projects in these fields. Technological constructivism (SCOT) is used to demonstrate how scientific research and technologies may embody the values and power of their respective designers, and how the perpetuation of these values and power from homogenous groups of scientists, engineers, and leaders are enforced upon native Indigenous communities (Klein, Kleinman, 2002).

Analysis with SCOT is in two parts: the first is the interpretive flexibility of different forms of value, and the second is how closure may be achieved in these conflicts. Interpretive flexibility is the multifaceted relationship between a technology and how this relationship manifests between the different social groups that interact with it (Bjiker, Hughes, 1987). Some factors that influence this relationship pertain to cultural differences, economic necessity, geographical locations, and politics surrounding these technologies. In some cases, such as the ones discussed in this paper, differences regarding interpretive flexibility result in conflict. The second stage, Closure, typically outlines how the differences in interpretive flexibility between different social groups and their resulting conflicts are resolved. Although some case studies in this paper are in the process of resolution, analysis I put forward through a SCOT approach expounds upon improved methods to achieve closure in each situation. Winner's view of technological determinism is also used to contrast with the SCOT framework in demonstrating the inherent nuclear nature of some technological applications, especially with regard to astronomy and intercontinental ballistic missiles (ICBM's).

The Thirty Meter Telescope

On the big island of Hawaii sits one of the largest active volcanoes and the largest mountain from base to summit in the world: Mauna Kea. This volcano is both an important religious site and environmental landmark for the people of Hawai'i, and it had been recognized to both of these ends until the islands of Hawaii were colonized by the United States in 1898.

Mauna Kea's religious purpose is that it serves as the fabled "home" to several Hawaiian deities, and it is even believed to be the physical body of Wakea, the creation deity known as the "Sky Father" (Nicholls and Ito). Although Hawai'i was once a sovereign nation of the greater region of Polynesia, settler colonialism in the late 1800's grew in Hawai'i primarily as a means to annex valuable land for plantations to grow varieties of fruit and sugarcane (Nicholls and Ito). In 1893, a combination of white plantation owners, capitalists, and the United States Navy overthrew Hawaiian Queen Lili'uokalani and placed the owner of the Dole plantations in charge of the newly annexed territory of Hawaii (Nakamura, 2022). Although Hawaii would be recognized as a U.S. state nearly 70 years later, Naval occupation and subjugation has existed since the Age of Imperialism.

Beginning in 2014, the Thirty Meter Telescope (TMT) was starting the process of construction atop Mauna Kea in Hilo, Hawai'i. The namesake for this telescope is descriptive of the width of the lens to be used in the observatory, which is notable for its size as it is one of the largest telescopes in the world (Hurley). Having been selected for the lack of light pollution, Mauna Kea has seen multitudes of protests in increasing magnitudes since construction began in 2014. Given the aforementioned historical suppression of Native Hawaiian people, customs, and history, the TMT protests are the most recent culmination of anti-colonist sentiments. As stated by the executive director of the Lālākea Foundation, "We…believe that Mauna Kea, and the summit area in particular, is the place where the Earth Mother, or Papa, meets the Sky Father, Wākea. So all life begins at that point…the mountain is the first born out of that union"(Molero, 2022). Despite that fact nearly 50% of Native Hawaiian Citizens support the installation of the TMT, the increasing protests indicate unaddressed historical instances of Hawaiian oppression at the hands of American, and today, the international scientific community at large.

Between 2015 and 2019, construction of the TMT was paused due to the mass influx of protestors on the limited roads that lead towards the summit of Mauna Kea. According to Clery, over 1000 protestors had gathered both in 2015 and in 2019 in order to voice their opposition to the construction of the telescope (Science, 2019). Despite the efforts of Hawaiian citizens' protests to the TMT, pressure from the international astronomy community coupled with more than 1 billion dollars in funding for the telescope's construction and operating costs have resulted in the slow, yet iterative construction of the TMT (Clery, 2023). Nations, such as Canada, France, and the U.S., fund and support outreach programs surrounding the TMT in an effort to share the

benefits of the prospective observatory with the local Islander community, including jobs, educational programs, and internships. Despite these benefits, however, Native Hawaiians have voiced their opposition to the TMT's originates not from the lack of benefits to be shared with the Hawaiian community, but from the continual disrespect and silencing of Native Hawaiian Rights and voices with regard to colonization and the utilization of Mauna Kea for the TMT. These sentiments of anti-Western oppression for the sake of Western scientific research and progress have been reinforced most recently by the removal of several shrines, called *ahus*, from the summit of Mauna Kea to clear paths for construction vehicles (Stone, 2019).

What is being repeatedly witnessed by the Native Hawaiians as the TMT construction progresses is not only the continuation of centuries of oppression and subjugation by Western Society, but also the excuse that the most recent construction of the TMT is for the international scientific community and for "the greater good". Why then, must the greater good come at the expense of the Hawaiian peoples who have, time and again, had to pay the price for the benefit of their Western neighbors? Here, I utilize SCOT to understand the rejection or acceptance of technology through the social context in which the technology exists (Bijker, Hughes, 1987). The rejection of the telescope is a direct result from the inability of central stakeholders' and scientists' lack of understanding regarding the social context of Hawaiian relationships with Western Nations. Additionally, these same Western stakeholders do not possess the same cultural awareness of the sacred *ahus* or the religious sites of worship at the summit of Mauna Kea. The scientists in control of the TMT perceive Mauna Kea's value through the "mountains' flat shape, gentle winds, and low humidity" for astronomy (Molero, 2022). The cultural significance Native Hawaiian creation stories and how they took place in these same mountains is tertiary to the entities behind the TMT. The first stage of SCOT, interpretive flexibility, manifests as differences in relationships between the observatory's location and the astronomers and Native Hawaiian community. What exists as a holy site of birth and creation for the entire Hawaiian Island chain is the "number one in the world…site for locating telescopes" (Molero, 2022). How then is the second stage of SCOT, Closure, achieved given the difference in values towards the TMT and its respective social groups? One method the state of Hawaii is employing is the increased inclusion of Native Hawaiian citizenry into the decision making processes and management of the TMT. By elevating Native Indigenous voices, the Hawaiian Government aims to ensure that dutiful protection of the culture, land, and religious practices involving Mauna Kea is upheld. This

method of finding Closure addresses the key conflicts of value and historical colonization as Native Hawaiians are being empowered to actively protect and manage their own land. While Hawaiians have been historically removed from land and positions of self-governance, the inclusion of Indigenous peoples into the stewardship of the TMT is a positive first step.

Concerning differences in value proposed in the SCOT critique of the TMT, I argue that the current structure regarding political and financial control of the TMT reinforces trends of Neocolonialism. As stated by Nkrumah, "its [the State] economic system and thus its political policy is directed from outside" (1965). The collection of scientists, astronomers, and engineers who currently preside over all operations of the TMT and its construction consists predominantly of Canadians, North Americans, and the French. These stakeholders are guilty of reinforcing Neo Colonialism in that the capital investment into the TMT is for the net benefit of powers external to the State of Hawaii. Although educational programs are being added to support the local Indigenous communities to the TMT, these programs are a fraction of the capital investment and capital gain. When a foreign entity invests political and economic resources into an otherwise independent state and begins to exercise disproportionate amounts of control at the expense of the state, Neocolonialism occurs. These same stakeholders lack the understanding regarding the motivations for the aforementioned protests. They view the scientific research, education, and employment opportunities as a satisfactory exchange for use of Mauna Kea as an observatory. Given the composition of stakeholders in charge of the project, the overwhelming majority of leaders and scientists are of non-native Hawaiian, Western/European societies. As such, Western society's value systems are being conflated with what Native Hawaiians culturally value. As mentioned before, centuries of oppression and exploitation have not been addressed by any of the institutions of power in charge of implementing the TMT. Additionally, the removal of religious shrines and the expansion of telescope sites beyond a predetermined limit set by the state government of Hawai'i have further eroded trust between Hawaiian citizens and the 6 universities who own the TMT (Clery).

I propose that Hawaiian inclusion into the decision making processes and operations of the TMT creates additional understanding regarding the social contexts of the shrines atop Mauna Kea and the agreed-upon terms of construction. The University of Hawaii's current management of the leased land atop Mauna Kea has damaged the thin thread of trust that hangs between Indigenous Hawaiians and the non-native entities behind the TMT. I posit that, should

the Native Hawaiian communities have more active voices in the entities governing over this project, the narrative of the TMT could be remedied such that Hawaiians are in a position to personally reclaim their land, their ancestry, and their preexisting cultural roots to astronomy. As stated by the late Dan Akaka, a native Hawaiian Senator and cultural figure, “Let’s allow Mauna Kea, rightfully, to become a bridge between our past, as Hawaiians, and our future. Students of stars are who we are” (Wallace, 2017).

Nuclear Weapons Testing in the Bikini Atoll

The Bikini Atoll is a collection of islands nestled within the larger Marshall Islands which served as a test site for the first hydrogen bomb developed by the U.S. Government during WWII. The atoll was originally inhabited by a native population of nearly 200 individuals, who were relocated to the nearby Kili islands in 1946 by the U.S. Navy (Britannica 2022). The U.S. Navy seized control of the Marshall Islands from Japan in 1944, as the island system had been colonized by the Japanese years previously. When relocating the indigenous peoples of Bikini to nearby islands in Micronesia, the U.S. government signed the U.N. Trusteeship Agreement for Micronesia, which was a written promise that the United States would protect the inhabitants of the Marshall Islands from loss of land, resources, and general wellbeing (Weisgall, 1980). The Navy sought to use the island to evaluate the effects of hydrogen bombing on naval ships and in the marine/pacific theater, as the Manhattan Project was well underway in developing nuclear weapons in 1946 (Nuclear Museum, 2017). The Bikini Atoll saw the nuclear detonation of 23 bombs over the course of the twelve years since the indigenous peoples were removed (Marshall Islands Science Foundation Program). Since the first detonation, nuclear fallout in the form of radionuclides permeated the terrestrial and marine ecosystems of the atoll and the surrounding ocean. These radionuclides were absorbed from the water into the fish and plants which inhabited the radioactive regions of the testing site, which effectively removed any potential sources of food for prospective human populations. One of the most harmful radionuclides was cesium-137, which is a radioactive isotope that is particularly concentrated in agricultural products.

When the United States sought to follow through on their treaty with the United Nations and the Marshall Islands communities, the United States Navy began to repopulate the Bikini Atoll with their original inhabitants in 1968 (Weisgall, 1980). Although the United States had performed over 16 different observations of the Bikini Atoll over the course of the nuclear

testing programs performed in the small island chain, President Lyndon B. Johnson's assurance that the island chain was fit for repopulation proved to be premature (Weisgall, 1980). For nearly a decade, the United States allowed for the native populations of the atoll to live in severely radioactive regions of the atoll. Once the U.S. Navy realized that lethal doses of radiation were found in the biological systems of the human populations in the Bikini Atoll, they began a hasty relocation of these populations to the neighboring Kili islands, as the 800 mile islands were outside of the lethal radiation zone which encompassed the atoll (Britannica 2022). Once the second relocation had occurred in 1978, American scientists informed the American Government that the Bikini Atoll itself would not possess safe levels of radiation for at least another 60-80 years, as cesium-137 takes over a decade to decay to 50% of its original radioactivity (Marshall Islands Science Foundation Program).

With the goal of remediation as a key pathway to resettlement, local governments within the larger Marshall Island nation began to introduce two key methods to reduce exposure to the cesium-137 in the topsoil of the atoll: Potassium based fertilizer and substrate manufactured from local coral. Potassium served as a biological replacement for the cesium which was being absorbed by the agricultural products used to feed the citizens in the atoll. Frequent use of the potassium fertilizer (several times per month) had lasting effects in reducing the levels of radiation absorbed by crops anywhere from 5% to 10% (Marshall Islands Science Foundation Program). With regard to the coral substrate, use of this "soil" was meant to reduce physical contact between people and the irradiated ground. By employing both of these methods, Lawrence Livermore National Laboratory observed in 2010 that doses of radiation from potential habitation of the atoll may be significantly less than the 2040-2060 date that originally resulted from the initial levels of radiation contamination from 1978 (Marshall Islands Science Foundation Program). Although there are clearly improvements in remediation processes for the atoll, the earliest resettlement date lies near 2030 at the earliest.

Similar to the Indigenous peoples of Hawaii, the people of the Marshall Islands are currently experiencing Neocolonialism through the American Naval Habitation of their land, the dependence of their economy on foreign goods, and the domination of their politics. Although nuclear technology initially served as the prime source of colonialism in the Bikini Atoll, the lasting effects of this highly destructive technology persist today. Because the Indigenous Peoples of the Atoll lack the educational and financial resources to heal their land, they are

forced to accept aid from the United States. While intuition might view this cooperative approach as a positive development, as the United States are responsible for the current state of the Bikini Atoll, the balance of power in this partnership heavily favors the United States. One example is the Naval occupation of the Marshall Islands by the United States. As described by Nkrumah, the occupation of a foreign military "is one of the final stages of Neocolonialism" (1965). Because the Marshall Islands are already financially dominated by foreign interests, the prospects of raising significant capital to provide sufficient self-protection are already poor. Some forms of external financial and political control manifest in the Marshall Islands reliance on U.S. remedial fertilizers and agricultural produce, as the Indigenous peoples of the island nation have to use specialized radiation-hardened agricultural products to remove the harmful cesium-137 isotopes from food (Robison, Hamilton, 2010). Additionally, the Lawrence Livermore National Laboratory's stewardship over the remedial programs for the Marshall Islands effectively remove any agency the Marshall Island peoples have in this issue, as the National Laboratory is a strictly U.S.-based entity.

Through a SCOT lens, both the interpretive flexibility and closure components of this framework revolve around the land of the Marshall Islands themselves, and how the lasting effects of nuclear weapons testing has impacted the United States and the Pacific Islanders who are native to this land. The United States originally removed the Native Indigenous peoples of the Marshall Islands from the Atolls because of the strategic location within the Pacific during WWII, the low-lying islands, and the ease of Naval occupation across the entire Marshall Island system (The Marshall Islands Program, 2023). For the people of the Marshall Islands, the land is home to themselves, their culture, their religion, and their ancestors who lived and died there. The conflict that arose manifested as the desire for both groups to possess the limited land in the Marshall Island Chain. Given the scarcity of food and general resources on neighboring islands, the Native Indigenous peoples to these islands were faced with increasingly difficult living situations (The Marshall Islands Program 2023). For the United States, the "price" they had to pay to possess these islands by relocating Native tribes was worth the net benefit the nuclear naval tests would grant the United States for wartime applications. Although closure appears to have been reached between both groups, the reality is that the United States still possesses clear, multifaceted dominance of the Marshall Island nation whilst the Indigenous peoples of these islands have had to struggle with increasingly limited land and harmful levels of radiation

(Robison, Hamilton, 2010). I posit that, should the Marshall Island nation be given more agency over remediation programs, complete and independent jurisdiction over all land in the island nation, and decision-making power with regard to Naval occupation of their land, more just and equitable implementation of remedial programs will result in a net benefit for the Marshall Island nation instead of the external powers who occupy the island chain.

Conclusion

Whilst technology has always granted its proponents power and greater standards of living, the technological singularity modern society is reaching calls for greater discrepancy and caution. Especially for technological foreign policy, many modern nations are guilty of enforcing forms of Neocolonialism upon underdeveloped and underprivileged nations and communities. With respect to both Hawaii and the Marshall Islands, these independent States are politically, economically, and socially dominated by the United States and its employment of technologies in both Pacific-Islander communities. In both Indigenous Nations, Colonialism has shifted from strictly land-based occupation to settlement and control based on technological need. Using SCOT, I discussed how astronomical and nuclear technologies create need for the United States, and how the United States in turn has subjugated Indigenous communities to fulfill these needs at the expense of these same communities. Although Closure has been sought after by all social groups in both case studies, the current state of Closure which is achieved in either situation is at a net benefit for the Neocolonial power. However, most recent forms of successful Closure being implemented with respect to the TMT have begun integrating pathways for Indigenous voices to be heard and to be given decision-making power. I conclude that, should Indigenous peoples be given platforms and true self-governance, more just and equitable outcomes will be achieved.

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