The Making of National Robot History in Japan:
***Monozukuri*, Enculturation and Cultural Lineage of Robots**

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Introduction

Japan is pursuing an ambitious program of societal robotization.[1] The declining birth rate, aging society, and shrinking population of productive age are the reasons why robot technologies are perceived by the government, almost mythically, as solutions to social challenges, including labor shortages, overwork, manufacturing and agricultural productivity, medical services, nursing care, construction, and infrastructure maintenance.[2] While Jennifer Robertson emphasizes the Japanese government's aversion to immigrant labor and a tendency to preserve a normative family structure as drivers of robot culture,[3] there is almost a univocal critique[4] that robots are deployed as technological fixes[5] to treat symptoms of social issues without solving their causes. Yuji Sone thus defines a Japanese national tendency to robotize the country as "techno-determinist economic rationalism," which aggressively promotes robot culture but does not indicate "why integration of robots in the society would bring significant social benefits."[6]

I contribute a historical analysis of *monozukuri* discourse to this debate as well as a genealogical perspective on robots based on the *monozukuri* view on Japanese technology. *Monozukuri* (a combination of *mono*, "thing" and *tsukuri*, "make"), is composed of diverse ideas and practices related to manufacturing or "thing-making." The English words "craftmanship" and "manufacturing" only partially translate its meaning. *Monozukuri* denotes the Japanese spirit and way of making things as well as the process of making, the striving for improvement, artisanship, and dedication.

I emphasize industrial and government strategies to construct a national robot culture through a manufacturing-dependent notion of "Japaneseness." As a result, material culture is reinvented, "Japaneseness" reformulated, and robots encultured. Two questions follow from this: How and why is a shared ontology between Japanese cultural identity, government-economic agendas, and material culture being assembled in robot cultures;

[1] For a comprehensive overview of government plans, programs and policies see Wagner 2013 and Robertson 2018.
[2] METI 2015.
[3] Robertson 2007.
[4] Robertson2007; Sabanovic 2010.
[5] The term is discussed by Rudi Volti in his book *Society and Technological Change*, seventh edition. 2014.
[6] Sone 2017, 21.

and what does the making of a genealogy and hence national history of robots mean for Japanese society? The perceived homogeneity of robot "Japaneseness" currently legitimizes production of policies surrounding robots. The popular robot discourses invoking this "Japaneseness" in robots and the affinity for robots ("We, the Japanese, have a special feeling toward the robot."[7]) require a thorough consideration of Japanese technological modernity inscribed into robots.

While *monozukuri* discourse is of relatively recent origin, its conceptual structure is based on a historical reinterpretation of robots and technology as part of national industrial plans to innovate society and invigorate the economy. [8] Without exception, all big manufacturers in contemporary Japan, including Nissan, Honda, Toshiba, and Toyota have appropriated *monozukuri* DNA as a tool to re-conceptualize the Japanese manufacturing process. Traditional handmade crafts in Japan have been undergoing a similar transformation over the past five years. Since the perceived ancestors of modern and contemporary robots and technology are *karakuri* (mechanical devices), particularly *karakuri ningyō* or anthropomorphic clockwork automata[9] – complex self-moving devices that looked human and could perform automated activities like serving tea – from the Tokugawa period (1603-1867), this enables construction of a common history and origin of today's industry, artisanship, and robots linked by the Japanese spirit and artisanship lineage represented in DNA. The *monozukuri* DNA link between traditional crafts and the manufacturing industry is relevant because it sets the government-driven agenda for framing Japanese technology and society. This is relevant for robots because they are being created and mobilized within the same thing-making ecosystem, and then legitimized through discourses that relate specifically to "Japaneseness" and a historical technology lineage. This is important for Japanese society because it perpetuates a homogeneous narrative through robots about the desirable Japanese subject in a top-down process that imposes a selected regime of values on society at large. In other words, Japanese industry and the government are co-creating a national robot history that aims to legitimize a vision of a future robot society. Rather than being an issue of "robots taking over," it is about existing regimes of power animating robots to assert a particular set of social values and views on gender, family, work, ethnicity, and history.

Rather than exploring the history of robots in Japan, I analyze robot genealogy currently under construction. In doing so I situate current social strategies in Japan, which include robots, in the sites of cultural inscription such as Shintō shrines, department stores, expositions, and museums that generate narratives about the common origins of the ancient automata (self-moving machines) and modern electrical appliances. These sites, I argue, co-produce[10] robots as boundary objects – objects "that are part of multiple social worlds" with "a different identity in each social world" [11] they inhabit. They are culturally inscribed with Japanese spirit or cultural DNA across different areas, epistemological frameworks, and enculturation and encoding (acquiring and transmitting meanings) sites. This enables the creation of a consensus on robots as a normative part of society. This approach emphasizes the ever-continuing process of how robots are constituted as social, cultural,

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[7] Nakayama 2006, 16.

[8] As another example that Shinzō Abe's politics is about restoring old social values rather than introducing new ones, "Innovation" is rephrased in the Abe cabinet's policy Innovation 25 to mean "renovation" and "renewal." (Prime Minister of Japan and His Cabinet 2005).

[9] Automata (plural of automation) is a term for self-moving mechanical devices from ancient Greek word *automatos*, which means "moving of one's own will." Automata move in a predetermined pattern by the use of wind, air, water and clockwork.

[10] Jasanoff 2004, 409.

[11] Star and Griesemer 1989.

and scientific objects across different areas. I follow up on this by considering robot performativity and robots as the body "directly involved in a political field."[12] My central argument is that the construction of a national history of robots and a national robot culture in Japan is dominated by corporate and government visions. This hegemonic process includes a mobilization and interpretation of history, and highly symbolic cultural sites, and a redefinition of "Japaneseness" through applying the *monozukuri* discourse on robots. As a result, a single robotic narrative and culture are privileged and used to assert a particular set of values and norms.

Analyzing these strategies, unique to the Japanese context, also opens up broader perspectives relevant to understanding how robots are perceived in different national contexts. The wider perspective is important because we are entering an important new phase of global automation and robotization of work and society. While my analysis is particularly focused on discourses surrounding robots, it also considers the economic and political framing of robots as well as discourses on "Japaneseness."

Monozukuri and National Robot Culture

Nihonjinron or theories of "Japaneseness" attempts to explain, particularly in the periods of Japan's economic and geopolitical rise, the uniqueness of Japanese culture and the racial and ethnic essence of the Japanese people. Over the decades, many cultural traits have been cited as the defining characteristics of Japanese national character: [13] ecology,[14] social structure,[15] psychology,[16] subsistence economy,[17] ethos[18] and language.[19] *Nihonjinron* publications were at its height from the 1960s to 1980s, and works on the topic are still being regularly published.[20]

The Japanese notion of craft-making and manufacturing directly links with *nihonjinron* and encompasses handmade traditional crafts as well as mass-produced consumer electronics and consequently industrial and social robots through *monozukuri* discourse. The term was adopted by the Japanese government in 1998 when the Prime Minister's office established the Consultative Council on *Monozukuri*. On March 19, 1999, the government enacted the Basic Law for Promoting Monozukuri Foundation Technology so as to " reverse the trend of de-industrialization and hollowing out that Japan was experiencing after the end of the Japanese financial bubble in the 1990s by reaffirming Japan's strengths in manufacturing."[21] By encompassing ideas of traditional artisanship, industrial manufacturing, and technological development, *monozukuri* emphasizes the cultural and national lineage of manufacturing as the core of technological progress. Recently, the term DNA was added to *monozukuri* and has been adopted by local governments, craft-makers, designers, and manufacturers. *Monozukuri* DNA signifies the organic cultural lineage of Japan's manufacturing tradition as well as innovative excellence, social continuity, and homogeneity of products based on artisanship that is transmitted generationally.

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[12] Foucault 1995, 25.
[13] Befu 2001, 17-39.
[14] Watsuji 1961 (first published in1935).
[15] Kawashima 1957.
[16] Doi 1971.
[17] Sabata 1964.
[18] Saitō 1972.
[19] Tsunoda 1978.
[20] Befu 2001, 14-15.
[21] Pringle 2010.

Recent cultural branding efforts by the Ministry of Economy, Trade and Industry (METI) to promote generationally-transmitted traditional artisanship as a Japanese pseudo-biological resource and the core of Japanese national soul follows this pattern, According to METI,

A reflection on craftsmanship can yield insights into the sensibilities of the Japanese, because tangible objects embody the traditional spirit of the Japanese. And as this spirit is transmitted from generation to generation, it continues to imbue the process of artisanship.[22]

Japanese traditional crafts (*kōgei*) are promoted by the government as the embodiment of the Japanese spirit. This view hails back to *nihonjinron* texts, particularly the *mingei* (folk crafts) movement of the 1930s and writings on Japanese aesthetics.[23]

The artisanship system emphasizes skill and technique – the intangible aspects of manufacturing – allowing abundant interpretative possibilities in top-down decisions on the cultural, national, and historical value of cultural products. Persons are secondary to this process as carriers of generationally transmitted skills. While persons and products are perceived as dynamic and transformative, the artisanship lineage, expressed in the term DNA, represents the historical continuity of the Japanese spirit.

Robots also are part of *monozukuri* and its *nihonjinron* underlining. The University of Tokyo, for instance, features a web article with a telling title *Japan: the Land of Rising Robotics*, subtitled *Japan, the World's Leading "Robot Nation"* which states that "in recent years, robotics has been the driving force behind Japan's *monozukuri* culture."[24] Rather than a photograph of a robot, the article includes one of a craft-maker hand-cutting *kiriko* (cut) glass. An official Fujitsu blog asks "can a robot follow the precepts of *monozukuri*?" The answer is yes, "because humans build and program them."[25]

Japanese manufacturers are expected to assert their important global position and uniqueness to ensure their global market competitiveness and the country's socio-economic welfare amid the current fourth industrial revolution (driven by robots). As it rapidly transforms society and work, technology integrates with sociocultural identity. Kaplan (2004) refers to this process as the "taming of technology" by which once foreign technologies, including robots, are "mastered and harmoniously integrated in society" without losing cultural essence.[26] In 2011, the Chairman of Toyota, Fujio Cho, was quoted as asserting that the company's goal was to "preserve the Japanese *monozukuri*."[27] This urgent agenda arises from the need to reinvigorate the economy and domestic industry following the economic stagnation of the past several decades, and which robots are envisioned to solve. This is apparent in METI's Robot Revolution policy that embraces robot technologies as a solution to a declining birth rate, shrinking labor force, and aging society. The promotion of robots also is in line with Shinzō Abe's anti-immigrant politics.[28] In 2014 METI formed the Robot Revolution Realization Council, which aims to realize a "New Industrial Revolution Driven by Robots" through Japan Revitalization Strategy. Robot technologies are expected to "make Japan [the] world's robot innovation hub" as part of "utilization and dissemination of robots across Japan … aiming to achieve

[22] METI 2017.
[23] See for instance Kuki Shūzō: *Iki no kōzō* (1930).
[24] The University of Tokyo, n.d.
[25] Wallenius 2018.
[26] Kaplan 2004, 2 and 4.
[27] SA partners 2012, 2.
[28] See Robertson 2007; 2014; 2018.

a society with the highest level of robot utilization in the world and to realize the daily life that robots exist all over Japan."[29]

Monozukuri DNA

Composed of around three billion bases,[30] of which more than ninety-nine percent are the same in all people, DNA not only denotes the biological essence of life but has come to increasingly account for who we are and *how* we are. The field of behavioral genetics, for instance, studies whether personality traits, intelligence, and behavior have a genetic component. DNA as a holistic coding of an individual potentially involves larger sociocultural systems as well as cultural homogeneity – or hegemony. It is unclear whether policymakers and *monozukuri* industry in Japan were aware of these sociocultural implications, but they seem to have appropriated DNA as a semiotic value for the Japanese (manufacturing) spirit precisely for these reasons.

Just as DNA passes through bodies, only temporarily confined to individual bodies, thus generating collective temporal and spatial cohesion, the discourse of *monozukuri* DNA denotes a collective skill or spirit of making that inhabits bodies of Japanese craft and technology-makers. In the case of the Toshiba Corporation, *monozukuri* DNA refers to an inheritable Japanese skill and spirit of manufacturing things, a strand of productive crafting memory shared by all Toshiba products, in which this legacy is actualized and embodied.[31] Likewise, Yanmar Construction is proud of a 100-year *monozukuri* DNA in their products.[32] Similarly, the Three Principles that comprise the management philosophy of Mitsubishi are "Mitsubishi Group's DNA, inherited as unbroken string of traditions."[33] Nissan has taken a more interactive approach by creating the Nissan Heritage Museum, known as the Nissan DNA Museum, in Kanagawa prefecture. This museum displays the historical lineage of Nissan cars.

In 2015, the 54th Japan Crafts Exhibition, Tokyo Midtown Design Hub Special Exhibition's topic was "Design Resonates with DNA." The exhibition featured objects fusing innovative designs with old craft techniques, from textile weaving to pottery and lacquerware. New traditional crafts depictions rely on *monozukuri* to invigorate production and contribute to "Japaneseness." An example is Sumida, one of Tokyo's twenty-three wards, which prides itself on being a historical center for manufacturing. The ward authorities introduced Sumida Modern Brand that requires that craft products "follow a connected strand of DNA from the Edo period through the Meiji period to the present."[34]

In the historical narrative of manufacturing, hand-made and machine-made, the purpose of DNA as a sign in the *monozukuri* discourse is to transcend physical time-space, and disciplinary constraints to ensure a homogenous, unbroken, and linear transmission of the Japanese spirit. In other words, it creates a national lineage of thing-making. The fact that the *monozukuri* incentive originated with the government shows a state commitment to change the conditions of manufacturing and impact the society and economy by re-mobilizing the *nihonjinron* paradigms.

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[29] METI 2015.
[30] Bases are chemicals which make up strands of DNA: T - thymine, A - adenine, G - guanine, C – cytosine.
[31] Toshiba. Toshiba prides itself on inheriting the unbroken string of 140-year *monozukuri* DNA [*Sōgyō irai 140-nen ni watari myakumyaku to tsuzuku monozukuri DNA wo uketsugi*]
[32] Yanmar, n.d.
[33] Mitsubishi, n.d.
[34] Sumida Local Brand Strategy n.d., 3.

The Origins of Japan's *Monozukuri* and Robot Culture

The history of robots and their lineage in Japan begins with the Tokugawa period *karakuri ningyō* (mechanical dolls) and *karakuri* (mechanical devices), when *karakuri*-makers applied Dutch clockwork technology. The first mechanical clock built by the Chinese Tantric Buddhist monk-mathematician I-Hsing reached Japan in the seventh century. However, after the Jesuits introduced clockwork technology in 1549 and presented the first European clock to the Japanese emperor in 1551, the clockwork technology enabled the spread of automated devices for practical use and entertainment.

Urban Tokugawa Japan was an eclectic dynamic environment where boundaries between high and popular culture, technological entertainment, and mechanics of scientific instruments disintegrated amid the rise of the merchant class and consumerism. The Dutch trading outpost (VOC) on Dejima Island outside Nagasaki had a considerable impact on Japan's technology at the time. The most famous of *karakuri* devices were *karakuri ningyō*, clockwork humanoid dolls. Of the three main types, *zashiki karakuri* (tatami room dolls) were small clockwork robots for play and entertainment. C*hahakobi ningyō* (tea-carrying dolls, see Figure 1) and *yumihiki-doji* (archer dolls) were the most representative of this genre. *Butai* or *shibai karakuri* (theatre dolls) were used in theatre while *dashi karakuri* (festival float dolls) carried on wooden floats during religious festivals, were used as vessels for deities (*kami*). The four most popular *karakuri* masters were Takeda Ōmi (?-1726), Hosokawa (Hanzō) Yorinao (?-1796), Tanaka Hisashige (1799-1881), and Ōno Benkichi (1801-1870). Takeda Ōmi popularized *karakuri* culture by staging the first *karakuri* show in 1662 in Osaka, where he established the first *karakuri* theatre to give regular performances. Tanaka Hisashige started a firm that would later become Toshiba. Hosokawa Yorinao authored *Karakuri zui* (*Illustrated Compendium of Clever Machines*, 1796), which is still used by contemporary *karakuri*-makers as a guide for making clockwork dolls and clocks [*wadokei*].

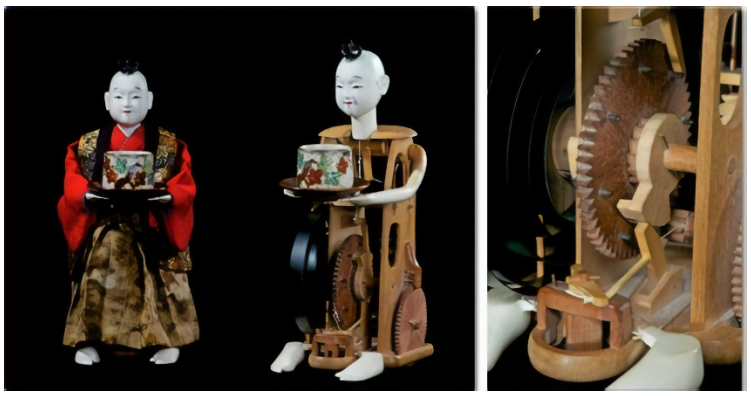

Figure 1. *Chahakobi ningyō*/Tea serving doll.
Photo by Ryoichi Oikawa
With permission of the Ninth Generation Tamaya Shobei Appreciation Society

After Japan was opened to the outside world in 1853, the socio-technical landscape was transformed by the processes of West-centric modernization and industrialization. The contemporary historiography of *monozukuri* draws its genealogy directly from the Tokugawa-period craft and *karakuri*-making as the last historical era of authentic "Japaneseness" and a starting period for the generationally-transmitted tradition of *karakuri*-making. As *karakuri* products were inspired by Dutch-imported European clockwork mechanisms, this only demonstrated indigenous talent for cross-cultural

technological innovation – the key ingredient of the contemporary industrial vision and the *monozukuri* DNA discourse. Another characteristic of *nihonjinron* that informs the history of robot making is that Japan is defined predominantly in relation or opposition to the "West." The mechanisms that animated *karakuri ningyō* are therefore vital to "the development of the principles of modern mechanical engineering," demonstrating that Tokugawa Japan was technologically advanced despite "often been portrayed as a technological backwater in comparison to its western European analogues."[35] Furthermore:

This wooden robot culture dating from the Edo period probably had an impact on the present-day automotive and industrial robotics industries in Nagoya, whose products are consistently some of the best-selling of their kind. The same mechanical skill applied to wood to create these dolls in the Edo period was applied to iron starting in the Meiji period, giving Nagoya artisans a certain authority which helped them play a large part in the industrialization of Japan.[36]

As boundary objects – objects whose knowledge and practice are simultaneously constituted across multiple disciplines, epistemologies and cultural spaces, contemporary robots are positioned in the national robot history as descendants of *karakuri ningyō* and part of the manufacturing ecosystem through their "birth" companies, artisanship lineage, and links with popular culture.[37] Honda's ASIMO, for instance, continuously references *karakuri ningyō*,[38] Similarly, Capek's play *R.U.R.*, which introduced the word "robot" in the 1920s, and the popular manga and anime character Atom Boy (1960s) link robot benchmarks over nearly 400 years. Hirose Masato, the lead engineer for ASIMO, has said that he was told to make Atom.[39] Such cultural positioning of robots opens them up to an array of cultural inscription possibilities as discussed in the case studies on the therapeutic robot seal Paro by Jennifer Robertson,[40] Cosima Wagner,[41] and Selma Sabanovic.[42]

DNA of Tanaka's Passion!

In 2005, Toshiba staged an exhibition on the history of their products titled *Mannendokei kara hajimatta jōnetsu no DNA odoroki! 130-nen monozukuri monogatari* ["The DNA of passion that began with the ten-thousand-year-clock.[43] A surprising 130-year story of *monozukuri*"].[44] Staged in the National Science Museum, this exhibition showcased

[35] Ninth Generation Tamaya Shobei Appreciation Society n.d.
[36] Suzuki Reiji (1994) qtd in Ninth Generation Tamaya Shobei Appreciation Society n.d.
[37] "It is not too much to say that these Edo Karakuri masters have built the foundation of what became the technology giant that is the Japan today." (Suematsu n.d.).
[38] See, for instance Karakuri Tamaya that features references to contemporary robots and newspapers articles on ASIMO as an introduction to *karakuri ningyō*: http://karakuri-tamaya.jp/en/robot.html (accessed May 1, 2017).
[39] In the original: 時期外れの中途入社で、たった１人で研修を受けていた私が、１番最初に言われたのが『アトムを作れ！』だった。["Jikihazure no chūto nyūsha de, tatta hitori de kenshū wo uketeita watashi ga, ichiban saisho ni iwareta no ga "Atomu wo tsukure!" datta.]. (Since I entered the industry, my training was all about only one thing; the first thing they told me was "Make Atom!"). IT Media 2002. My translation.
[40] Robertson 2007.
[41] Wagner 2010.
[42] Sabanovic 2014.
[43] The exhibits are now part of permanent exhibition at the Toshiba Science Museum in Kawasaki.
[44] In the original: 万年時計からはじまった情熱のＤＮＡ 驚き ！１３０ 年モノづくり物語. *Toshiba 130th Anniversary Event [The DNA of passion that began with the Ten-thousand-years-clock. A surprising 130-year story of monozukuri] held at the National Science Museum* (Toshiba 2005). My translation.

Toshiba's mechanical engineering achievements including the aforementioned archer doll and a replica of the 1851 ten-thousand-year-clock, also known as the eternal clock [*Mannendokei*]. Both were originally manufactured by Tanaka Hisashige, a Tokugawa-period *karakuri* maker and entrepreneur who opened a shop in 1852 in Kyoto and named it the "Hall of Automata." Importantly, he was later employed by the Saga domain to assist with technological modernization. Tanaka built Japan's first steam locomotive and his combined talent for mechanics and business transformed his firm into Tanaka Engineering Works, the forerunner of today's Toshiba Corporation.
In Toshiba's imaginary, Tanaka represents the link between Tokugawa clockwork devices and modern technology. At the exhibition, visitors could follow a genealogy representing linear technological progress from the Tokugawa period to 2005, embodied in products that symbolize historical technological achievements. These included clockwork dolls, light bulbs, rice cookers, washing machines, television sets, and personal computers (Figure 3). Compiled together, these objects provided a compressed narrative of Toshiba's techno-scientific history as well as the national history of *monozukuri* DNA.

Figure 2: Displays in Toshiba's *130-year Monozukuri DNA* exhibition: *Yumihiki doji* Archer Doll (replica), *Manendokei* (original), early incandescent light bulbs, the first automated rice cooker in Japan (1955), an electric washing machine (1930), and the world's first laptop (1985). Permission by Toshiba Science Museum.

Situated within the same artisanship ecosystem, clockwork dolls and consumer electronics demonstrated the coexistence of continuity and change in the supposedly homogenous structure of the pluralistic manufacturing landscape. The assemblage of these particular objects as boundary objects in an institutionally authoritative space co-produced a privileged socio-technical narrative, legitimized by the historicity of the objects and their public exhibition. The aim was to both generate a history of Toshiba and align this history with the official historical narrative. In other words, it provided a material representation of the national *monozukuri* DNA history, completing the circuit of translating a cultural product into a discursive form and then into social practices.[45] The encoded messages in

[45] Hall 1980, 117.

this process revolved around the understanding that robots did not emerge "elsewhere" but "here" – in a familiar, technologically advanced Japan.

Nationalizing the Robot Body

From its historicized clockwork beginnings, the robot body has been encoded with meanings for interrogating and (re)constructing the collective and individual self. Robot bodies have been carriers of information beyond their electronic and electrical circuits. They have often served as part of a semiotic system for political uses. Robots in Japan thus carry considerable historical baggage, often ambivalent and violent, that has been purified through a contemporary idealization of robots.

The national showcase of technology started in the 1870s, when textile factories in Japan became filled with machines and a series of National Industrial Expositions introduced modern machines. The Meiji period (1868-1912) was an era of industrial machines, mass transportation, and mass communications based on machines of dominance[46] presented to the government by Commodore Perry of the United States in 1854. Among these gifts were the telegraph, trains, and steam technology. From the 1870s to the 1920s, the government drafted *karakuri* masters like Tanaka Hisashige for the project of building the electrical appliances industry. In the 1920s, the government promoted mass consumption among the rising urban middle class, modelled after a romanticized vision of affluent American middle-class families.

During the following Taishō era (1912-1926), Karel Capek's (1890-1938) 1920 play "R.U.R." ("Rossum's Universal Robots") inspired a robot boom in fiction and widespread interest in robots after its first staging in Tokyo's Tsukiji Shōgekijō [Tsukiji Little Theatre] in July 1924. The play's title was translated as *Jinzō ningen*, "Artificial Human," which remained the term for humanoid robots until the postwar period. Capek's influence in Japan was revived in 2003 when Honda's bipedal humanoid robot ASIMO payed tribute to Capek by leaving a bouquet of flowers – yellow and white chrysanthemums, the symbol of the Japanese imperial family -- at his bronze bust in Prague's National Museum.

Robots also became a tool for exploration into technological and military power. Unno Jūza (Jūzō) (1897-1949), one of the founders of science fiction in Japan, was a prolific author on robots.[47] After he was conscripted to produce war propaganda, Unno wrote about Japanese robots fighting the Chinese, although his work was mostly replete with metaphors that critiqued the political situation. In the first half of the twentieth century, robots had a fluid national role as either concealed Soviet Union and Chinese agents or protagonists fighting for the Japanese military.[48] These examples illustrate how Japan's current national robot strategy is not a novel case. Toshiba's exhibition explicitly denoted which historical moments "matter" for the national robot history, but the national(istic) discourses can be more implicit and difficult to decode. Therefore, I look next at the first modern Japanese humanoid automaton Gakutensoku at the Shōwa emperor coronation ceremony.

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[46] Adas 2014, 1-16.

[47] Unna authored numerous works, among which many that thematised artificial human or robot. Examples include *Jinzō Ningen Efu-shi* [Robot Mr. F] (1939), *Jinzō Ningen Jiken* [The Robot Incident] (1936), *Jinzo ningen satsugai jiken* [Robot Murder Case] (1931), *Jinzo ningen no himitsu* [Secret of the Robot] (1940), and *Jinzo ningen hakase* [The Robot Scientist] (1939).

[48] A more detailed overview of the twentieth-century science fiction robot history unfortunately exceeds the scope of this paper. Authors who contributed to the trend include a eugenics proponent Nagai Hisomu (1876-1957), Yumeno Kyūsaku (1889-1936), Shisui Matsuyama (n.d.) and Kunieda Shiro (1887-1943). For more on the topic see Itō 2010.

Robot as Peace-making Technology

While the majority of Japan's twentieth century robots were fictional, one real-life automaton received domestic and global attention. Gakutensoku ["learning from the laws of nature"], built in 1928 by the biologist Nishimura Makoto (1883-1956), was the first modern humanoid automaton in Japan. Conceived as part of the natural world and a universal being representing peace and tolerance, Gakutensoku was a stark contrast with robots in the popular war propaganda.

Figure 3: Picture of Gakutensoku (學天則). Its arms and legs moved and it could change its facial expression automatically.
By Osaka Mainichi Shimbun [Public domain], via Wikimedia Commons

The three-meter tall Gakutensoku was first presented at the formal celebration of the emperor Hirohito's coronation ceremony on November 10, 1928. The coronation ceremony was staged as a national exposition for showcasing novel technologies to the public. Despite the country's militarization, the ceremony was replete with the rhetoric of "world peace" and this was the performative frame within which Gakutensoku was placed. The way that Gakutensoku was presented in the public space is relevant because it shares some similarity with the contemporary demonstrations of robots in Shintō shrines, department stores, national museums, and other culturally and nationally symbolic sites.

The imperial coronation resembled a national expo with pavilions showcasing Japan's industrial riches. Costly preparations included equipment for "railways, illumination, telegraphs, telephones, telephoto and radio."[49] Gakutensoku's public performance alongside other modern technological artifacts generated a material-ideological assemblage similar to Toshiba's *130-year* exhibition. The enthronement ceremonies, symbolically and materially important, were aimed at "large-scale public participation."[50] What made this mega-event unique was the state's reliance on mass media and modern technology to disseminate a national ideology and frame the opportunities and possibilities of the nation-state's new technological agenda. The coronation ceremony was replete with symbolic artifacts and therefore served as the collective making of the Japanese national identity with "a very broad definition of "Japaneseness:"'

[49] TIME 1928.
[50] Wilson 2011, 290.

In the media and the ceremonies, the nation that was discursively presented to the Japanese people, to other Asians, and to those from beyond the region was unified, modern yet traditional, emperor-centered, cultured, internationalist, imperial, technologically advanced, and incorporated men and women in different ways.[51]

The contemporary framing of Japan's Robot Revolution echoes this and other previous attempts to construct a unitary identity through innovative technology in culturally significant places. It also reveals a complex interplay between "modern" and "traditional" through an array of hybridized consumer products legitimized by their "Japaneseness." The case of Gakutensoku illustrates the complexity and heterogeneity of materials and mechanisms to constitute and diffuse messages to domestic and international audiences.

Achieving a Collectively Shared Dream

Tezuka Osamu's (1928-1989) robot character "Atom Boy" first appeared in manga "*Tetsuwan Atomu*" [Atom Boy, Astro Boy or Mighty Atom] in 1959, followed by an anime TV series (1963-1966). Tezuka provided a positive image of a mechanical boy who wished to improve the world with his vast scientific knowledge and operational superiority.[52] Envisioning robots as a tool to improve human life was Tezuka's response to the atomic bomb, indicated by Atom's nuclear heart. The current generation of Japanese engineers and roboticists grew up surrounded by the Atom imagery in an atmosphere of economic and consumption growth.[53]

With the spread of television across Japan (coinciding with the 1964 Tokyo Olympics), Atom became an instant success and icon of Japan's techno-scientific progress.[54] Atom's appearance correlated with postwar optimism fueled by an industrial shift from military to consumer technologies for everyday use.

From the 1960s, consumer technologies abounded in people's homes. The leading consumer electronics, home appliances and car manufacturing companies that became powerful actors in the Japan Inc. system and make robots had been established before the war and restructured after it, including Mitsubishi (1870), Toshiba (1875), Nissan (1933), Fujitsu (1935), and Toyota (1937). The postwar economy was characterized by the close cooperation between the government and private companies, underscored by protectionist policies and MITI (Ministry of International Trade and Industry)-centralized governance, which systematically generated initiatives, agendas, and recommendations for private producers. In this environment industrial manufacturing was intertwined with the making of a national identity.

Many roboticists in Japan refer to Atom as their source of inspiration not only because they grew up with him but also because the 1960s were the closing years of traditional robot bodies with wires and circuits. This has contributed to a perception of contemporary humanoid robots as descendants of Atom Boy. In the post-Atom imaginary,

[51] Ibid., 306.
[52] For more on the topic see Schodt 2007.
[53] Industrial robot designer of Mitsubishi, Norio Kodaira, for instance, said: "I am very happy about being in the robot business. I've wanted to be in the robot business since I was a high-school boy. My dream was to make Tetsuwan Atomu." (Qtd. in Menzel and D'Aluisio), 2011, 196.
[54] For more on this topic, see for instance Schodt 1988; Hirose 2002; Itō 2010; Hornyak 2006; Wagner 2011; Wagner 2013.

the fictional robot paradigm has shifted to technologically enhanced humans. There are many ways in which Atom Boy was deployed and used by contemporary manufacturers to enculture and market their robots in a socially acceptable form. Mitsubishi used Atom imagery in promotional materials for their personal service robot Wakamaru in 2005, while Toyota's 2013 companion robot Kirobo Mini was modelled after Atom. Sony introduced their companion robot QRIO in an episode of a 2003 "Tetsuwan Atomu" anime titled "The Robot that Admires Humans." In 2003, Honda promoted ASIMO rentals on Atom's birthday (April 7).[55] These examples illustrate how collectively shared images, fantasies, and ideas about robots and "Japaneseness" have enabled the creation of a national robot culture and made robots more culturally acceptable.

Constituting Robot Cultures

The process of unbundling connections between Tokugawa clockwork dolls, popular robot imaginary, manufacturing industry, *nihonjinron*, and official robot politics shows that robots are not only bound by the processes of human interaction and construction of the self and society, but are integral to it. Amid the enduring economic crisis, the lagging-behind industry, and a declining and aging population, Japan is redefining its social relationship with machines. The new trajectory, exemplified by the *monozukuri* DNA discourse, unsettles the boundary between old and new, "here" and "elsewhere," local and global in an attempt to redefine Japanese culture as homogenous, linear, and continuous.

In METI's recent *nihonjinron*-genre manifesto "Roots of Japan," for instance, the old *nihonjinron* ideas[56] about Japanese cultural essence are quietly renovated. In line with the ongoing techno-nationalistic agenda, the booklet links Japan's contemporary technological richness with unique Japanese characteristics, such as love for nature and aesthetics, exemplified in traditional crafts and performing arts.[57] For example, *ogi* (traditional fans), *shinkansen* (bullet trains), and steam-engine locomotives are presented as a shared lineage, while Japanese rice culture, which is at the core of *nihonjinron*, is linked with automobiles, whisky, Euro-American fashion, and electronic goods. The tea ceremony, ceramics, *rakugo* comic storytelling, Mount Fuji, and the sound of heavy snowfall share the same ontology as Lexus, pachinko, ASIMO, and Nintendo.[58] The booklet emphasizes the multiplicity of Japan, intertwining its past and present, to point to the linkages between technology and society that have shaped the sociocultural matrix of Japan through a single genealogy. The key to understanding these phenomena is the Japanese relationship with the natural world, addressed through Japanese conceptualizations of bodily and spiritual existence displayed in artisanship and manufacturing. The underlining philosophy reveals the *nihonjinron* outlook about the unchanging ontology of Japanese cultural essence which subsumes foreign and technological influences. So Honda's robot ASIMO is featured in the booklet not only because it is a technological achievement of global significance but also because ASIMO represents the cultural roots of Japan.

As I have demonstrated, there are many places where robots and the discourse of traditional, uniquely Japanese, thing-making culture intermingle. The examples mentioned here are not exhaustive, but they show the making of a social genealogy of robots by the corporate and government sectors. Placing robots within the *monozukuri* paradigm is one

[55] Ndanialis 2006, 41-64.
[56] For instance, a paragraph on the difference between the Japanese and the Western brain inspired by Tadanobu Tsunoda's *The Japanese Brain* (1985).
[57] A similar neo-traditionalism in the spheres of gender and family has been discussed by Robertson 2014.
[58] METI 2011.

strategy to make them intelligible as part of national culture. There are other ways to make robots socially intelligible and acceptable, such as granting them citizenship and residency – something that only living beings are entitled to – or passing them through social rituals – something that only members of a society do. This can be seen in the case of Paro, another Japanese robot. Paro's creator Dr Shibata Takanori, described his robot as a "continuation of the local traditions of artisanship and appreciation for quality of his hometown, Nanto City."[59] In addition to being defined by the artisanship lineage, Paro was presented with a birth certificate which listed Shibata as its father by the local government in 2010.[60] By presenting Paro with this certificate in a symbolic ceremony, political authorities recognized the robot's social and symbolic civic role, making Paro a naturalized Japanese citizen and a member of society.[61] Listing Paro's birth origins was significant because it ascertained its Japanese genealogy by credentialing Paro's "Japaneseness" and both family and national lineage. Although DNA was not mentioned during the ceremony, for Paro to have a "father" and citizenship, and the fact that a birth certificate only can be obtained by proving Japanese genealogy, it is clear that this was an act of symbolic pseudo-biological enculturation that asserted Paro's family and national lineage. Noting that Atom (in 2003) and another anime and manga robot character, Doraemon (in 2013) were granted special residency permits, Jennifer Robertson explained that Prime Minister Shinzō Abe's 2007 *Innovation 25* program to reinvigorate the economy through innovation is "the convergence of advanced technology—like robotics—with nostalgic re-creations and ethno-nationalist policies."[62] The ways that robots are positioned in society shows an inclination to create a sociocultural space, framed by familiar products and imaginary, for social acceptability and enculturation of new robot technologies. This is not merely a legitimization strategy; it allows innovation without threatening the Japanese spirit.

Another example of robot enculturation is the Kyomori robot's performative visit to the Munakata Taisha Shintō shrine in Fukuoka prefecture in December 2005. Even before this symbolic visit, Kiyomori was layered with historical and cultural references, namely through its warrior armor from the Heian period (794-1185) and its name, inspired by the Heian period war general Taira no Kiyomori (1118-1181). [63] At the shrine, Kiyomori was received by *miko* shrine priestesses and a performance of the Shintō rituals, part of praying for the prosperity and the safety of the robot. Whereas it was common to welcome industrial robots in factories with Shintō rituals for purification and blessing, and the Japanese continue to bring their cars and computers to shrines for this purpose, Kiyomori's presence signaled a different form of presence – the sociocultural belonging with a historical lineage.

On another occasion, Kiyomori was used to enculture a new personal robot in Tokyo's Takashimaya department store in June, 2006. Takashimaya first opened at the end of the Tokugawa period and was among the first stores in Japan to install air conditioners across all its floors in 1933. Symbolizing affluence and socio-technical modernity, Takashimaya is a designated "important cultural property."[64] To introduce a Heian "general" robot in Tokugawa-period Takashimaya, surrounded with two other Heian human "warriors" there to help the robot navigate smoothly, created a historical topos to promote new robot technology – "Roborior." On a stage behind Kiyomori were two *dashi*

[59] Sabanovic 2014, 10.
[60] Robertson 2014 and 2018.
[61] Ibid.
[62] Robertson 2014, 592.
[63] van Gennep 2004; Turner 1997.
[64] Ninth Generation Tamaya Shobei Appreciation Society, n.d.

ningyō, dolls on wooden floats carried during Shintō festivals. These two particular dolls were Chikubushima Ryūjin and Tamanoi Ryūjin, which have been carried in Sakura city's Makata Shrine Festival since the Tokugawa period.[65] The purpose of Kiyomori's performance was to introduce a guard robot, Roborior. Unlike Kiyomori, Roborior is a watermelon-like white robot, without a visible past, identity, or sociocultural belonging. Robots like Kiyomori that act as semiotic signs that open access to society through a "socially accepted imaginary space"[66] within which they assume familiar patterns of behavior and appearance and are hence more easily accepted. In this particular case, it was not Kiyomori but Roborior that went through a rite of passage, with the help of a familiar presence from the distant past.

Conclusion

As boundary objects and semiotic signs robots open up questions about the unique ways of cultural embodiment and social embeddedness of social machines and humans. These processes are specific to particular contexts and are also, very often, related to state visions and government agendas. Humanoid and non-humanoid, robots are constantly being shaped into semiotic systems, within which they impact society. Robots should be studied as cultural objects within particular and global contexts. Robots are highly discursive and inscriptive; they are both object and idea imbued with meanings and cultural values. But they are also material products, and their existence contains economic, political, technological, and sociocultural structures. A historical and anthropological perspective thus informs our understanding of the ongoing processes and relations that constitute robot cultures.

From a science and technology studies perspective, robots, particularly humanoid and human-like robots, re-assert the non-boundary co-existence of society and technology. Case studies cited in this paper show this enmeshed co-existence, and also that robots are hyper "social objects."[67] This is demonstrated in the DNA discourse, which supports a consensus that there exists a national lineage in Japanese machines because they are made by the Japanese people. The many layers of lineage created across different areas, from artisanship and *monozukuri* to family and the nation-state represented by DNA, can also be explored as a boundary object and the continuation of *nihonjinron* which finds its penultimate expression in *monozukuri*. The discourse of *monozukuri* is thus not merely about the production process but about philosophies that make the production process happen and adjust to the new social and manufacturing challenges and needs. However, while responding to new needs and challenges, *monozukuri* tends to preserve and restore traditional ideas about social relations. Rather than being expanded to include new ideas, *monozukuri* and *nihonjinron* are expanded to include new (material) objects.

Robot cultures, Japanese culture, and cultural practices and social relations are far more diverse and complex than presented in this paper: rather than capturing all these, my aim has been to discuss the making of a single, dominant, robot culture and the making of a social genealogy of robots. Both are important for Japanese society because they emphasize the cultural embeddedness of robotic objects, often perceived as neutral dead matter, and the regimes of power that animate these inanimate machines. Another reason why this matters is because robots are in the process of becoming a normative part of society, not as objects but as actors – and not only because they are acted through but also

[65] Sakura City 2014.
[66] Sone 2017, 21.
[67] Latour 2005.

because they act upon. A national robot history and national robot culture, like any national culture and history, is a dominant narrative that often erases and renders invisible cultures, voices, views, and relations that fall outside it, legitimizing a linear positivistic process that strives to homogenize all forms of existence. There is, however, nothing deterministic about a history of robots. Hopefully, other researchers will tackle these nuances and explore different actors that participate in the making of robot cultures and histories.

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