Recreating Japanese Men

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University of California Press
BERKELEY LOS ANGELES LONDON

13 Gendering Robots

Posthuman Traditionalism in Japan

Jennifer Robertson

> Even Triumph Japan, the maker of intimate apparel, has joined in [the celebration of Astro Boy's fifty-second birthday on 7 April 2003]. As part of its program of one-off theme items, it has produced the Astro Boy bra, with the cups in the shape of Astro Boy's head. For what it is worth, he faces away from the wearer, and unfortunately, his facial features have been omitted. This may have been the moment Astro Boy became Astro Man, but we will never know.
>
> SHANE GREEN, "Astroboy Still on the Go"

> The construction of gender is both the product and the process of its representation.
>
> TERESA DE LAURETIS, *Technologies of Gender*

> We need to recognize that robot design is not simply the design of an object but the design of a whole range of dynamics.
>
> MATSUI TATSUYA

Many Japanese roboticists, almost all of whom are male, have either a picture or a figurine of Tetsuwan Atomu ("Mighty Atom," better known to English speakers as Astro Boy) in their laboratory, and most acknowledge the boy robot as a childhood inspiration, as the reason for their interest in building sociable robots. Atomu (figure 13.1) played a key role in fostering among postwar Japanese an image of robots as cute, friendly, and humanlike, characteristics that currently inform the thriving humanoid robotics industry. In this chapter, I will analyze the gendering of "real" humanoid robots designed to coexist and interact with human beings in the home and workplace. Among the questions informing my analysis are how do robots embody notions of the relationship in humans between sex, gender, and sexuality, and how do (the mostly male) roboticists design and attribute the female or male gender of humanoid robots? As I will

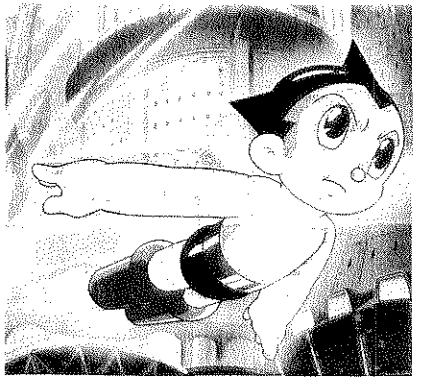

Figure 13.1. Tetsuwan Atomu (Astro Boy). Available at http://connect.in.com/serie-rubi/photos-1-1-1-b4f674a411e7df7cbe0d399191253d21.html.

show, the gendering of humanoid robots draws from domains of gendering practices contingent upon shape, color, function, and sociolinguistic convention. Most of the humanoids developed over the past two decades are gendered, if sometimes ambiguously, and the recent trend is toward distinctly feminine/female and masculine/male robots.

Atomu's origin story is in part a case study, albeit a fictional one, of gender fluidity. Created in 1951 by the physician-cum-cartoonist Osamu Tezuka (1928–89), Atomu is Japan's most famous robot. A nostalgia-fueled revival of things Astro Boy peaked in 2003 when a new television anime series was broadcast to mark both the fortieth anniversary of the first series and Atomu's birthday. The story of Atomu, described by Tezuka as a "reverse Pinocchio," begins in the Ministry of Science, which is headed by one Professor Tenma, who has been trying to create a robot capable of human emotions. His son Tobio suggests that he build a boy robot. Ironically, Tenma's obsession with his quest keeps him from giving Tobio fatherly love. The son runs away from home and is killed in an automobile accident, whereupon the grieving professor creates a boy robot in Tobio's likeness.

In actuality, Tezuka's prototype for Atomu was the "girl robot" in his own comic "Metropolis" ("Daitokai"), which is not to be confused with Fritz Lang's film *Metropolis*, a movie that also featured a gynomorphous robot.[1] The girl robot in Tezuka's "Doctor Mars" ("Kasei Hakase") was also a precursor to Atomu. In other words, in a reversal to the epigraph, the "Astro Boy bra" might be understood figuratively as acknowledging and confirming Atomu's originary femininity and not his emergent manhood. An enthusiastic fan of the all-female Takarazuka Revue, in which females assume men's roles, Tezuka also created a number of tomboy characters in

his comics, such as Sapphire, the protagonist in "Princess Knight" ("Ribon no Kishi"), who alternates genders, living as both a prince and a princess.[2]

I should note at the outset that there are two key cultural factors that influence the generally positive view of robots in Japan. First and foremost is Shinto, the native animistic beliefs about life and death. Unlike the three major monotheisms that have never had a home in Japan, Shinto lacks complex metaphysical and theological theories and is primarily concerned with notions of purity and pollution. Shinto holds that vital energies or forces called *kami* are present in all aspects of the world and universe. Some *kami* are cosmic and others infuse trees, streams, rocks, insects, animals, and humans, as well as human creations such as dolls, cars, and robots.[3]

The second factor concerns the meanings of life and living; life and fertility are especially celebrated in Shinto. *Inochi* is the Japanese word for "life." It encompasses three basic, seemingly contradictory, but interarticulated meanings: it is a power that infuses sentient beings from generation to generation; a period between birth and death; and the most essential quality of something, whether a living being or a made object such as a car or a puppet.[4] Thus robots, humanoid and otherwise, are "living" things within the Shinto universe, and in that sense they are part of both the natural world and human society. And, as we shall see, it is as gendered members of a household or workplace that humanoid robots are being conceived and marketed.

GENDER AND CONTINGENCY

In humans, gender is both a concept and a performance embodied by females and males, a corporeal technology produced dialectically. The process of gendering robots makes especially clear that gender belongs both to the order of the material body and to the social and discursive or semiotic systems within which bodies are embedded.[5] Teresa de Lauretis's enduring insights into the "technology of gender" are especially relevant to the exploration of robot gender. To paraphrase her argument, the construction of gender goes on through the various technologies of gender (such as robotics) and institutional discourses (such as nationalism and pronatalism) with "power to control the field of social meaning" (value, prestige, kinship location, and status, for example) and thus "produce, promote, and 'implant' representations of gender." As she observes astutely, if gender representations are "social positions which carry differential meanings," then for someone or something—such as a humanoid robot—to be represented as female or male "implies the assumption of the whole of those meaning effects."[6] However, the assumption of those "meaning effects" is not necessarily conceived as part of a bigger picture. My aim in this chapter is to make visible that bigger picture and to show how its constituent components effectively, if not necessarily intentionally, reproduce a sexist division of gendered labor among humans and humanoids alike.

Much of what roboticists take for granted in their own gendered socialization and quotidian lives is reproduced and reified in the robots they design. In short, gender for them constitutes commonsense knowledge, or a cognitive style through which they experience the social world as a factual object. The practice of attributing gender to robots is not only a manifestation of roboticists' commonsense knowledge, or habitus, but it is also an application of this knowledge to create and sustain, or to leave self-evident, the facticity of their social world.[7]

Gender attribution is a process of reality construction. In my investigation of the criteria by which roboticists assign gender, it became clear that their naïve and unreflexive assumptions about humans' differences informed how they imagined both the bodies and the social performances of their creations. Unlike human infants, robots lack "naturally occurring" genitals, which therefore play no role in their initial gender assignment.[8] However, as explained by Suzanne Kessler and Wendy McKenna, in the absence of visible physical genitalia—which is usually the case among humans, who are usually clothed in public settings—"cultural genitals" are invoked in attributing gender: "The relationship between cultural genitals and gender attribution is reflexive. The reality of a gender is 'proved' by the genital, which is attributed, and, at the same time, the attributed genital only has meaning through the socially shared construction of the gender attribution process."[9]

Euro-American feminists were instrumental in establishing the now accepted view that bodies are not simply given or neutral. There are at least two kinds of bodies: the male and the female. That said, male and female bodies themselves are distinguished by a great deal of biological variability, from phenotype to physiology. Corporeal variability is also expressed in the form of intersexed bodies with genitals and reproductive organs neither clearly male nor clearly female. Suzanne Kessler details how this natural "variability"—a word she uses deliberately instead of the medical referent "ambiguity"—both confounds and underscores the dominance of sociocultural constructions (and medical reconstructions) of the sex/gender dichotomy.[10]

Gender is not simply a feature or characteristic of a given female body

or a given male body. Examining the processes whereby Japanese roboticists assign gender to humanoids necessarily involves looking closely at the sociohistorical particularities of the sex-gender system in Japan. In Japan past and present, for example, femininity and masculinity have been enacted or lived by *both* female *and* male bodies as epitomized by the four-hundred-year-old all-male Kabuki theater and the all-female Takarazuka Revue, founded in 1913. Nevertheless, both theaters continue to reproduce not alternative but dominant stereotypes of femininity and masculinity. Moreover, there is a qualitative, socially reinforced—and socially sanctioned—difference between the kind of femininity performed and lived by male bodies and the kind of masculinity performed and lived by female bodies, whether on or off stage.[11] In short, the kind of body matters in the meaning and function of gender that emerges in practice. The point to remember here is that the relationship between human bodies and genders is *contingent*.[12] Whereas human female and male bodies are distinguished by a great deal of variability, humanoid robot bodies are effectively used as platforms for reducing the relationship between bodies and genders from a contingent relationship to a fixed and *necessary* one.

Roboticists may perceive female and male bodies as "specific forms of livability in the world," but they do not interrogate them as feminists especially have done.[13] Rather, they tend to uncritically reproduce and reinforce dominant stereotypes (or archetypes) attached to female and male bodies. I came to realize, over the course of my fieldwork, that in their theorizing about human-robot relations, roboticists in general treat humans and robots as if they were gender-neutral categories, despite all evidence to the contrary. Like the average person, robot designers and engineers take for granted their habitual, everyday behavior, which is resistant to change and thus reproduced in the stereotypic forms they give, and the activities they assign, to their humanoid creations.

ROBOTS AND INNOVATION

Up until now, I have referred to (humanoid) robots as self-evident things. But what exactly is a robot? Coined by his artist brother Josef from *robota*, or "forced labor," the term was first used by Czech playwright Karel Čapek in his play *R.U.R., Rossum's Universal Robots. R.U.R.*, which premiered in Prague in 1921, was about a factory in the near future where synthetic humans, or robots, were mass-produced as tireless laborers for export all over the world. Performed in Tokyo in 1924 under the title *Artificial Human* (Jinzō ningen), it sparked a "robot boom" in Japanese popular culture that has continued to this day, from Atomu to the androids and cyborgs that dominate anime (animated films).

In practical usage, a robot is a device that performs its tasks either under direct human control, under partial control with human supervision, or completely autonomously.[14] A robot is an aggregation of different technologies—sensors, software, telecommunications tools, motors, and batteries—that make it capable of interacting with its environment. Industrial robots look like pieces of machinery, whereas to be called a humanoid, a robot must meet two criteria: it has to have a body that resembles a human (head, arms, torso, legs) and it must act like a human in environments designed for the capabilities of the human body, such as an office, hospital, or house. There are basically two categories of humanoid robots with respect to their gendered embodiment: those designed to "pass" as human and those whose overall shape bears some resemblance to human morphology.

The five-year Humanoid Robotics Project (HRP), launched in 1998 by the Japanese Ministry of Economy, Trade and Industry (METI), gave a consortium of twelve corporations and ten universities a mandate to develop first-generation intelligent humanoid robots able to use hand tools and work in human environments, including hospitals, offices, and households. This project established the groundwork for *Innovation 25*, the central government's manifesto or visionary blueprint for revitalizing Japanese society by 2025. First introduced online in February 2007 by former prime minister Abe Shinzō, and apparently supported by the current prime minister, *Innovation 25* promotes a "robotic lifestyle" epitomized by security and convenience. Robot technology is widely thought to be the industry that will "rescue" the Japanese economy from an ongoing recession. Robotics is also promoted as the means to secure the revival and stability of Japanese social institutions, such as the traditional extended family, by paving the way to "a life that will become so much more convenient, safe, and comfortable."[15] No other country as yet attributes to robotics such powerful agency and efficacy.

More than 75 percent of Japanese families live in nuclear households. How will robots and robotics revitalize the traditional extended family? One section in *Innovation 25* provides us with a clue. A detailed illustrated sketch of a day in the life of the "Inobe family," it introduces the typical Japanese extended household of the future, that is, fifteen years from now. Their fabricated last name is a shortened form of *inobēshon* (innova-

tion). The family consists of a heterosexual married couple, Naoyuki and Yumiko, their daughter Misaki and son Taiki, the husband's parents Ichiro and Masako, and Inobē-*kun*, a male-gendered robot. The newest member of the household, Inobē-*kun* is five years old and the size of an elementary school student. He is connected to the household's many electronic gadgets and the family's own and regional wireless networks, and he can "converse" to an "impressive extent" with family members.[16]

Following the introduction of the Inobe family, the fictional ethnography records each member's daily routine, beginning at 6:30 A.M., when the elderly couple arises, and ending at 11 P.M., when LED lights in the house dim and then turn off automatically.

> At 7:00, Yumiko, Naoki and Taiki arise. [The elderly couple is already up.] The extended family eats breakfast together in front of a 103-inch flat-screen display, which is actually a composite of many different screens, enabling each person to watch their preferred program wearing headphones. But this morning they are all watching Misaki in a broadcast from Beijing [where she is an exchange student], and they talk and laugh among themselves.

The kitchen-table-cum-home-entertainment-center around which the Inobes gather in the morning is described in the popular robotics literature as the contemporary equivalent of yesterday's *irori*, or hearth, around which a family would gather for meals and socializing.[17] Yumiko, in a pink apron, is busy preparing a meal, her normative gender role of "good wife, wise mother" *[ryōsai kenbo]* intact.

Yumiko has the closest relationship with Inobē-*kun*. This is not surprising, since household robots (regardless of their attributed gender) are imagined to serve as surrogate housewives, that is, as devices through which a human housewife distributes her personal agency,[18] a point clearly illustrated in *Innovation 25* by a cartoon of a multiarmed pink humanoid fembot simultaneously holding a basket of clothes to be ironed, doing laundry, rocking and bottle feeding an infant, and helping a young girl with her geometry homework. Implicit in *Innovation 25* is the notion that a married woman who is relieved by advances in Internet technology and robot labor of housekeeping, caretaking, and child-raising chores will be free not only to maintain a career, but also to have more children. This is an especially important development given the static birthrate and rapidly aging population. The use of the suffix *-kun* to indicate a male person, the boybot's use of familiar kinship terms, and references to his ability to think make clear that the Inobe's household robot is regarded as a living member of the corporate household.

> At 17:00 Yumiko finishes "teleworking" in her home office and has a conversation with Inobē-*kun*. She asks the robot: "Have you finished cleaning the house?" "Are there any messages?" "Have you started preparing the bath?" Inobē answers, "The whole house is clean except for mama's [Yumiko's] office. Grandpa will be home at around 18:00, and there was a message from Grandma saying that she would be home at 17:00 so she should be here any minute now. I'm thinking of preparing the bath at 18:00. Papa said he would be home at 19:00.[19]

Innovation 25 has provoked a number of criticisms on Japanese blogs. As one critic, a housewife and mother of two who manages a website on social issues, fumed: "There's absolutely no reality to the image of everyday life [in the proposal]. It reads like a twenty-year-old science fiction novel! Am I the only person who doesn't share [*Innovation 25*'s] view of an ideal future? If the Japanese have become spiritually and intellectually impoverished it's because they leave things up to machines in the name of convenience; they've lost the ability to gain knowledge from the natural environment."[20]

However much its vision of the future reads like blog-worthy if dated science fiction, *Innovation 25* is *the* platform on which the state has based the national budget. Twenty-six billion dollars have been earmarked for distribution over the next ten years to promote robot technology. METI set aside more than $17.5 million in its 2007 budget to support the development within eight years of intelligent robots that rely on their own decision-making skills in the workplace.[21]

EMBODIED INTELLIGENCE

What has distinguished Japanese robotics—although now robotics in almost all other countries has followed suit—is the concept of embodied intelligence or embodied cognition. Roboticists point out that intelligence cannot merely exist in the form of an abstract algorithm but requires physical instantiation, that is, a material body. "Embodiment" in this sense follows a phenomenological paradigm in recognizing that the body (whether human or robotic) is actively and continually in touch with its surroundings. Moreover, cognitive processes originate in an organism's sensorymotor experience. Dynamic interaction between a robot and its environment generates emergent autonomous behavior, as opposed to behavior initiated by some external control system. Advances in nanotechnology and artificial life (or alife), including self-evolving genetic algorithms,[22] have led to the development of new sensory, actuation, and locomotion

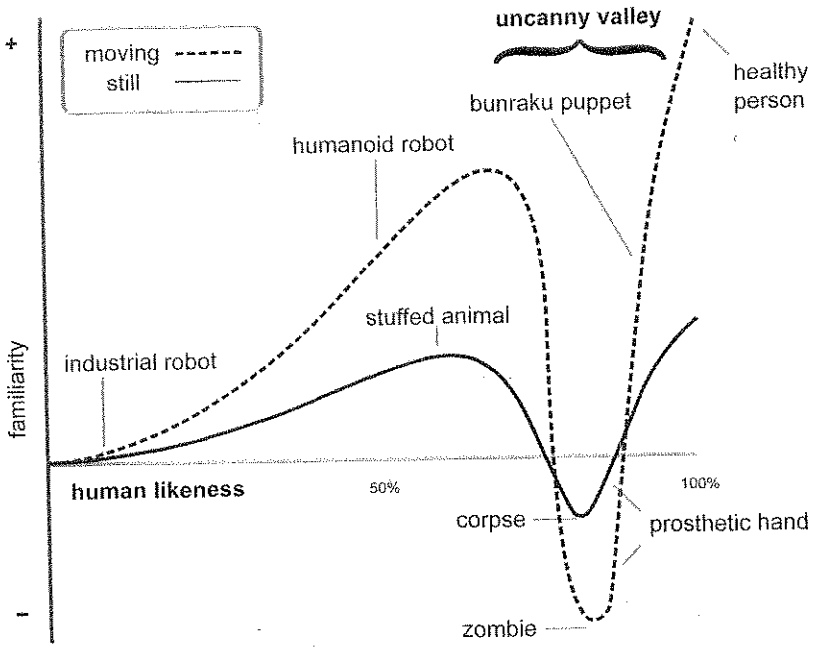

Figure 13.2. A diagram of Mori's theory of the uncanny valley. Available at http://en.wikipedia.org/wiki/Uncanny_valley.

components that enable the actualization of embodied (artificial) cognition. Also contributing to the refinement of the concept of embodied intelligence are new robot designs based on a deeper understanding of the role of form and material properties in shaping the physical, behavioral and overall performance characteristics and capacities of robots.[23] These new designs along with recent discoveries in neurophysiology have confirmed the relationship between the "motor system" and the "cognition system."[24]

Central to the emphasis in robotics on embodied intelligence has been qualitative research in the field of child development. Data from studies of infants are also used dialectically. In June 2007, the Japanese Science and Technology Agency unveiled the Child Robot with Biomimetic Body, or CB2, which will teach researchers about sensory-motor development in human children. CB2 moves like a human child between the ages of one and three years old, although it is disproportionately large and heavy at 1.2 meters tall and 33 kilograms. The humanoid has neither genitals nor an attributed gender identity—yet. Its 56 actuators take the place of muscles, and it has 197 sensors for touch, small cameras working as eyes, and an audio sensor. CB2 can also speak through a set of artificial vocal

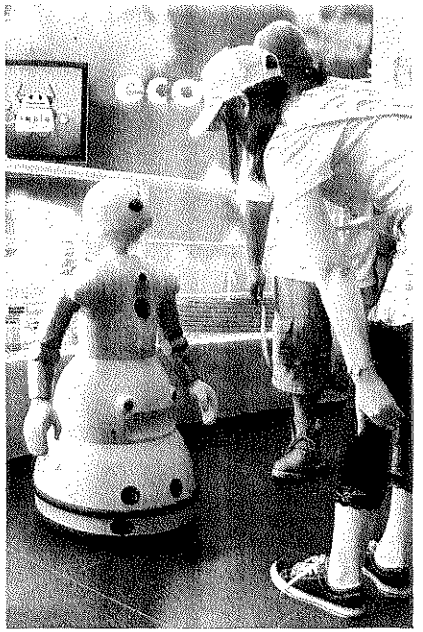

Figure 13.3. Wakamaru. Photograph by the author at TEPIA, Tokyo, August 2009.

chords. With this robot, researchers hope to "study human recognition development," such as language acquisition and communication skills. Left unaddressed is how gender identity is formed, inasmuch as the gender attribution process and the performance of gender roles alike are premised on language and communication. Roboticists involved with CB2 are keen on the eventual creation of a new intelligent "robo species."[25]

CB2 and other humanoids notwithstanding, there is considerable debate among roboticists about what embodiment entails: how humanlike—how femalelike or malelike—should or should not humanoid robots look? How should their bodies be proportioned? Should they be bipedal or move about on wheels? Germane here is Mori Masahiro's theory of the uncanny valley, or *bukimi no tani* (figure 13.2). A roboticist who focuses on humans' emotional response to nonhuman entities, Mori argues that a thing, such as a prosthetic hand, that looks real but lacks the feel and temperature of a living hand creates a sense of the uncanny or sudden unfamiliarity. Conversely, wheeled robots such as Wakamaru (figure 13.3), which resembles the human body in only a general way but speaks and gestures as humans do, generates a sense of familiarity. Mori thus recommends that engineers retain the metallic and synthetic properties of robots so as to avoid the creepiness factor and forestall any cognitive-emotional confusion among humans.[26] Incidentally, Wakamaru, created by Mitsubishi

Heavy Industries, was assigned male gender, although at first glance the banana-colored humanoid seems to be wearing a petticoat. This is actually a body shape that combines the look of samurai armor with that of the *hakama*, or pleated "skirt" worn over a man's kimono. Wakamaru is named after the immortalized twelfth-century samurai Minamoto Yoshitsune, whose childhood name was Ushiwaka.

Among the roboticists who have not followed Mori's advice are Hara Fumio and Ishiguro Hiroshi. They create "face robots" and androids that can "pass" as humans. Whereas Hara is working on facilitating emotional interactions between humans and humanoids (or "morpho-functional machines"), Ishiguro believes that android and gynoid twins offer an improvement on teleconferencing because they project the physical presence of particular humans and not just their video images and voices.[27] Ishiguro is among those who reason that the creation of "soft-bodied systems" will facilitate human-machine communication and interaction and will stimulate the development of new biocompatible materials, including artificial muscles, tendons, and tissues, as well as biosensors.[28] Whereas both Hara and Ishiguro are intent on creating female and male proxies, Cynthia Breazeal, an MIT roboticist, eschews anatomically realistic sociable robots. Kismet, Breazeal's first, somewhat cartoonish sociable robot, was purposively designed as a gender-neutral creature ("kismet" is Turkish for "fate").[29] In contrast, the majority of Japanese roboticists designing humanoids that will interact with humans in everyday living and working environments proceed with an idea of the gender of their creation in mind.

GENDERING HUMANOIDS

Because face robots are designed to pass as humans, roboticists either model them after specific females or males or resort to giving them standardized and stereotypically gendered features. Ishiguro's first adult gynoid, Actroid Repliee Q1, covered in skinlike silicone, was modeled after Fujii Ayako, a newscaster at NHK (Japan Broadcasting Corporation). She was debuted at the 2005 World Expo in Aichi prefecture. Sophisticated actuators made it possible for her to mimic Fujii's facial and upper body movements. Moreover, internal sensors enabled her to make subtle "natural" movements that simulated breathing, blinking, and shifting her weight from one side to the other.[30] Unlike bipedal humanoids such as Honda's Asimo (figure 13.4), she cannot walk.

Ishiguro created a second Actroid, which he also debuted at Expo 2005. Instead of appropriating the face of an actual model, Actroid Repliee Q2's

Figure 13.4. Honda's Asimo (Advance Step in Innovative Mobility) with author, Honda Laboratory, Wako City, February 2007. Photograph by Jack Yamaguchi.

face was a composite of that of the "average" Japanese female (figure 13.5). To create it, the faces of several young Japanese women were scanned and the images combined to derive a statistically average composite face. The result is a female face that is both anonymous and singularly *Japanese*. In short, for Ishiguro a face, as a constellation of features, is not just "a unique three-dimensional barcode" of a particular individual's gender identity, but also a topographical map of and for a national ethnic identity.[31]

Actroid Repliee Q2's Japaneseness was further underscored by her voice, which was "high-pitched" and "girlish."[32] Her male designers clearly correlated gender (femininity) *and* nationality (and/or ethnicity) with voice. Even if they were not intending to reify a pernicious stereotype, they nevertheless reinforced Japanese "men's language" and "women's language" as essentialized and essentializing performances. As feminist linguists argue compellingly, in reality, Japanese women's speech is a prescribed norm that *does not* reflect how most women actually speak. High voice pitch is a feminine ideal and a cultural constraint promoted in

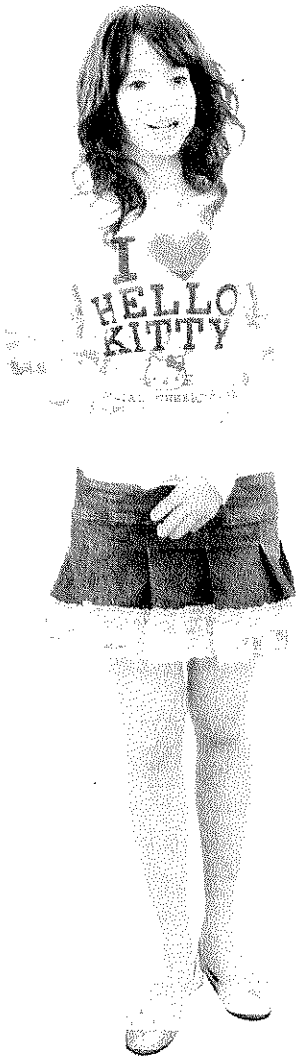

Figure 13.5. Actroid Repliee Q2, a composite of the "average" Japanese female. Image adapted from *Robocon* 60 (2008): 8.

recent history by the government in collusion with the popular media and reinforced today by robot designers.[33]

Numerous YouTube videos of Actroid Repliee versions can be viewed to corroborate my point. The gynoid featured in the video at www.youtube.com/watch?v=4sjV_lxSVQo&feature=related, for example, is overdeterminedly feminine, from her breathy, high-pitched, girlish voice to her fashionably shaggy brown hair and manicured nails. She is dressed in an

"I ❤ Hello Kitty/official cheerleader" white sweatshirt, a black miniskirt hemmed with white lace, and chartreuse pumps festooned with a large bow of the same color. In the YouTube spot, Actroid Repliee Q2 protectively covers her chest with her right arm and, in a teasingly cute voice, warns (presumably male) visitors to the robot expo that touching her bosom constitutes "sexual harassment."

Will human females be replaced by their humanoid counterparts within decades? It was not an accident that Actroid Repliee was named after the French *répliquer*, to replicate. Takahashi Tomotaka, a leading robot designer and founder of Robo Garage, who is committed to creating "feminine female" robots, predicts that half all the humanoids created in the future will be fembots.[34] Already the many uses (male) roboticists imagine for the Actroid Repliee gynoids include their employment "in upmarket coffee shops, bars, information booths, office complexes, and museums to greet customers and to give directions." An advertising poster also suggests the use of Actroid Repliee as an ambassador, a spiritual leader, and a nurse. No further details of these applications are provided, although the nurse Actroid is shown presumably interacting with a patient. Clearly she cannot yet perform any nursing task—or any other such task for that matter—except perhaps formulaic interviews, but it is conceivable that even this may be of some value in situations where there are staff shortages and long waiting times. Rentals currently cost about $4,000 for a five-day period, plus charges to choreograph the humanoids' software.[35]

Meanwhile, in July 2006 Ishiguro's lab built a robot clone of Ishiguro himself named Geminoid HI-1, "H" and "I" being the roboticist's initials. The android was purposively created by Ishiguro as his doppelgänger through which he aims to "tele-presence" his unique personhood.[36] Its silicone-and-steel body was made from casts taken from Ishiguro's body. Controlled by a motion-capture interface, Geminoid HI-1 can imitate Ishiguro's singular body and facial movements, and it can reproduce Ishiguro's voice in synchronization with his posture and movements. The android not only wears his maker's clothing, but the android's hairpiece was fashioned from hair plucked from Ishiguro's head (figure 13.6). Ishiguro is keen on tele-lecturing from home to his students at Osaka University through Geminoid HI-1, who would substitute for its maker in the classroom.[37] To summarize from a limited sample based on Ishiguro's precedent-setting creations, whereas gynoids have been designed to replace flesh-and-blood females, androids—and Geminoid HI-1 is the only example thus far—are designed to augment and multiply the agency of a particular human male, in this case, Ishiguro.

Figure 13.6. Ishiguro Hiroshi and his robot double, Geminoid HI-1. Available at http://sankei.jp.msn.com/photos/etc/080514/etc0805142251000-p1.htm.

Enter HRP-4C, a new-generation gynoid unveiled in the spring of 2009 as a body double of and for (or to replace?) the average human female. Her "name" is an acronym for Humanoid Robotics Project–4th Cyborg, and she sports a silicone face—framed by shoulder-length black hair in a page-boy—fashioned from a composite photograph of five female employees at the Advanced Institute of Science and Technology (AIST), where she was created. HRP-4C's dimensions are based on the averages for Japanese women recorded in the Japanese Body Dimension Database (1997–98): she is 158 centimeters tall and weighs forty-three kilograms (including the battery). Her height is average, but she is about ten kilograms lighter than the average woman in her twenties. Like her face, her hands are also covered in a silicone skin. The rest of her anthropometrically calibrated body consists of silver and black plastic molded to resemble a Barbarella-like costume, which accentuates the ample "breasts" and shapely "buttocks." The fembot's movements were part of an algorithm developed by motion capturing those of human females and then mimicking them. Similarly, the robo-Barbarella's interactions with humans are enabled through speech and gesture recognition.[38] HRP-4C debuted at a fashion show held during the Eighth Japan Fashion Week in Tokyo, which opened on 23 March 2009. As explained somewhat tautologically on the AIST website, "HRP-4C is expected to pave the way for the early practical application of humanoid

robots by utilizing the key characteristic of humanoid robots, namely a human appearance."[39]

Whereas human female and male bodies are distinguished by a great deal of variability, humanoid robot bodies are effectively used as platforms for reducing the relationship between bodies and genders from a contingent relationship to a fixed and necessary one. This is obvious in the case of gynoids and androids and is evident even in the case of nonface robots. In April 2006, Takahashi unveiled the bipedal FT *(efutei)*, for Female Type, his first fembot. Up until that time, he explained, "the great majority of robots were either machinelike, malelike, or childlike for the reasons that not only are virtually all roboticists male, but also that fembots posed greater technical difficulties. Not only did the servo motor and platform have to be 'interiorized' *[naizōsuru]*, but the body [of the fembot] needed to be slender, both extremely difficult undertakings."[40] Technical difficulties aside, Takahashi—and my research suggests that he is representative of Japanese roboticists in this regard—invokes, in no uncertain terms, his commonsense view that an attribution of female gender requires an interiorized, slender body, and male gender an exteriorized, stocky body. Takahashi has not been consistent in equating the interiorization of body parts per se with a female-gendered body as his very first robot, the Astro Boy–inspired Neon, was specifically assembled so as "not to have any of its mechanical components visible."[41] Thus, in order to feminize FT over and beyond her interiorized body, Takahashi consulted with a number of professional fashion models in developing an algorithm enabling the thirty-three-centimeter diva-bot to "perform a graceful catwalk with all the twists, turns and poses of a supermodel" (figure 13.7).[42]

FT, HRP-4C, Geminoids, and Actroids point to roboticists' interest in the correspondence of sex, gender, and anthropometrics; face robots in particular are a product of "facial studies," an interdisciplinary and thriving field in Japan. One of the main activities of the Japan Academy of Facial Studies, established in March 1995 by anthropologist Kohara Yukinari, is to determine the link between faces and (gendered) professions. In an exhibition sponsored by the Academy at the National Science Museum in 1999, photographs of males, from the Meiji period (1868–1912) and the present, employed variously as bankers, professional wrestlers, politicians, and students were compiled and processed by a computer, producing a composite "typical" face for each category.[43] As Kohara notes, the "results reveal that the characteristic features vary from one group to another and inspire the question: Do those with similar faces join the same profession, or does working in a particular field change one's face?"[44]

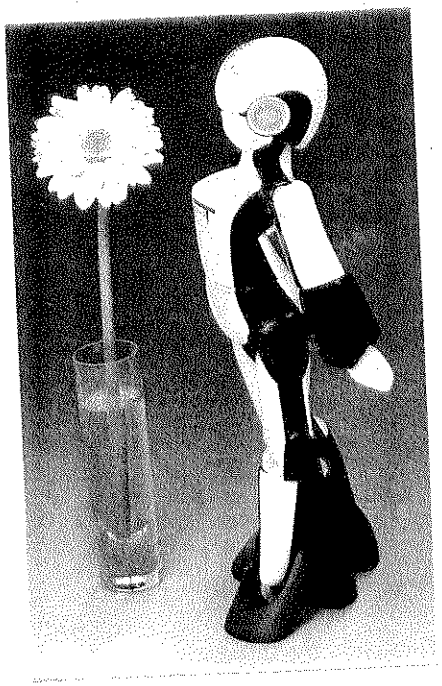

Figure 13.7. The FT (Female Type) "performing a graceful catwalk." Available at www.rawfish.com.au/ft-robot.

Significant here with respect to the technology of gender is the conflation of sex (*qua* anatomical body) and profession and the conflation of face and profession. In the former, biological maleness is the universal qualification for a career in finance, spectator sports, politics, and academia, whereas in the latter, a particular *kind* of masculine appearance seems to qualify one for a particular *kind* of career for males.

It is clear that face robots are also designed with particular professions in mind. The gender of humanoid robots that do not pass as actual humans is less literal and in many cases unclear, even if a humanoid is given a gendered name and referred to by a gendered suffix, such as *-kun* (for boy). Instead, the assignment of a gendered identity in such robots seems to be contingent upon their function or "profession" (whether security guard or catwalk model) and constructed character.

Several years before FT's debut, Matsui Tatsuya, Takahashi's contemporary and the founder of Flower Robotics, created Pino and Posy (figures 13.8 and 13.9), two bipedal humanoids that typify the commonsense attributes of female and male gender noted above. For Matsui, aesthetics is a "technological issue . . . inseparable from [a] robot's primary mechanical functions." Although he does not use the word "gender," his allusions

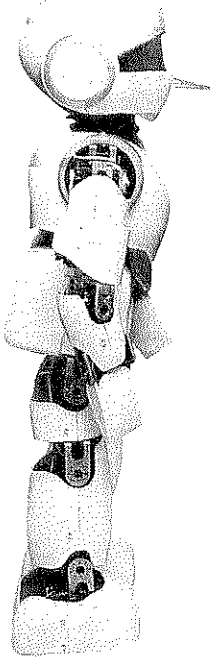

Figure 13.8. Flower Robotics' Pino. Image adapted from Robotto-gurafuitei (Robot graffiti) 2002, p. 17.

Figure 13.9. Flower Robotics' Posy. Image adapted from Robotto-gurafuitei (Robot graffiti) 2002, p. 36.

to the gendered character of his technological creations are numerous and striking. Matsui emphasizes that in designing humanoid robots, he (and other roboticists) are also "design[ing] the relationship between the human and the robot." Moreover, he continues, the exterior design of the robot "subverts" the privileged gaze of the human by enabling the robot to look back at the human, "thus creating . . . a spatial dimension previously unexplored in the research of humanoid robot design":

> The relationship between robots and humans is a factor that designers have to explore more deeply for the successful integration of one into the society of the other. Indeed, the mere inclusion of the robot in society in this century is not enough to sustain a lasting or particularly harmonious relationship between the two. For the robot to evolve from object to entity we need to address its genesis in purely human terms as we did with PINO *[sic]*, the humanoid robot who shares an ancestral link with Pinocchio, the puppet who aspired, through artificial means to be a boy, or more specifically, human.[45]

The pointy-nosed Pino, named after his Italian namesake, was therefore scaled to the size of "a one-year-old child taking its first steps," or about seventy-five centimeters tall. According to Matsui, invoking the theory of the uncanny valley, "the scale of a fully grown adult pose[s] a threatening presence and would . . . cause a general sense of unease, being less a companion than a cumbersome and overpowering mechanical object."[46]

Pino's masculinity is suggested through the incorporation of conventionalized masculine gender markers, such as a squarish head, angular jaw, well-developed chin, sturdy neck, and straight shoulders. Matsui claims that the humanoid's body was inspired by the lithe muscularity of male ballet dancers, and, echoing Takahashi's notion of exteriorized masculinity, he left the boybot's internal machinery visible to underscore his anatomy.[47]

Unlike Pino, whose segmented body is "incomplete" or "unfinished" *(mikansei)*, Posy's veiled body conveys a sense of modesty and innocence. Although Matsui modeled Posy after a flower girl at a church wedding, he imagines her serving as a receptionist.[48] Posy's expressive almond-shaped, and feminine, eyes stand in contrast to Pino's visor, which changes color according to his mood. Like Hello Kitty, Posy lacks a mouth (as does Pino). Her head, in the form of a pageboy haircut, sits atop a willowy neck, and her puffy cheeks recall cherubic young girls. A sleeveless gossamer dress simultaneously gives Posy an angelic appearance, highlights her smooth anthropomorphic arms and hands, and covers ("interiorizes") the unfeminine network of wires and metal plates forming her body.

ROBO-IMAGINEERS

Let us return again to the relationship between robotics and Japanese society. The Humanoid Robotics Project was spurred by demographic problems facing Japan, namely the looming population crisis caused by a declining birthrate coupled with a rapidly aging society. The birthrate presently stands at about 1.3 children per married woman, and more than 21 percent of the population of 127.8 million people (which includes permanent foreign residents) is over sixty-five years of age. That percentage is expected to increase to over 40 percent by 2050. The latest estimates produced by the health ministry project that the population will shrink to less than 111 million in 2035 and to less than 90 million in 2055.[49] Moreover, demographic estimates made back in 1995 indicated that more than 600,000 immigrants a year for the next fifty years would be needed to keep the labor force at its 1995 level of 87.2 million persons.[50] Former prime minister Koizumi Junichirō chose to ignore these estimates, and he responded to the question of how widely Japan should open its domestic labor market to foreign workers as follows: "If [foreign workers] exceed a certain level, it is bound to cause a clash. . . . Just because there is a labor shortage does not mean we should readily allow [foreign workers] coming in."[51]

How will robots change these disturbing trends? Most roboticists, I realized from their writings and my interviews, have a conservative, if not reactionary, sociocultural agenda for their high-tech creations. This is blatantly evident in the image of the kind of household robots will share with humans, namely, a traditional extended, patriarchal family model imagined to secure a stable society.[52] This timeless ideal-type model, reified in *Innovation 25*, serves as a foil against which to measure demographic trends. These trends are not contextualized or analyzed in terms of the constellation of historical, political, and socioeconomic conditions that occasioned their emergence. Rather, they are treated simply as surface abnormalities rather than indicative of a deeper malaise within the society itself. Women who choose not to marry or to give birth, for example, are disparaged as "selfish" or "parasites." What is missing in the sociocultural applications of robotics is any sense of how real women and men struggle with the trials and tribulations that confront them on a daily basis.

In a commentary that can be applied to robotics, critical theorist Manuela Rossini notes that "the inventors and scientific users of biomedical technologies are also *imagineers*, not just of bodies but of cultural configurations and social arrangements as well."[53] But the act of imagining per se does not necessarily yield fresh or progressive results. *Innovation 25* and the Japanese humanoid robot industry exemplify "retro-tech," or advanced technology in the service of traditionalism. A vision of and for new technologies that facilitate the transcendence of ethnocentrism, paternalism, and sexism, and their associated power relations, apparently is shared by neither roboticists nor the government committee and planners responsible for *Innovation 25*.

In my view, robotics in Japan today represents an ethos of technological progress conjoined with an ethos of revanchism. Or, put differently, robots (and robotics) are being enlisted to perform a kind of technologically sophisticated salvage anthropology that can be used to mobilize ethnic-national sentiments and to revivify the traditional patriarchal family as a microcosm of Japanese society. I describe this complex of motives as "reactionary postmodernism," in which images and forms of the past, including invented traditions, are mined for their nostalgic and novel impact. My

use of "reactionary postmodernism" is informed by the insightful and prescient analyses of Hal Foster and Susan Foster.[54] According to them, reactionary postmodernism stands in contrast to "resistant postmodernism." Whereas the former is "an instrumental pastiche of pop- or pseudo-historical forms," the latter "is concerned with a critical deconstruction of tradition." And whereas reactionary postmodernism exploits cultural codes and conceals social and political affiliations, resistant postmodernism questions cultural codes and explores social and political affiliations.[55]

Innovation 25 develops a view of the Japanese family and its members as "posthuman," a term that generally refers to humans whose capacities are radically enhanced by biotechnological means so that they surpass those of "ordinary—or unenhanced—humans." The posthuman condition is already a staple of Japanese manga (comics) and anime. Of course, posthumanism as I have just defined it is nothing new: human bodies today have prosthetic limbs, immune system "reprogrammers," artificial hearts, titanium bones, and a whole host of inserts and implants. We are all dependent on technology and converging with machines, but perhaps this trend is actualizing more explicitly and relentlessly—and is even more desired—in Japan. The Japanese state is the first to attempt to organize and orchestrate society around robot technology and the advent of humanoid robots that will both compensate for the declining and aging population and make replacement migration less necessary (or even unnecessary).

Complementing the technological enhancement of humans is the perception of humanoid robots as, effectively, living persons. Nearly twenty years ago, feminist sage Donna Haraway envisioned a posthuman future as liberating. Her symbol of freedom was the cyborg, an individual who is neither entirely technological nor totally biological, and neither male nor female in any absolute sense.[56] As eulogized in *Innovation 25*, posthumanism may offer unprecedented convenience, safety, and ontological security to the majority of Japanese, but those "benefits" are accompanied by entrenchment in, and not liberation from, conventionally embodied male and female gender roles and the patriarchal family.

NOTES

I would like to thank my colleagues at the University of Tel Aviv, Princeton University, and the University of Maryland, where I presented different versions of this chapter, for their astute and helpful comments. Research for this article was supported by a 2007 fellowship from the NEH (Advanced Research in the Social Sciences on Japan) and a 2008 faculty research grant from the Center for Japanese Studies, University of Michigan. A longer, revised version of this chapter is "Gendering Humanoid Robots: Robo-Sexism in Japan," *Body & Society* 16, no. 2 (2010): 1–36.

1. "Gynomorphous" and "andromorphous" are the adjectives describing an automaton resembling a woman and man, respectively. Similarly, I distinguish between gynoids and androids.

2. Tezuka's "Princess Knight" (1953) inspired comic book artist Ikeda Riyoko's "Berysaiyu no bara" (The rose of Versailles, 1972–74), performed at regular intervals by the Takarazuka Revue as one of its most successful postwar productions. For detailed information on the revue, see Robertson 2001 [1998].

3. Many journalists, roboticists, and scholars writing about the friendliness ascribed to robots by the Japanese cite Shinto as an important factor.

4. Adapted from Morioka 1991, pp. 85–87.

5. De Lauretis 1987, p. 18.

6. De Lauretis 1987, p. 5.

7. I made a similar argument with reference to the practice in the Edo period of attributing gender to plants and seeds based solely on aesthetic criteria (Robertson 1984). "Habitus" is a mindless or unconscious orchestration of actions that do not presuppose agency and intentionality. It is a set of internalized predispositions that enable people to cope with unexpected situations and improvise (see Bourdieu 1977).

8. Sex robots, which are fitted with humanlike genitalia but are without "intelligence," as defined in this chapter, are an exception. I do not deal here with these sex toys (see www.ananova.com/news/story/sm_1361247.html, http://kafee.wordpress.com/2007/10/28/sex-dolls-robots-love-and-marriage/; Dorfman 2005; Levy 2007). As Kessler and McKenna argue, physical genitals play little role in gender attribution among humans, except at the moment of gender assignment at birth, when a newborn is determined to either have or lack a penis. Those infants whose genitalia are ambiguous are often "corrected" surgically and, later, hormonally (Kessler and McKenna 1985, pp. 58–59; also Kessler 1998). See also chapter 11 in this volume. Having followed the scholarly feminist literature on gender for decades, and having explored the operations of the sex-gender system in Japan and elsewhere, I continue to find Kessler and McKenna's pathbreaking work on the gender-attribution process and on the phenomenon of "cultural genitals" salient. It is misleading to assume a theoretical teleology in gender studies—that the most recent publications are the most cutting edge. The relentless presentism of a good deal of contemporary scholarship on the relationship of sex, gender, and sexuality conjures the image of a reinvented wheel.

9. Kessler and McKenna 1985, p. 155.

10. Kessler 1998.

11. Robertson 1991 and 2001 [1998]

12. Cf. Bloodsworth-Lugo 2007, pp. 18–19; Grosz 1994, p. 58.

13. See, e.g., Sheets-Johnstone 1992. This is true of male and (the comparatively few) female roboticists.

14. Autonomous (or semiautonomous) robots did not become possible until the 1950s and 1960s, with the invention of transistors and integrated circuits. Compact, reliable electronics and a growing computer industry were also critical to the development of robots. In the computing world, having more transistors on a chip means more speed and possibly more functions. Moreover, as the component density of chips radically increases, the chips themselves become smaller and thinner, which has enabled developments in humanoid robotics in the area of emergent and embodied intelligence.

15. See www.kantei.go.jp/jp/innovation/chukan/inobeke.html.

16. All material on the Inobe family is from *Innovation* 25 unless otherwise noted.

17. Kanemori 2007, p. 16.

18. See, for example, Yamato 2006.

19. Inobē-*kun*'s use of kin terms underscores his membership in the Inobe household.

20. See http://studiom.at.webry.info/200703/article_2.html.

21. See www.pinktentacle.com/2006/08/intelligent-robots-by-2015-says-meti/.

22. The term *artificial life* (or *alife*) describes research into human-made systems that possess some of the essential properties of life. This interdisciplinary effort runs the gamut from biology, chemistry, and physics to computer science, robotics, and engineering (adapted from www.alife7.alife.org/whatis.shtml).

23. Inman 2006.

24. Adenzato and Garbarini 2006, p. 749.

25. It is in this context that I came up with the title of an earlier article, *Robo sapiens japanicus* (Robertson 2007). See also http://forum.ebaumsworld.com/archive/index.php/t-206094.html; www.pinktentacle.com/2007/06/cb2-baby-humanoid-robot/; www.engadget.com/2009/04/06/cb2-child-robot-returns-smarter-creepier-than-ever/.

26. Mori 1970.

27. Ishiguro's research team has found that whereas his realistic child-type Geminoid quickly precipitates uncanniness, an adult humanoid seems to provoke less eeriness and more familiarity. See www.engadget.com/2006/07/21/hiroshi-ishiguro-builds-his-evil-android-twin-geminoid-hi-1/ and www.ed.ams.eng.osaka.ac.jp/research/Android_BehavAppear_e.html.

28. Hara and Pfeifer 2003. Whereas both Hara and Ishiguro are intent on creating female and male proxies, Cynthia Breazeal, an MIT (and rare female) roboticist, eschews anatomically realistic sociable robots and has created a gender-neutral "metal bust" called Kismet with an expressive, cartoonlike face consisting of round eyeballs with blue irises, metallic eyelids, pinkish cone-shaped ears, fuzzy ochre eyebrows, and thick red cablelike lips. See Breazeal 2002, p. 48.

29. Although she provides an incisive reading of the interactive relationship between (the now mothballed) Kismet and Breazeal that occasions the robot's sociability, Lucy Suchman does not address the gendered (or not) component of actual (as opposed to fictional) humanoids in general. See Suchman 2007, pp. 235–38, 245–46; Breazeal 2002, p. 48.

30. See http://news.nationalgeographic.com/news/2005/06/0610_050610_robot.html.

31. See de Lauretis 1987; www.wellcome.ac.uk/doc_wtx023405.html.

32. Wood 2005.

33. Shibamoto 1985.

34. See www.luxurylaunches.com/auctions/tomotaka_takahashis_ft_female_bot_to_be_auctioned.php.

35. See http://en.wikipedia.org/wiki/Actroid.

36. "Distributed personhood" refers to the ability of human actors intentionally to relocate some of their agency into things beyond the body boundary. To borrow from Alfred Gell, Geminoid HI-1 is an objective embodiment of *"the power or capacity to will* [its/his] *use"* (Gell 1998, p. 21).

37. See http://en.wikipedia.org/wiki/Actroid.

38. HRP-4C was developed as part of the User Centered Robot Open Architecture (UCROA), one of the projects under the Industrial Transformation Research Initiative, a three-year industry-academia joint project implemented by AIST in 2006 with intended applications in the entertainment industry.

39. See www.aist.go.jp/aist_e/latest_research/2009/20090513/20090513.html.

40. Takahashi 2006, p. 194.

41. Takahashi 2006, p. 67.

42. See www.luxurylaunches.com/auctions/tomotaka_takahashis_ft_female_bot_to_be_auctioned.php; http://cgullworld.blogspot.com/2007/06/ft-female-robot-does-catwalk.html.

43. The exhibition was titled "Daikaoten" (Great exhibition of faces).

44. See http://web-japan.org/trends00/honbun/tj990918.html.

45. Matsui 2000.

46. Matsui 2000.

47. Burein Nabi 2002, p. 83.

48. Burein Nabi 2002, pp. 83–84.

49. "19 prefectures to see 20% population drops by '35" 2007.

50. Kondo 2000.

51. Kashiwazaki and Akaha 2006.

52. See also Ambo 2007.

53. Rossini 2003, p. 1.

54. Foster 1983; Foster 1985.

55. Potter 1996, p. 7.

56. Haraway 1991, p. 181.

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