Chapter 2
Social Robot Morphology: Cultural Histories of Robot Design



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Abstract Social robot morphologies are not conceived in a void but build on cultural trajectories of artifact design that precede them. We suggest three design tropes that are predominant in many robots morphological design choices: the human replica, the futuristic machine, and the cute companion. We discuss the first two of these tropes in the context of their historical origins, and the third from a contemporary lens. For all three, we present cultural implications of the aesthetic typologies to emphasize the critical importance of conscious engagement with these contexts when designing social robots.

2.1 Introduction

The physical appearance of a robot does not suddenly materialize from the imagination of its designer but exists within a cultural history of artifact design, drawing on this history and its traditions. Yet many designers of social robots do not recognize or acknowledge their design's position as part of a lineage of cultural traditions, instead citing interaction requirements, user preferences, or pure inspiration as the basis for their design choices (see: the "motivation" column in Dunstan (2019), *Twenty-Five Robots in Twenty-Five Years*).

This lack of acknowledgment can limit or complicate the reception and treatment of robots and the subsequent success in interaction with social robots. In her consideration of *Robots in Society, Society in Robots*, Šabanović (2010) identified that the design of social robots had been primarily developed in a unidirectional, technologically determinist manner, where technology is developed in a linear fashion of continual progress and society fulfills a passive role by accepting and adapting to the results of technical innovation. Due to the highly social contexts for which

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social robots are designed, Šabanović called for a move away from the technocentric forward-march of social robot development and instead proposed a "bidirectional shaping" between society and robots that

> paves the way for approaching design in a value-centred manner, consciously incorporating social and cultural meaning-making into design.

Šabanović proposed that it was not sufficient to consider the social and cultural impacts of a robot in post-production user testing, but rather that

> the meaning of various technological choices ... should be questioned throughout the process of technology design (2010, p. 445).

Šabanović also notes that the integration of robots into broader society should incorporate the study of both the social and technical aspects of the technology. While there is a significant body of contemporary critical theory concerning aesthetic trends in technological product design and the emergence and acceptance of social robots, the identification and analysis of aesthetic trends and their origins, specifically in social robot morphology, is necessary to foster a more conscious incorporation of social values and cultural meaning into these artifacts that are being designed to share social spaces with humans.

In this chapter, we aim to map several cultural trajectories of artifact design that lead up to contemporary social robot morphologies. We suggest three design tropes that are present in many robots morphological design choices. The first is that of the human replica, a wish to artificially recreate with mechanical means the naturalistic structure of a human. The second is that of the futuristic machine, a neutrally designed, streamlined device that is often represented through clean lines and neutral color palettes, suggesting a better-than-nature efficiency. The third is that of the cute toy or companion, emphasizing child-like or pet-like features and suggesting a certain naïvité, helplessness, vulnerability, and loyalty. We discuss the first two of these tropes in the context of their historical origins, and the third from a contemporary lens. For all three, we present the cultural implications of these aesthetic typologies for robots.

Social robot morphology has been surveyed several times in the existing HRI literature. However, these surveys are often in the form of categorical classifications of robot forms with limited cultural or historical analysis (Hegel et al. 2009; Diana and Thomaz 2011; Mahdi et al. 2022). We start to fill this gap by tracing some historical and cultural origins of social robot design, which reveal underlying notions about the function of technology that echo in contemporary applications and contexts.

In Sect. 2.2, we trace the origins of the human replica from antiquity through the design of clockwork automata to the "steam men" of the Victorian age. In Sect. 2.3, we discuss the transition of design from the naturally inspired to the machine-centric in the twentieth century. We particularly emphasize the evolution of the streamlined aesthetic through post-Industrial Revolution Italian Futurism, suggesting an ideology of speed, efficiency, and hygiene.

We then move to a more contemporary lens. Section 2.4 presents the development of a cute aesthetic for social robots, exemplified early on in robots such as Kismet,

Leo, and iCat, and persistent in the quarter-century since in contemporary research robots such as Blossom and commercial robots such as Pepper, Astro, and Otto. We detail the development and persistence of this typology in social robot design, along with its ethical implications, through the lens of Sianne Ngai's aesthetic theory.

To create robots for effective and affective interaction, social roboticists must design morphologies with an awareness of the cultural origins and social implications of their chosen aesthetics, just as designers in any other discipline would.

2.2 The Human Replica

We start our historical analysis with perhaps the most obvious and uninspired robot design: an attempted replica of the human form. This design trope can be traced back to prehistoric human figurines and mechanically actuated puppets in antiquity but began to take on a more decidedly robot-like form in the sixteenth century through the development of clockwork automata.

The urge to recreate a semblance of intelligent life via artificial means was never culturally neutral and has often been consciously related to questions of control, be it control over nature, over death, or over other living creatures. For example, sophisticated clockwork mechanisms were built as scientific tools to give humans control over the seasons, seas, and crops, and simultaneously inspired attempts to recreate living creatures, including humans, via mechanical means. The relationship between anthropomorphic machines and control is also evident in the robot-like designs of "steam men" in the nineteenth century, where the imagining of such steam men was closely linked to racism. We argue that the cultural associations between human form robots and control over other humans linger today, as does the notion that the design of a human-like machine, can help its designer both overcome the limitations of nature and reveal important truths about the mystery of humanness.

Humans have been creating replicas of the human form since prehistoric times, with human-like figurines dating back 35,000–40,000 years. These early sculptures indicate the long-standing interest of humans in creating artificial versions of themselves. Sculptures led to articulated and jointed masks and dolls, for example, those found in Egypt as early as the 2nd millennium BC. Some of these figures are described as being augmented with hidden voice boxes for dramatic effect. There is also written evidence of Roman wax figures that were actuated with complex mechanisms, including an attempt by Mark Antony to "revive" the dead Julius Caesar to shock a crowd of observers. Derek J. de Solla Price (1964) presents a clear and concise history of such pre-modern automata, and the reader can find an extensive presentation of ancient-to-modern automata in Chapuis (1958).

Along with the creation of these figurative representations, there is also long-documented contemplation about the possible aliveness and humanness of artificially created human figures. Two well-known examples are the Greek myth of Pygmalion from the eighth century, and the Golem, an animated anthropomorphic creature of Jewish folklore, dating back at least to the Middle Ages. In many of the treatments

of possibly-alive artificial creatures, the theme of control arises, be it over nature, death, gods, or other humans. These mythologies also usually come with moral warnings related to the hubris of control and the inevitable disaster that it brings. These questions and warnings remain to this day in the context of robotics.

The link between man-made mechanisms, artificial creatures, and control over nature clarifies during the early modern era, starting in the late fifteenth century CE and continuing throughout the sixteenth and seventeenth centuries. This period is marked by three simultaneous and interleaved developments: first, sophisticated metalwork leading to the ability to build complex spring-driven clockworks; second, the seeds of a pre-Enlightenment mechanistic and secular scientific thinking moving away from a sacred idea of humanity; and third, the expansion of European colonial empires along with a culture of exploitation.

At the same time, as European monarchies expanded their control over distant regions, including exercising control over the humans who lived in these colonies, metalwork improved to enable, among others, the construction of sophisticated measurement machines, used for long-distance ocean navigation and timekeeping. Some examples are depicted in Fig. 2.1. The increased precision of these machines—precursors of automata, then calculators, and eventually computers and robots—must have given their owners a heightened sense of control over complex natural processes. The leap from mastering the stars and seasons to mastering other living creatures and viewing them as nothing but sophisticated machines was short. De Solla Price cites St. Thomas Aquinas as stating that,

> [...] animals show regular and orderly behavior and must therefore be regarded as machines. (de Solla Price 1964)

De Solla Price adds that

> [s]urely, such a near-Cartesian concept could only become possible and convincing when the art of automaton-making had reached the point where it was felt that all orderly movement could be reproduced, in principle at least, by a sufficiently complex machine.



Fig. 2.1 Astronomical clock, circa 1568; mirror clock, ca. 1565–1570; clock-watch with sundial, ca. 1605–10



Fig. 2.2 Automaton clock in the form of a lion (1620–35), and automaton in the form of a frog (c.1820)

By the end of the eighteenth century, the courts of Europe were awash with automata, celestial prediction machines, and calculators, all made of precious metals and stones often harvested from faraway slave colonies. True to the idea that even animals and perhaps humans are nothing but complex machines, many of these clockwork devices were in the shape of natural creatures (see Fig. 2.2) and attempted to recreate the behaviors of animals and humans. This rise of these clockwork machines was wonderfully documented in the exhibition "Making Marvels" at the Metropolitan Museum of Art in 2019–2020, and in the accompanying catalog (Koeppe 2019).

Fast-forward into the Victorian era, as steam engines become the height of technology, but the dream of artificial humans is still alive and well. In the nineteenth century, spring-loaded clockwork animals and human figures are supplemented by so-called steam men. These mostly imaginary constructions appear both in Europe and across the Atlantic in the USA. One example is Edward S. Ellis's early science fiction dime novel *The Steam Man of the Prairies* (1868), which triggered a range of copycat and sequel novels published throughout the second half of the nineteenth century. In it, an anthropomorphic steam machine, its face painted black, carries white frontier-people across the American prairie through a variety of nineteenth-century adventures (see Fig. 2.3, bottom). Another notable example is Zodoc Dederick's 1868 US patent application for a steam carriage shaped like a human pulling a cart, thought to be the real-life inspiration for the above-mentioned series of novels. Other steam men of the nineteenth century (Fig. 2.3, top), which quite clearly resembling modern-day robots, were imagined for a variety of labor tasks, from hauling carriages of cargo and passengers to agricultural chores.

It is not difficult to see the imagination of slave owners in both the fictional and the engineering versions of American steam men. The machines' human appearance was often designed with stereotypical features of Black men, and the narratives of the steam man novels are laden with racist tropes. The tasks given to these steam men were, at the time, associated with labor of enslaved people, including agriculture or—in the dime novel series—capturing Native Americans. If the automata of the sixteenth to eighteenth century were set in a cultural moment of the scientific conquest

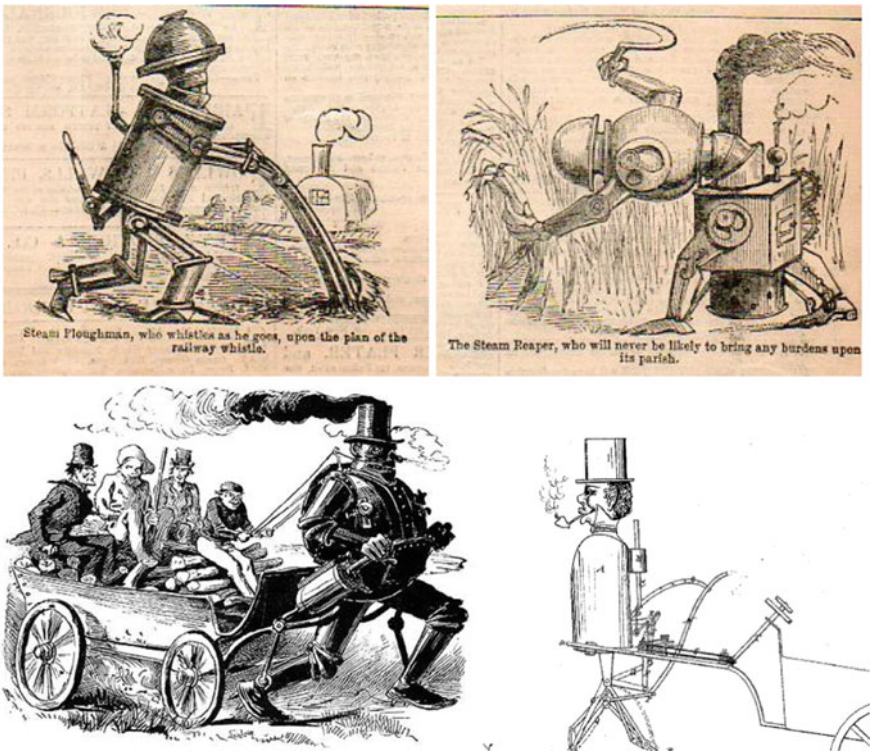


Fig. 2.3 Fictional steam men from the late nineteenth century: steam plowmen depicted in a British journal (top), the Steam Man of the Prairies (bottom left), detail from the 1868 android-drawn Steam Carriage patent drawing by Dederick and Grass (bottom right)

of nature and its inhabitants, the robots of the nineteenth century—especially in the United States—were set in the recent historical context of the normalization of owning other humans for labor. Evans (2018) reads these inventions as being distinctly shaped by the historical context following the emancipation of enslaved people:

> Coming on the heels of the Civil War, the steam man stories, like Dederick's patent, drew on extant black caricatures to explicitly racialize their central invention, vividly illustrating the afterlife of slavery at the birth of America's machine culture.

According to Evans, these design speculations mark

> a moment when, in the wake of emancipation and the early promises of Reconstruction, the former economic base built on enslaved labor slowly transformed into what became nominally free forms of wage labor, supplemented by an increasing adoption of mechanical labor… [These] cultural artifacts index a shift happening across the country as old forms of mastery, structured by the institution of chattel slavery, were co-opted by and transformed into new narratives of mastery over machines.

The shift from dependence on wage labor to mastery over machines is still a central theme in the justification of robotics today, and the aesthetic trope of a human replica robot is the continuation of the artificial human designs of past centuries.

2.2.1 Implications

A continuous cultural thread runs from articulated figurines, through mechanically reincarnated emperors, semi-alive Golems and Pygmalions, to clockwork animals and humans, steam servants, and eventually today's humanoid robots. It is a thread of a mechanistic attempt to understand, capture, and control nature and its inhabitants. No matter what the current high technology was, humans made the leap from its precision to its ability to model nature and its creatures and, subsequently, to control them. Especially if a technology—be it a clock or a machine learning model—can accurately predict events, such as the movements of stars, the seasons, or animal behavior, engineers were tempted to use it to recreate and control natural and social phenomena. This recreation was often accompanied by a sense of deep understanding of the natural phenomenon simply due to the creation of a superficial replica.

The desire and sense of ability to control nature can lead to a similar desire to control humans. The nineteenth-century comfort with "using humans" of a perceived lower rung set the groundwork for a fantasy of creating artificial lower-rung humans, to be placed in jobs roboticists now call *dangerous, dull, and dirty*. Today's human-like robots suggest a similar exploitative connotation. They are being seen as less-than human but still imagined as being capable of replacing humans in a variety of tasks. This tension between the sense of approaching humanness but being placed in roles that humans shy away from, challenges contemporary social mores and may cause some of the unease felt in relation to robots in human society.

In addition, the construction of human-like robots and their suggested intelligence also uncovers a hubris, running millennia-long, that if some remaining engineering issues could just be resolved (and they always will be, "soon"), humans would not only get better tools, but also a better understanding of themselves. It is not hard to see a foreshadowing of the current technological hubris of being able to represent "all orderly movement" of people, both online and offline, by "a sufficiently complex" machine learning model, to paraphrase de Solla Price.

Beyond the well-known "uncanny valley" of robot design, we suggest that the cultural heritage delineated in this chapter explains some of the issues with the humanoid form, just as many of the predecessors of today's humanoid robots were viewed as dangers, moral warnings, and uncanny cohabitants.

2.3 The Futuristic Machine

Design in the twentieth century moved away from the cultural and political values of the past and with it discarded the aesthetic trappings of prior generations. Minimalist, abstract, and futurist ideas emerged around the turn of the century, took root in product design in the period between the World Wars, and became ubiquitous in consumer homes in the mid-century and beyond. This history of what a "futuristic machine" looks like is the second design tradition that we trace to contemporary robot design.

Several principles drove these "aesthetics of the future," the primary of which was a desire to escape from the ornamental, naturalistic, rich, and decadent images and ideologies of the past. Instead, abstraction, minimalism, and streamlining were considered to be the height of design in the early to mid-twentieth century. This attempt to discard the history of detailed arts and crafts from the sixteenth to nineteenth centuries was already apparent in the minimalist works of the Vienna Workshop around the turn of the century. But the drive toward a different future was highly accelerated after the collective trauma of World War I, ushering in a new era in politics, be it fascism or socialism, and with it, new aesthetic principles.

Politics was not the only dramatic driver of change in design. The twentieth century also became an era of mass manufacturing, which replaced handcraft and one-off designs. New processes promised access to technology for people beyond the aristocracy, and the aesthetic that accompanied this promise spoke to new materials, methods, and production speed. The design language that grew out of these technological novelties was one of simple geometric shapes, smooth surfaces, and an increased use of stamped metals and molded plastics.

The aesthetic of mass manufacturing stood in dialogue with contemporaneous currents in the visual arts, which also moved away from realism toward clean lines, abstraction, curves and non-representation. These qualities that came to represent the "futuristic" aesthetic in the early 1900s can be seen in the sculptures of the Italian Futurist artists, who mimicked the form and finishes of mass manufacturing technologies, including broad smooth surfaces and basic geometric shapes that appear to meet at a seamed line or fold. The Futurists also emphasized dynamism, the difficult-to-capture but omnipresent movement that was absent from the static representational art of prior periods.

Futurist aesthetics bled into the minimalism of European avant-garde art and the mass-produced aesthetic of design schools like the German Bauhaus, and eventually inspired a new movement in US American product design, known today as "Streamline Moderne" (Kowalik 2017). As its name implies, this style is inspired by the aerodynamic lines of fast-moving vehicles, from automobiles to aircraft. The adoption of streamlined designs into other realms, most notably household appliances, came to symbolize the intangible qualities of the machine age: speed, efficiency, predictability, reliability, and strength. These qualities remain associated with the streamlined designs of robots, even when these robots do not need to worry about "gliding efficiently through space"—to paraphrase Marshall (2012)—any more than the streamlined toasters of the 1950s.

The clean aesthetics also aligned with the twentieth-century political ideal of equality. Instead of the mechanical replica of a human servant, as described in the previous section, the machines of the future were neutral, modern ways to live a life of affluence without exploiting others. This promise carries over to today's "intelligent machines," from smart speakers through to mobile devices and social robots: clean lines represent simplicity and efficiency, while masking the still-existing human toll that enables their existence.

2.3.1 Futurism, Dynamism, and the Simultaneity of Human and Machine

The beginning of the twentieth century was marked by an acceleration across many aspects of European life, along with an erasure of boundaries due to the speed of new modes of transportation and communication. This acceleration led to an artistic focus on the future, perhaps brought on by the sense that technology was accelerating faster than traditional styles could capture. In 1909, Filippo Tommaso Marinetti published the "Futurist Manifesto" (Marinetti 1909), initializing an ideology that would be expressed though a multitude of media, including poetry, film, drawing, painting, and sculpture. Two notable ideas were permeating in Futuristic art: The first was *dynamism*, the wish to capture qualities of movement and change, even in static artforms. The second is that of *simultaneity*, both of times and places, and of the human body and machines. These principles were evident in an obsession with the aerodynamic and functional shapes of vehicles and other machines, which later led to the association of certain machine-like elements with speed, efficiency, and a hopeful future.

Between the years of 1900 and 1916, the erasure of boundaries across many aspects of European life was immense. The reader can find these changes insightfully documented by Marjorie Perloff (2003). Perloff notes how the appearance of advertising posters saw "art" and "life" blurring together in every shop window and towering above the streets. In 1905, the Trans-Siberian Railway was completed, linking western Russia to the Pacific coast, together with the Trans-African Railway and the Trans-Andean Railway, dissolving nation boarders and previously impossible distances. Between 1909 and 1914, the corners of the globe were tugged tightly together as the world witnessed the first successful expeditions to both the North and South Poles, together with the first extended airplane flight (Wilbur Wright 1909), and the first flight across the English Channel (Louis Blériot 1909); humankind now traversed the globe somewhere between the land and the sky. One's thoughts and words could be spoken in one place and heard miles away in another with the increasing availability of the telegraph and telephone. In any of the nearly 200 new cinemas that had opened in Paris by 1913, audiences could sit in one place and be transported entirely to another through the advent of film. The increasing production of automobiles, together with the expansion of steam train lines, saw the

body and self-move with speed and dynamism through space, observable as a blur: simultaneity.

Among the slippages and states of simultaneity, Futurists experienced blurred boundaries between the space of the human body and the qualities of the machine age, as is detailed in the "Futurist Manifesto":

> 4. We affirm that the world's magnificence has been enriched by a new beauty: the beauty of speed… a roaring car that seems to ride on grapeshot is more beautiful than the Victory of Samothrace. (Marinetti 1909)

Similarly, Boccioni et al. wrote in the "Technical Manifesto of Futurist Painting" (1914):

> Our bodies penetrate the sofas upon which we sit, and the sofas penetrate our bodies. The motor bus rushes into the houses which it passes, and in their turn the houses throw themselves upon the motor bus and are blended with it.

The speed, efficiency, mobilization, and dynamism of the mechanical world would be expressed not simply as something they experienced, but rather, something they felt they were becoming, and would become, as

> motion and light destroy the materiality of solid bodies (Lista 1986)

In his "Technical Manifesto of Futurist Sculpture," Boccioni states,

> [O]bjects will not be placed alongside the statue, [...] they will be embedded in the muscular lines of a body. We will see, for example, the wheel of a motor projecting from the armpit of a machinist (Apollonio et al. 1973)

and urges,

> Let us open up the figure like a window and enclose within it the [mechanical] environment in which it lives. (Apollonio et al. 1973)

This Futurist philosophy resulted in a dynamic vehicle-inspired aesthetic typified by sleek lines, simplification of surfaces, elongation, a reduction to basic geometric shapes, and a neutral color pallet. Aerodynamic lines were only broken by tubes and other machine components, merging human bodies and mechanisms, and setting the tone for what is viewed as "futuristic" and "advanced" for a century to come. When met with the true power of mass manufacturing, this aesthetic of the future would permeate not only art galleries and catalogs, but the design of everyday objects and, eventually, robots.

2.3.2 Streamlined Design

The dynamism and affinity for fast-moving vehicles embodied in Italian Futurism found its way into the consumer market through a design movement known today as Streamline Moderne. Kowalik (2017) provides an excellent survey of this movement,

its influences, and the principles it embodies, and much of this section is based on his discussion. While previous twentieth century art forms, including Art Deco, Futurism, and Art Nouveau, all similarly rejected the opulence of the aristocratic art of previous centuries, Streamline offered a

> further abstraction [...], rounding the angular edges, making the style less harsh and more approachable, and shaped by the speed of progress. (Kowalik 2017)

Streamlined design took on the forms of trains and cars, such as their rounded, smooth, and teardrop-shaped lines that enabled them to move quickly through space. Just as Futuristic sculptures and paintings connected vehicular shapes with the speed of a new century, the streamlined design of consumer objects offered connotations of speed, efficiency, and modernity, creating a completely new ideal of elegance that did not rely on intricate craftsmanship and ornamentation. This promise of a bold future embodied by the fast-moving machines of the new century was especially necessary in the years following the trauma of World War I and the subsequent economic depression, both of which could be viewed as the complete failure of the "old ways." The promise of fast-paced modernity soon flowed over beyond transportation, as many household items were designed using the language of aerodynamics, even though this was not a functional requirement of these objects. Contemporaneous industrial designers such as Raymond Loewy progressed directly from designing steam engines and automobiles to designing pencil sharpeners, hair dryers and Dutch ovens (Loewy 1999) (Fig. 2.4).

As a result, the mid-century kitchen was replete with curved, smooth surfaces that were meant to remind the modern housekeeper of the efficient and dynamic life she was part of. Nickles (2002) presents an excellent case study of the mid-century streamlined refrigerator as a functional machine, a mass-appeal technology, and an icon of the clean and hygienic future. She positions the technology as part and parcel of a new sociology of the middle class and an ideology of progress.

Ideologically, streamlining was futuristic and hopeful. New mass manufacturing methods were more than just technologies; they were objects that promised participation in a brave new world, full of hope, and convenience for all. Consequently, parts stamped or extruded from steel, or molded in new materials such as polystyrene and polyvinyl chloride (PVC) (Roser 2016) and joined through fastener-less methods

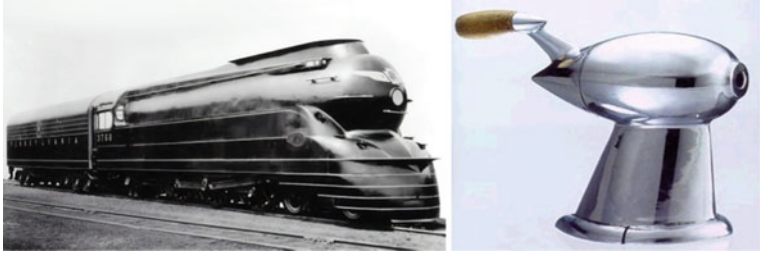


Fig. 2.4 Streamlined designs by Raymond Loewy: the Pennsylvania Railroad K4-Class 4–6-2 3768 train known as "The Torpedo," 1938, and Pencil Sharpener, 1934



Fig. 2.5 Streamlined designs of household objects, designed in the intra-war and post-war period. From left to right: Electrolux vacuum cleaner (designed in 1937), electric iron (ca. 1930s), electric mixer (1945–1955)

such as gluing, welding, or heat sealing, realized both an aesthetic and an ideology of simplicity and efficiency. These techniques could lead to quickly mass-manufactured objects and therefore could democratize luxury. The smooth lines and lack of visible fasteners also indicated a fetish of simplicity, ease, health, and cleanliness, which was part of the hopeful future (Fig. 2.5).

The streamlined aesthetic claimed an adherence to and celebration of "functionality." According to this idea, morphology is driven by its function and therefore it *is* its aesthetic, along the lines of Sullivan (1896): "form ever follows function." The catalog of the 1934 exhibition "Machine Art" at the Museum of Modern Art devotes a section to "Function." The exhibition was contemporary with many of the streamlined designs and celebrated mass-produced household objects as "art." About the beauty of functional design, the curators write:

> A knowledge of function may be of considerable importance in the visual enjoyment of machine art […] Whoever understands the dynamics of pitch in propeller blades (No. 41) or the distribution of forces in a ball bearing (No. 50) […] is likely to find that this knowledge enhances the beauty of the objects.

Ironically, the diffusion of streamlined design from vehicles of transportation to household objects goes against this form-follows-function principle. In fact, the streamlined design of non-moving objects often concealed the mechanics of their operation. As Marshall (2012) notes regarding Loewy's streamlined pencil sharpener (also in Kowalik 2017):

> That pencil sharpener might have *looked* [emphasis in original] smoothly aerodynamic, but when was the last time a pencil sharpener had to glide quickly through space? […] Here the streamlined shape was a metal casing put over an old-fashioned machine, not only obscuring the turning, spiraled blades of its working interior, but pretending to a 'look' of functionalism at cross purposes with a function!

This role of hiding a device's mechanism also appears in Nickels's analysis of refrigerator design. She especially points out the design decision to move the cooling element from the top of the appliance to a more hidden position. Quoting a complaint communicated inside the General Electric company,

> These people would rather *not* [emphasis in original] have the mechanical part of the device in evidence … [W]hat interests them in such a product, that is, the machine itself, is the very thing that the woman buying it wants kept out of sight and out of mind. (Nickles 2002)

Finally, it is important to note the social context of luxury without servants that Streamline Moderne represented, namely an attempt to break from the feudal and colonial traditions of servants and, subsequently, of automata and steam men. Nickles speaks of the mid-century refrigerator as a technology aimed at the "servantless housewife." Ensconced in her house, which architect Le Corbusier termed a "machine for living" (Cohen 2014), this servantless housewife was now required to take on many more of the domestic chores, aided by the new mass-produced technology that promises to relieve her from the difficulties associated with this new situation. Nickles also speaks of the transition from marketing to "class" to focusing on "mass," enabled, of course, by the innovative manufacturing techniques of the new century.

That said, amidst all of this technological innovation hid a highly regressive social program. The ultimate goal of the new appliances of the twentieth century was to maintain women in the role of homemakers instead of encouraging them to join the workforce,

> as a way to stabilize not only the economic crisis but also a social one that threatened to undermine traditional gender roles. (Nickles 2002)

2.3.3 Implications

The aesthetic of the futuristic machine that dominated the first half of the twentieth century lives on into the digital age, from "smart" appliances all the way to robot aesthetics. Robot designs employing smooth, simple curves and made from plastics and metal remain abundant, even as mass manufacturing techniques give way to the on-demand "mass customization" of rapid prototyping.

The design trope of the futuristic machine aims to suggest neutrality, and form based purely on function. Robot designers draw on these non-realistic abstractions that originated in the early twentieth century in an attempt to make robots look "futuristic". It also suggests a robot's non-human objectness, along with its objectivity and anonymity.

Tracing the social history of Futurism and streamlined design shows that, again, its cultural baggage is not empty. The design of today's robots is tightly linked with the merging of human and machine, and are, in a sense, a Futuristic sculptural attempt to enclose the mechanical and artificial within an organic, human, or animal-like form. The result is a mechanical object which has been made to look like a natural creature and perform reconstitutions of behaviors and emotion. For these robots, the dissonance between appearance and behavior has often proven to be objectionable and bothersome.

The robots of the twenty-first century *do* present several technological revolutions, in both hardware and software engineering. This technological breakthrough could have sparked a disruptive innovation in aesthetics and design philosophy, as the machines of the early twentieth century did in Italian art. Instead, the robot designs of today fail to be an expression of our time, as their designers are—perhaps

unknowingly—reproducing exterior aspects of the stereotypical 100-year-old "futuristic look." This retrospective quality can be attributed to a limited critical and cultural consideration in robot design, and a lack of knowledge of the strong aesthetic links to the original work of the Futurists. Sadly, robot morphologies from the last twenty years might just have likely been designed by Futurist sculptors working in the early twentieth century.

Boccioni asserted:

> It is not simply by reproducing the exterior aspects of life that art becomes the expression of its time. (Apollonio et al. 1973)

But the exterior aspects of Italian Futurist sculpture have endured, and contemporary social robotics design appears to be caught in a 100-year loop. An example can be seen in the visual comparison between artist Henry Gaudier-Brzeska's sculpture *Dog* (1914) and Sony's AIBO robot:

Gaudier-Brzeska's *Dog* could be interpreted as a dachshund, but without a full set of breed-defining features, it may simply be Gaudier-Brzeska's approximation of "dog". Yet, of all the possible dog-like appearances, it shares remarkable aesthetic similarity to Sony's AIBO, designed and produced 85 years later. Both "dogs" sport a conical and almost featureless snout, with only an indication of eyes, and floppy ears that are rendered motionless at the side of the head, widening at the bottom. For both forms, the body is distinctly separate from the head, with one smooth form arching at the lower back to meet the raised hind legs. AIBO's "forearms" are formed in two key sections, distinguished by their points of articulation. Both the snout and the chest are finished at a flat angle. The mimicking of this 100-year-old "futuristic" aesthetic is preventing contemporary social robots from becoming a true and unique aesthetic expression of their time (Fig. 2.6).

In addition, rather than celebrating the merger of human and machine in robot design, many robots participate in the concealment of their reality, a fallacy already critiqued of the streamlined design of consumer goods, as discussed above. While streamlined design emerged in part as a result of the mass manufacturing techniques that promised to democratize luxury and convenience, it was quickly adopted as a veneer aesthetic, hiding the complexities of the machine that does the work. Robots today exploit the same metaphorical connotations to suggest a futuristic fantasy of



Fig. 2.6 Henry Gaudier-Brzeska, *Dog*, 1914 (left) and SONY's, AIBO (ERS-110), 1999 (right)

a "smart device" or "intelligent companion." As with the General Electric refrigerator of the streamlined pencil sharpener, the smooth cladding of the robot hides its complexity and frailness. Similarly, the round edges of a smart speaker hide the messy natural and human resources that work behind the scenes to enable the fantasy of intelligent devices (Crawford 2021).

The mass manufacturing of robots themselves poses additional social and ethical concerns. Since robots are often considered autonomous, the mass manufacturing of an autonomous agent raises the issue of the value of uniqueness, as described in Hoffman (2020). Moreover, the objectness, neutrality, and anonymity suggested by a streamlined robot design also promises the same values that Streamline Moderne promoted: efficiency, speed, hygiene, and low friction. However, this fantasy of clean and low friction interaction with a robot can also come at a cost. As Hoffman suggests, building on Turkle (2007), the cleanliness of the robot interaction fantasy could lead to a world in which

> People will accept the obviously designed social behavior of a machine in place of real relatedness. (Hoffman 2020)

In other words, if robot designers promote the concept of an easy-to-interact companion, we might run the risk of people ultimately finding human interaction too difficult (Turkle 2007). Finally, robot designers must ask themselves what kind of social structure their design represents. The futuristic design of the mid-twentieth century spoke of a brave new world of materials and technologies in a servantless society, but also represented a conservative view of the family and the gender roles within it. What kind of society does a robotic device suggest when it nostalgically feeds on the design tropes of the early and mid-twentieth century?

2.4 The Cute Companion

The third significant trend in robot morphology is that of the cute robotic companion. From the earliest days of social robotics, Breazeal and Foerst (1999) identified that "[p]eople tend to react emotionally to someone or something 'cute"' in a "tender and caring way." They designed the robot Kismet using cute features to encourage users to "treat it like an infant, and to modify their own behavior to play the role of the caregiver." One of the motivations for doing so was to help the robot better read facial expressions and voice cues, as they would be exaggerated. This idea is also reflected in the design of the robot Simon by Diana and Thomaz (2011). The authors decide to incorporate "cute" features for "people to immediately perceive the robot's lack of initial knowledge, or 'innocence'," which would in turn encourage them to teach the robot. The robot's cute appearance can also help to set realistic expectations about a robot's capacity and thus avoid high user expectations in human–robot interaction, which are easily disappointed.

For reasons that may be cultural (Lee and Sabanović 2014), and also, as discussed above, in response to the complications that can accompany designing robots that are

too hyper-realistic, an observable aesthetic trend of cuteness has emerged in robot morphologies. Typified by the use of large bright eyes, pastel colors, soft or shiny surface treatment, use of a high-pitched voice, and an overall small stature, cute robots can be seen in many examples, from research prototypes like Blossom (Suguitan and Hoffman 2019) and DragonBot (Westlund 2015) to industry-manufactured robots such as SoftBank's Pepper robot (Lafaye et al. 2014), Amazon's Astro, and Samsung's Otto. While cuteness may be used to increase technology acceptance and invite interaction that is more appropriate for a robot's technology readiness level, further analysis of this aesthetic is needed to understand its cultural function and to encourage a more informed usage of cute morphologies in social robotics.

In her seminal work *Our Aesthetic Categories*, Ngai (2010) discusses the aesthetic categories of the zany, the cute and the interesting, and argues for the contemporary centrality of these aesthetic categories. She examines the category of cute with the same philosophical seriousness that has previously been afforded to beauty and the sublime in literature. Ngai describes the capacity for the aesthetics of cute, when applied to an object or product, to *commodify*, *domesticate* and *pacify*, with the further potential to render an object charming, irrelevant, vulnerable, and inconsequential. We explore these three consequences of a cute aesthetic in this section.

By way of illustration, Ngai (2012) describes a cute frog-shaped sponge that shares remarkable similarities with many social robot morphologies. It has "an enormous face (it is, in fact, nothing but a face), and exaggerated gaze (but interestingly no mouth)," which she says emphasizes the way that cuteness is often achieved by moving away from realism. In Ngai (2010), the author explains that

> realist verisimilitude or even formal precision tend to work against or even nullify cuteness. (2010, p. 64)

Ngai argues that the move away from detail and realism toward cute is best sought in objects with round contours and little to no detail, which suggest a certain pliancy and responsiveness, either materially or metaphorically, where "the less formally articulated… the cuter" (Ngai 2012). This rounded blob of detail-less mass is best accompanied by the qualities of "smallness, compactness, formal simplicity, softness and pliancy." While it is not a functionally plausible option for many social robots to be pliable or soft, some are, including The Hug (2003), Keepon (2007), PARO (2014), and Blossom (2019). Others imply their social pliancy and compliance through rounded contours, an exaggerated face, smallness, and simplicity of form.

In the remainder of this section, we discuss how cuteness aids in commodifying, domesticating, and pacifying a design, and ask what the implications are for robot appearances.

2.4.1 Commodify

Cuteness, according to Ngai (2012), while passive and pliable, is also seductive and "capable of making surprising demands," such as the demand to be purchased and

thus turned into a commodity. Ngai (2012) quotes Johnson (2010), who says that the purchaser of an object that uses a cute aesthetic is often

> seduced into feeling that buying the product is, in fact, carrying out the wishes of the product itself.

One must only consider the cute images of farm animals on the packages of animal food products as an example of this fallacy of transferring the wish of the consumer to the imagined wish of the product. In this manner, cuteness allows robots to transcend the category of "expensive research prototype" or "out-of-reach home appliance" and be trivialized, appealing to the consumerist tug to be purchased.

Cuteness also invites interaction. In the case of a cute small object, the aesthetic invites the "subject to handle it physically" (Ngai 2012). In robotics, cuteness also promotes interaction, inviting a viewer to move closer, and to participate and interact with a robot. However, cuteness has the power to go further than mere interaction. Ngai explains that consumption is conflated with identity, where "wanting to have" becomes "wanting to be like," and cuteness "thus produces what Doane (1987) describes as a "strange constriction of the gap between consumer and commodity," where "commodity and consumer share the same attributes."

In this symbiotic chicken-and-egg relationship, cuteness thus not only appeals to those wanting to be like the cute object, but cuteness is a mimetic aesthetic that generates more cuteness; those interacting with a cute object tend to get smaller and lower to the ground, the pitch of their voice getting higher, and they use "small sized adjectives." This blurring of boundaries is exploited by designers of cute artifacts, leading consumers to want to not only "own" but "adopt" objects. Adoption, however, brings with it an additional layer of object characteristics. Harris (1992) argues

> advertisers have learned that consumers will 'adopt' products that create … an aura of motherlessness, ostracism and melancholy.

2.4.2 Domesticate

A robot's cute aesthetic contributes not only to a robot's commercial appeal but also to its domestication, taming, and introduction into the sphere of the home. Young et al. (2009) argue that cuteness fosters the passage of the "Other" into domestic environments and is indicative of powerlessness, and therefore the implied safety of the consumer. In their study *Toward Acceptable Domestic Robots: Applying Insights from Social Psychology* (2009), they posit that

> one of the most important and unique barriers to the widespread adoption of robotics is an especially complex socialisation process,

and that for social robotics

> the problems of technology acceptance are far more significant in a domestic environment than an industrial one.

Young et al. (2009) argue that the domestic socialization or 'absorption' of social robots into domestic settings will be largely dependent on upon

> domestic consumer perceptions of what robots are [...] and what exactly they are and are not capable of doing.

The study contains guidelines for the acceptance of social robots, where the authors outline the importance of robot design methodologies, and how designers may choose to leverage user tendencies to anthropomorphize robot appearances to influence the user's perception of the harmlessness or safety of the robot. One example they cite is that consumers referred to Roomba robotic vacuum cleaners as "cute," thus

> [The] Roomba can become a social part of the home and in a sense, a social participant in the family, not that different from, say, a pet hamster.

To become a pet, however, an animal must be controlled, made submissive, and rendered harmless. In other words, it must be stripped of any surplus power or dominance. Cuteness is a design mechanism that aides in this process, as it

> solicits a regard of the commodity as an anthropomorphic being less powerful than the aesthetic subject, appealing specifically to us for protection and care. (Ngai 2012)

In this way, consumer concerns about the harmlessness and safety of domestic social robots might be assuaged through cuteness, which Lori Merish argues can transform "transgressive subjects into beloved objects" (Lori Merish in Ngai 2012, p. 60).

2.4.3 Pacify

As noted in the previous sections, Ngai (2005) argues that the aesthetic of cute is undeniably trivializing, and as noted above, this design choice embodies a sense of vulnerability that can evoke a desire in us to protect, potentially pacifying any concerns we may have about these "transgressive subjects." However, Ngai also asserts that the cute (just like the interesting and zany) can have an ambivalent nature that evokes contradictory effects. Specifically, cuteness can evoke both empathy and aversion (Ngai 2012), as well as both tenderness and aggression (Ngai 2005).

In *Cuteness*, Harris (1992) warns that cuteness

> disempowers its objects, making them appear more ignorant and vulnerable than they really are

and, as summarized by Ngai (2012), cuteness

> excites the consumer's sadism or desire for mastery as much as her desire to protect and cuddle.

The contradictory affective implications of cuteness can be seen in the treatment of a number of contemporary robots. HitchBOT, the hitch-hiking robot, was designed with several cute features. It has a digital smiley face, pool-noodle arms, yellow rain boots, and is completely dependent on the goodwill of the public to hitch-hike to its destination. HitchBOT successfully hitch-hiked across Canada and Europe, gaining a popular online following, but later met a violent end in Philadelphia, USA, where civilian pranksters fabricated a surveillance tape of them repeatedly kicking and eventually "destroying" the robot.

In a study of the cute, small, yellow robot named Keepon, Kozima et al. (2009) reported a variety of behaviors toward Keepon, including

> Violent versus Protective behaviour: … a boy … beat Keepon several times, and a girl stopped him, 'No! No!'. When [the boy] hit Keepon's head several times, [the girl] stopped him by saying 'It hurts! It hurts!'. [The boy] hit Keepon's head a couple of times … observing this, [the girl] approached Keepon and checked if it had been injured … stroking it gently."

In 2015, a man was reportedly arrested in Japan for allegedly "kicking a Pepper robot in a fit of rage," although the man admitted he was "frustrated with a store clerk." The robot reportedly now moves more slowly and has been permanently damaged. While the imbalance of power that cuteness affords robots may pacify them and render them unthreatening to humans, it evidently has the capacity to give rise to aggressive and exploitative behavior in their human counterparts.

The deliberate pacification of robots through a cute aesthetic may also carry other social undertones. Ngai explains that the act of "'giving face' to an object," particularly an expressive face to a dumb object with no mouth, is to "phantasmically make it lose face," which is categorically "an act of humiliation." Ngai describes the use of overly large eyes as "perversely literalizing the gaze (as described by Walter Benjamin)," enabling the robot to "empathetically return our gaze" while "other facial features—the mouth in particular—tend to be simplified to the point of barely being there" (Ngai 2012). It is interesting in this context to see how many cute robot designs have increased the eyes and either left out the mouth or made it unnaturally small (see examples such as Robotics Today's PaPeRo R500, 2001, and Mayfield Robotics' Kuri, 2017). This trend is also observable in the documented design stages for the robot Simon, where in the prototyping phase, the robot was modeled to include lips and a mouth, which were later removed, together with the decision to make the head smaller (Diana and Thomaz 2011). Ngai asserts that much like the appearance of Hello Kitty, the large eyes and lack of any mouth seem to "amount to denying speech," establishing and maintaining a strong power differential.

2.4.4 Implications

What are the implications of mass-producing and populating our homes with cute robotic agents that adoringly gaze at us and are unable to speak for themselves? Will this morphological subjugation be something we are called to account for?

Considering the symbiotic and mimetic powers of cuteness, is this belittling, helplessness, and subjugation something we also willingly bring upon ourselves? Social robot designers may unwittingly be designing cute robots in order to address interaction difficulties, aid in their complex socialization process, and boost commercial appeal. However, by pacifying, domesticating, and commodifying robots, they also run the risk of engaging with the politically and socially ambivalent nature of this aesthetic category, provoking elements of both engaging and potentially problematic responses from the human counterparts interacting with them. Furthermore, in light of the above, when we consider not only the process of humans designing and making robots, but also in defining robots as "making humans," this exploitation becomes particularly concerning.

2.5 Conclusion

This chapter traces historical origins and influences along with cultural implications on the most dominant robot morphological typologies. We specifically focus on the design tropes of cute companions, futuristic machines and human replicas. We posit that most robot designs today draw on these typologies and that almost all social robots today are located somewhere along the human replica–futuristic machine–cute companion spectrum.

Design is never "original," and just like any artifact design, the design of social robots is dependent on the cultural lineages that preceded them, and converse with the political and ethical implications that these lineages provide. Designing a social robot requires an informed awareness of the history and implications of the aesthetic that one is drawing upon and implementing. We issue a call to action for robot designers to explicitly choose and appreciate a certain aesthetic cultural lineage to build upon. This also calls for more scholarship into cultural topics as a basis for robot design and collaboration with those outside of traditional robotics research to contribute historical, cultural, and aesthetic knowledge to the design process.

In her discussion of Judith Butler's *Bodies That Matter* (1993), Suchman (2009) likens the "gendering" of human bodies over time through "the reiteration of norms" to technology construction, "as a process of materialization through reiterative forms." She argues that these reiterative forms can come to represent more or less uncontested "normative identifications of matter." It is not argued here that these normative forms of human replica, futuristic machines, or cute companion robots are inherently problematic, or always inappropriate. Rather, it is argued that these forms have materialized through multiple iterations and have resulted in normative and largely uncontested robotic typologies. An acknowledgment of responsibility for this technology and its agential capacity must be paired with a commitment to the critique and continual contestation of these human-like machines, for, as contended by Dumouchel et al. (2017),

> [H]ow we live with robots, and what kinds of robots we live with, reflects our own moral character.

Šabanović (2010) similarly identifies that robot design contributes to the construction of "technoscientific imaginaries" or "narratives about social order, human behavior and psychology, and common norms." The integration of robots into human environs will impact social norms and values, and the manner of this impact may be shaped, in the first instance, by design. It is therefore the responsibility of roboticists to be aware of their agency and responsibility in shaping social and cultural norms through design, and to seek to integrate aesthetic choices in an ethical and informed way.

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