Cultivating the Uncanny: *The Telegarden* and Other Oddities

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Abstract The concept of the Uncanny has attracted the attention of art critics and scholars for over a century. Freud's 1919 essay *The Uncanny* considers objects and other phenomena that evoke a powerful psychological response of fear and fascination. Freud links the human experience of the Uncanny—essentially an awareness of awareness—to repressed fears and desires. The Uncanny Valley—a related but distinct concept—was proposed by Masahiro Mori in 1970 concerning the design of robots and prosthetics. This chapter explores the Freudian and Morian concepts of the Uncanny and their influence on artists working with robots. We identify two categories: the representational uncanny is triggered by objects that look lifelike, and the experiential uncanny is triggered by non-anthropomorphic phenomena that behave in ways that signal awareness. We focus on the latter in our examination of three artworks—*The Telegarden* (1995), *Six Robots Named Paul* (2012), and *The Blind Robot* (2013)—which create a heightened atmosphere of awareness and challenge assumptions about authenticity and agency.

Some of the grandest and most overwhelming creations of art are still unsolved riddles to understanding.
Sigmund Freud

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I.

How does the uncanny function in robotic art? Does the English word "uncanny" accurately convey the unique mixture of arousal and fear, familiarity and strangeness implied in the German *unheimlich*? And what is the relationship between Freud's 1919 essay "*Das Unheimliche*" and Masahiro Mori's 1970 article "*Bukimi no tani gensho*"?

On May 10th, 2013, a group of thirty scholars, artists and roboticists came together to explore these questions at the *Art and Robots* workshop held at the International Conference on Robots and Animation (ICRA) in Karlsruhe, Germany.[1] Questions surrounding translations (German, Japanese, English) and of Freud's influence on Masahiro Mori (who does not speak English) arose repeatedly that day. Professor Hirochika Inoue, a renowned expert in robotics and former student of Masahiro Mori offered to telephone Mori (now in his eighties) in Tokyo to inquire. Professor Inoue soon returned with a surprising and perplexing report: Masahiro Mori said that he was completely unfamiliar with Freud's essay and had never heard of the link with Freud until Inoue's call.

Professor Inoue and the workshop organizers soon began planning an event to be held in Tokyo that November. *Revisiting the Uncanny Valley: A Tribute to Masahiro Mori* was attended by over 200 researchers at the International Conference on Intelligent Robots and Systems (IROS) in Tokyo, Japan.[2] Professor Mori discussed his research on prosthetic hands that led him to develop the theory of the Uncanny Valley. During his presentation, Mori expressed delight at learning that his essay (which was well known to robotics researchers and artists for over 40 years) had been "re-discovered" by researchers in 2012. Mori's unfamiliarity with Freud and the significant impact of his own essay over the past four decades prompted us to investigate further. If there was no direct link between Freud and Mori, were the two authors describing the same effect? How have these theories

[1]The workshop was organized by Ken Goldberg (UC Berkeley), Heather Knight (Carnegie Mellon University), and Pericle Salvini (Scuola Superiore Sant'Anna), and included presentations by Minoru Asada (Osaka University), Niklaus Correll (University of Colorado), Raffaello D'Andrea (ETH Zurich), Louis-Philippe Demers (Nanyang Technological University), Kyle Gilpin (Massachusetts Institute of Technology), Ken Goldberg, Guy Hoffman (IDC Media Innovation Lab), Ian Ingram (independent scholar), Hiroshi Ishiguro (Osaka University), Elizabeth Jochum (Aalborg University), Heather Knight, Todd Murphey (Northwestern University), Chang Geun Oh (Seoul National University), Pericle Salvini, Reid Simmons (Carnegie Mellon University), Stelarc (Brunel University), and Patrick Tresset (Goldsmiths University London). A summary of the workshop can be found at [14]: http://uncannyvalley_icra2013.sssup.it.

[2]*Revisiting the Uncanny Valley: A Tribute to Masahiro Mori* was held November 6, 2013 in Tokyo, Japan. The event was organized by Ken Goldberg, Minoru Asada (Osaka University), Hirochika Inoue, Sigeki Sugano and Erico Guizzo. Masahiro Mori's presentation was translated by Norri Kageki. Presentations were given by Ken Goldberg (UC Berkeley), Masaki Fujihata (Tokyo University of the Arts), Hiroshi Ishiguro (Osaka University), Elizabeth Jochum (Aalborg University), Oussama Khatib (Stanford University), Peter Lunenfeld (University of California, Los Angeles), Marek Michalowski (Carnegie Mellon University) and Todd Murphey (Northwestern University). Details of the event can be found at: http://goldberg.berkeley.edu/art/uncanny-summit/.

shaped design approaches in robotics, and what role does the Uncanny play in contemporary robotic art? Here we try to answer these questions by uncovering the links between the Freudian Uncanny and the Uncanny Valley, paying specific attention to anthropomorphic and non-anthropomorphic tendencies in robotic art.

We begin our investigation by tracing the experience of the Uncanny to modern anxieties concerning machines and automation. The Age of the Automaton coincided with the Enlightenment and a shift away from religious and spiritual understanding towards scientific and rational explanations of biology and nature. During the seventeenth century, the bodies of animals and human beings were increasingly regarded as complex machines, a philosophical stance that prompted fierce debate over what, precisely, separated humans from machines. The man-machine debate in philosophy coincided with new automation practices in agriculture and manufacturing that raised fears about machines replacing human labor and potentially subjugating human beings [26]. Not unlike the automata that featured prominently in literature and art works of this period, contemporary robotic art works continue to fuel popular imagination and raise critical questions about human experience and the urge to create mechanical life. The Uncanny is central to understanding the complex human reaction to robots and other technologies that signal agency or awareness.

Both the Freudian and Morian definitions of the Uncanny pivot on figures of artificial dolls, wax mannequins and anthropomorphic objects. Whereas Freud focuses on uncanny effects in literature (he cites E.T.A. Hoffman's *The Sandman* as the literary uncanny *par excellence*), Mori emphasizes the physical design of robots and prosthetics. In contemporary art, the notion of the Uncanny seems to shift away from anthropomorphism towards issues concerning authenticity and awareness. In an increasingly computational world, we are less concerned by robots that look humanlike than we are about our inability to distinguish between the real and the virtual. The contemporary Uncanny can be said to hinge on heightened experiences that provoke ambiguity about the authenticity of experience or the "aliveness" of an artefact.

Automata and anthropomorphic robots provoke the Uncanny through their remarkable lifelike appearance, but there is another category of robotic art that triggers the Uncanny through behaviors that signal awareness. We define humanoid robots as evocative of the *representational uncanny*, because they deliberately evoke the human form and shape. Examples of the representational uncanny include human-shaped automata built by Jacques de Vaucanson and Pierre and Henri-Louis Jaquet-Droz in the eighteenth century, waxwork figures found in Madame Tussaud museums, and contemporary androids such as Hiroshi Ishiguro's Geminoid HI-4(Fig. 1). A second class of artworks provoke what we call the *experiential uncanny*, where spectators perceive the robot as having agency, where the Uncanny occurs when the robot is perceived as alive or aware in ways that we typically associate with animate objects. Defining two classes of uncanny reveals their common trait: both create an *awareness of awareness*.

The aesthetic interest in behavior of interactive artworks is consistent with trends in robotic art that began during the 1960s with the advent of kinetic art and behavioral sculptures. In the twenty-first century we have become operators of online puppets, digital avatars and tele-operated robots, and it becomes increasingly difficult to distinguish real experiences from virtual ones. In this new

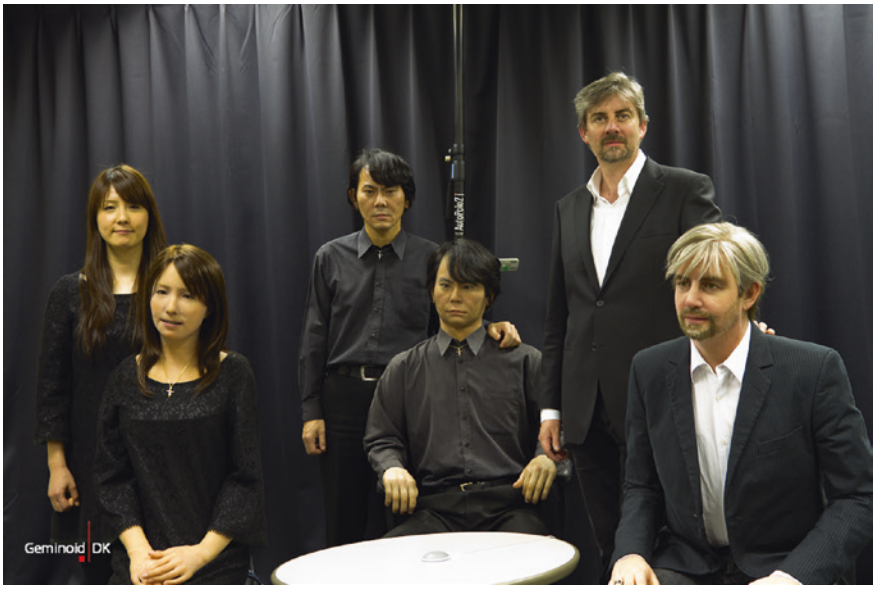

Fig. 1 Humanoid robots like the Geminoid (by Hiroshi Ishiguro at the Advanced Telecommunications Institute in Japan) provoke the Uncanny through their lifelike appearance and realistic movements. They are examples of the representational uncanny. (Photo by Julie Rafn Abildgaard)

landscape, the means through which objects and other phenomena provoke the Uncanny develop in new directions.

This chapter is organized in four sections. We first outline the emergence of the Uncanny during the Enlightenment in relation to the wider interest in monsters, scientific instruments and other "oddities" during the period. The second section focuses on Freud's discussion of the Uncanny in relation to psychological experiences (such as *déjà vu*), internal drives (such as the death instinct) and aesthetics. The third section considers Mori's essay in light of trends in robotics, sculpture and visual art. The final section considers three contemporary non-anthropomorphic robotic artworks that trigger the experiential uncanny. These interactive artworks raise troubling questions of authenticity and robot agency.

II. The Roots of the Uncanny

> When our first encounter with some object surprises us and we find it novel, or very different from what we formerly knew or from what we supposed it ought to be, this causes us to wonder and be astonished at it. Since this may happen before we know whether the object is beneficial to us, I regard wonder as the first of all the passions.
>
> Descartes, *The Passions of the Soul*, 1649[3]

[3]In Onians, J [22] A Short History of Amazement, p. 18.

> The eighteenth century in a sense "invented the uncanny"…the very psychic and cultural transformations that led to the subsequent glorification of the period as an age of reason or enlightenment—the aggressively rationalist imperatives of the epoch—also produced, like a kind of toxic side effect, a new human experience of strangeness, anxiety, bafflement, and intellectual impasse.
>
> Terry Castle, *The Female Thermometer*, 1983[4]

The Uncanny emerges from the Age of Wonder. The scientific revolution of the Enlightenment signaled both scientific and philosophical breaks with earlier notions of animism and spiritual beliefs, paving the way for both belief and skepticism in machines. This tension between belief and skepticism is at the heart of the late eighteenth century notion of the Uncanny. The Enlightenment interest in automata and their literary representations in Gothic fiction trace back to earlier creation myths concerning artificial life, from Homer's *Iliad* to the Golem myth (recounted in the tenth century *Sefer Yetsirah*, or *The Book of Formation*). The promise and threat of mechanical life gained new urgency as clockwork mechanisms assumed the shapes of humans and animals. In the previous centuries, philosophers such as René Descartes (*The Description of the Human Body*, 1647) and Julien Offray de La Mettrie (*Man a Machine*, 1748) described living bodies in mechanical terms, and late eighteenth century automata were exhibited as scientific "proof" that biological functions (such as breathing, digestion, blood circulation) could be reproduced mechanically. These proto-robotic technologies drew large crowds at public scientific lectures and captured the imagination of fiction authors. If, as Terry Castle has suggested, the eighteenth century "invented" the Uncanny, we might speculate that the Uncanny's pre-history can be found in seventeenth century philosophy. As evidence, we look to the enthusiasm for biological oddities and scientific instruments—the telescope, the microscope, and the barometer—that expanded our capacity to perceive and make sense of the world.

The mix of fear and wonder that characterizes the Uncanny relates to the concepts of the sublime, the fantastic and wonderment. Art historian John Onians connects the scientific and philosophical study of amazement with the proliferation of *Wunderkammer* (chamber of curiosities) during the seventeenth century.[5] *Wunderkammer* were collections of exotic art works, strange artefacts and other oddities held in private collections throughout England and Europe that gradually became material representations of self-understanding.[6] In the same period, the development of the microscope and the telescope made possible new sights and new modes of seeing: these tools were regarded as wonders fit for inclusion in the *Wunderkammer*. Optical instruments had the ability to turn anything into an object of wonder "whether by enlarging the familiar to make it strange or by bringing the

[4]Castle, T [4] The Female Thermometer, p. 8.

[5]Onians, J [22].

[6]Hagner, M [12] Enlightened Monsters, p. 187.

remote and invisible closer to give it novelty."[7] We will elaborate further on defamiliarization as a strategy in modern art, but what interests us is how optical tools and scientific instruments came to be regarded as aesthetic objects in their own right. Ocularism—the study of the eyes and ocular prostheses or enhancement—is a recurrent theme for Freud and central to his understanding of the Uncanny (eyeglasses, eyes and telescopes feature prominently his discussion). We do not suggest that every object that provokes wonder can be regarded as uncanny, or that the seventeenth century concept of wonder is synonymous with the eighteenth century notion of the Uncanny; however we regard the enthusiasm for *Wunderkammer* as evidence of aesthetic interest in scientific tools and material artefacts that create an awareness of awareness.

Popular interest in the Uncanny coincides with the movement away from religious belief towards scientific and rational explanations of the natural world. During the "Golden Age of Automata"[8] (or, alternately, what Gaby Wood calls the "Golden Age of the philosophical toy"),[9] mechanical statues became concrete symbols of materialist philosophical treatises (by Diderot, Rousseau, Voltaire, and La Mettrie) that sought to describe nature and biology in mechanistic terms. The Enlightenment interest in oddities and monsters from the natural word that eluded classification became the subject of scientific inquiry into the "invisible and dynamic processes of life," and the automaton became a symbol for the pursuit to replicate these processes through engineering. Androids (human-shaped automata) built by Jacques de Vaucanson, Henri and Pierre Jaquet-Droz and Wolfgang von Kempelen dealt head-on with the Uncanny. Coupled with new manufacturing processes of the Industrial Revolution, the preoccupation with machines and our relation to technology became a central concern in aesthetics and philosophy. As Gaby Wood proposes in *Edison's Eve*, "Men understood as machines and machines built to resemble men went hand in hand—it hardly mattered which had come first. Androids were more than curiosities: they were the embodiment of a daring idea about the self."[10] Androids formalized notions of mechanized human labor and society by combining the clock and the statue, fomenting the notion that living beings could be viewed as machines. But automatons were not in and of themselves uncanny: to evoke the Uncanny, something more was needed.

A machine that signals agency stimulates the uncanny by creating a heightened atmosphere of awareness. In this moment, the machine moves from being an object of wonder or fascination into the realm of the Uncanny. Vaucanson's flute player, first exhibited in 1738 at the Royal Academy of Sciences in Paris, was deeply troubling to audiences because it signaled awareness through a mechanism that simulated breath:

[7]Onians, J [22] p. 20.

[8]Kang [18] Sublime Dreams of Living Machines.

[9]Wood, Gaby [30] Edison's Eve, p. 17.

[10]Wood, G [30] p. 17.

> This automaton ***breathed***. Even though the art of mechanics was sophisticated enough by then to make a machine perform many other movements, and even though Vaucanson unveiled the fact that this breath was created by bellows, the very act of breathing, seen in an inanimate figure, continued to cause a stir well into the following century.[11]

The uncanny effect of the breathing android stems not only from its lifelike appearance but from what the breath signified: the possibility of the android's animacy and awareness. The possibility of a self-aware machine triggers the Uncanny because we can no longer be certain who is observing whom (or what intelligence lies behind the mechanism). The inability to resolve this question provokes a heightened state of awareness in the viewer.

Similar androids and automata followed. Pierre and Henri-Louise Jaquet Droz's android organ player also simulates breathing, and the captivating "spell" of the android's lifelike appearance is heightened through a series of small animations that embellish the organ playing but are not central to it: mechanized movements of the head simulate reading the sheet music, artificial eyes shift focus between the android's hands, the sheet music and the audience, and the performance ends with the android bowing to the audience.[12] Such programmed behaviors signal a preoccupation beyond scientific demonstration: they deliberately heighten the illusion that the android is self-aware and create an uncanny effect. The android behaves "as if" it had the faculties of sight and hearing and were conscious of its presence in front of an audience. Through these animations, the line between "real" automata becomes entangled with "sham" automata like Von Kempelen's chess player, which offered the illusion of mechanical life but was controlled by a hidden human operator. The boundary between the real and imaginary, and the line between animate and inanimate objects, becomes increasingly difficult to discern. This interplay of fascination (of the robot's remarkable human-likeness) and fear (that it may actually be alive) causes the experience of intellectual uncertainty that Jentsch and Freud will later identify as central to the Uncanny.

Following their appearance in scientific demonstrations, automata began to feature prominently in nineteenth century Gothic fiction, a genre that combines Romanticism with horror to elicit a pleasurable experience of terror. Gothic narratives frequently intertwine themes of the supernatural and the occult with figures of the double and automata: E.T.A. Hoffman's *The Sandman* (1816), Mary Shelley's *Frankenstein* (1818) and Edgar Allen Poe's short stories (*Oval Portrait*, 1842) are notable instances of automata and robots in fiction,[13] and indicate a popular fascination with the Uncanny that predates Freud's essay. The link between the Uncanny and androids is exemplified in Hoffman's *The Sandman*, which centers on the figure of a female automaton and the obsession of the young man who mistakes it for a real woman. Hoffman was familiar with Vaucanson's automata

[11]Wood, G [30] p. 25.

[12]Cohen, John [6] Human Robots in Myth and Science, p. 88.

[13]Cohen, J [6].

and drew on illustrations and diagrams from Johann Christian Wiegleb's *Instruction in Natural Magic, or All Kinds of Amusing Tricks*.[14]

Interest in the Uncanny (and in Hoffman's *The Sandman* in particular) inspired psychoanalyst Ernst Jentsch to write *On The Psychology of the Uncanny*[15] in 1906. Jentsch proposed that the Uncanny arises from objects or situations that trigger intellectual uncertainty, such as when we have difficulty categorizing or explaining objects that defy or disrupt our expectations. Jentsch is not so interested in defining the essence of the Uncanny as he is with understanding the affective response in psychological terms, or "how the psychical conditions must be constituted so that the 'uncanny' sensation emerges."[16] Making the familiar strange, rendering the invisible visible, and linking strange objects of uncertain origin with automata and Gothic literature are the foundations upon which Freud launches his investigation of the Uncanny.

III. The Age of the Uncanny

> An uncanny effect is often and easily produced when the distinction between imagination and reality is effaced, as when something that we have hitherto regarded as imaginary appears before us in reality, or when a symbol takes over the full functions of the thing it symbolizes, and so on.
>
> Freud, *The Uncanny*[17]

Freud's essay *Das Unheimliche* is an important reference for twentieth century critical theory and discourse. Harold Bloom calls it "the only major contribution that the twentieth century has made to the aesthetics of the sublime,"[18] and Hugh Haughton observes, "It is not only a theoretical commentary on the power of strangeness, but one of the weirdest theoretical texts in the Freudian canon."[19] In her post-structuralist reading, Hélène Cixous argues that the act of reading Freud's essay itself provokes an uncanny awareness, calling the essay "less a discourse than a strange theoretical novel."[20] Originally published in 1919 in the psychoanalytic

[14]Wood, G [30] p. 33.

[15]*Zur Psychologie des Unheimlichen* was published in two installments in the *Psychiatrisch-Neurologische Wochenschrift* in two parts (25 Aug. 1906) and (1 September 1906). The essay is translated by Roy Sellars and was published in Collins R, Jervis J (2008) Uncanny Modernities.

[16]Jentsch, E [16] On the psychology of the Uncanny. In: Collins J, Jervis J (eds) Uncanny Modernities, p. 217.

[17]Freud, S [9] The Uncanny, p. 244.

[18]Bloom, H [1]. "Freud and The Sublime: A Catastrophe Theory of Creativity." *Psychoanalytic Literary Criticism*. Ed. Maud Ellman. New York: Longman Publishing. 182.

[19]Haughton, H [13] The Uncanny. p. xliii.

[20]Cixous, H [5] Fiction and its Phantoms. p. 525.

journal *Imago*, Freud's essay investigates the "common core" of what makes certain objects, experiences or phenomenon appear uncanny rather than merely frightening. The essay was first translated into English by James Strachey (in collaboration with Anna Freud) and published in 1925 as *The Uncanny*.[21]

In his efforts to identify "that class of the frightening" unique to the Uncanny, Freud considers a range of objects and experiences drawn from literature to construct an aesthetics of the Uncanny. His inability to structure a unified theory says much about the elusive nature of the Uncanny and its entanglement with aesthetic philosophy, psychology and literary theory. The essay begins with a lexical index of the German word *unheimlich*, through which Freud concludes that *heimlich* belongs to two distinct—but not contradictory—sets of ideas: that which is familiar and agreeable and that which is concealed or hidden.[22] Through usage, Freud argues, *unheimlich* gradually became synonymous with the second meaning of *heimlich*, leading him to assert that "everything is *unheimlich* that ought to have remained secret and hidden but has come to light."[23] Armed with this definition, Freud offers a reading of *The Sandman* that connects the Uncanny with the subconscious and repressed desires.

Freud's interest is what the Uncanny reveals about key psychoanalytic concepts such as repression, castration anxiety, narcissism, the death instinct, involuntary repetition and wish fufilment. In his reading of *The Sandman*, Freud skips over the figure of the automaton and instead focuses on the Sandman of the title—the mysterious figure who never appears in the story and is believed to tear out children's eyes. For Freud, *The Sandman* is not about intellectual uncertainty but about fear of ocular castration, itself a symbol of repressed castration anxiety. According to literary theorist Samuel Weber, Freud's theme of ocular castration is not rooted in fact or experience ("the actual moment of non-perception"), but rather signifies a "restructuring of experience, including the relation of perception, desire and consciousness in which the narcissistic categories of identity and presence are riven by a difference they can no longer subdue or command."[24] This reading would suggest that the Uncanny is not necessarily about "not-seeing" but rather about heightened perception triggered by an object or phenomena. In other words, the Uncanny is triggered by objects or experiences that provoke the awareness of awareness.

Freud insists that a general theory "should differentiate between the Uncanny that we actually experience and the Uncanny that we merely picture or read about."[25] For Freud, this distinction uniquely positions creative writers and artists

[21]Freud, S [9] The Standard Edition of the Complete Psychological Works of Sigmund Freud.' XVII (1917–1919): *An Infantile Neurosis and Other Works.*

[22]Freud, S [9] p. 224.

[23]Freud, S [9] p. 225.

[24]Weber, Samuel [29] p. 217.

[25]Freud, S [9] p. 247.

to evoke or avoid the Uncanny in their works. For Freud, fiction is "more fertile province than the Uncanny in real life, for it contains the whole of the latter and something more besides, something that cannot be found in real life."[26] In art, the artist may "select his world of representation so that it either coincides with the realities we are familiar with or departs from them in what particulars he pleases."[27] Freud links the Uncanny to the perceptual stance we adopt towards works of fiction: "we adapt our judgment to the imaginary reality imposed on us by the writer, and regard souls, spirits, and ghosts as though their existence had the same validity as our own has in material reality." Artists, in Freud's view, provoke the Uncanny by exaggerating or distorting reality, or by staging events or experiences that could never occur in real life. The artist thereby re-exposes the viewer

> […] to the superstition which we have ostensibly surmounted; he deceives us by promising to give us the sober truth, and then after all overstepping it. We react to his inventions as we would have reacted to real experiences; by the time we have seen through his trick it is already too late and the author has achieved his object.[28]

The deliberate exaggeration or distortion of reality for artistic purposes relates to the strategy of defamiliarization caused by optical instruments that rendered the invisible visible.[29] For Freud, the Uncanny occurs when strange or fantastic objects - or the experience of objects - depicted in fiction are experienced as real, so that we come to regard these aberrations with the same validity as our own material reality.

Freud's interest in the Uncanny coincides with the advent of machine culture in the early twentieth century. The proliferation of electrical machines in manufacturing, war and medicine elicited contradictory responses from the artistic avant-garde. Artistic responses ranged from glorification of the machine and its potential to liberate humans (the Futurists), celebration of the machine as the harbinger of social progress (the Constructivists), to profound fear and anxiety about the oppressive and destructive potential of machines (the Expressionists and Dadaists).[30] Among the visual arts, sculpture proved fertile ground for exploring the Uncanny effects of mechanization. This is partly due to sculpture's position as the "most literally and rawly material of art forms"[31] and the contradictory responses provoked by sculptural representations of the human form. In *Compulsive Beauty*, Hal Foster identifies the Uncanny as the defining concept for Surrealism, linking art works by

[26]Freud, S [9] p. 249.

[27]Freud, S [9] p. 249.

[28]ibid. p. 251.

[29]Defamiliarization is also a key concept in twentieth century art criticism, and informed visual art: Viktor Skhlovsky [27] uses the Russian word *ostranenie* while Brecht refers to the *Verfremdungseffekt* or Alienation effect.

[30]Jochum, E [16] Deus Ex Machina, p. 84.

[31]Potts, A [24] Dolls and things, p. 355.

Breton, Bataille, de Chirico, Max Ernst and Hans Bellmer in the 1920s and 1930s to Freud's essay. According to Foster, the Surrealist interest in the Uncanny reflects

> a concern with events in which repressed material returns in ways that disrupt unitary identity, aesthetic norms, and social order…[S]urrealists not only are drawn to the return of the repressed but also seek to redirect this return to critical ends.[32]

The Surrealist preoccupation with the human form, wax figures and other artificial figures created a vogue for "mannequin art" in the 1930s, a legacy which continues in contemporary figurative sculpture. The 1920s and 1930s also witnessed the advent of motor-driven sculptures and mechanical art such as Alexander Calder's kinetic mobiles and Lászlo Maholoy-Nagy's *Light Space Monitor* (1922–1930), artworks that explore the intersection of sculpture and mechanical motion through non-figurative, non-representational forms. These early non-anthropomorphic art works laid the ground for later experiments by Jean Tinguely and Julio Le Parc, among others.

It is worth remembering that Karl Capek's science fiction melodrama *R.U.R.* (Rossum's Universal Robots)—the play that first introduced the term "robot"—was published 1920, one year after the publication of *The Uncanny*. The dystopian play dramatizes the destruction of human civilization by humanoid robots designed for industrial manufacturing. The play taps into fears about the inability to understand or control the internal mechanisms that govern machines, and dramatizes human fears concerning mechanized labor. During the same period, abstract paintings by George Grosz (*Heartfield, the Mechanic*, 1920; *Daum marries her pedantic automaton*, 1920) imagined artful assemblages of the man-machine, while kinetic sculptures and machine art (Tinguely's *Radio Drawing*, 1962, Edward Paolozzi's *St Sebastian No. 2*, 1957, and Ernest Trova's *Study Falling Man*, 1966) flourished. These art works set the stage for the development of robotic art in the 1960s and 1970s.

IV. The Uncanny Valley

> Man is a robot with defects.
>
> Emile Cioran

In 1970 Mori published *Bukimi no tani gensho* in a special issue of the trade journal *Energy* titled "Robots and Thought." The premise of Mori's essay is well known: human beings have an innate affinity for inanimate objects that look human-like, but if the object becomes too lifelike without actually being alive, this affinity quickly turns to fear or repulsion. Mori maps the relationship between affinity and human likeness on a graph, where the horizontal axis is the degree

[32]Foster H [8] Compulsive Beauty, p. xvii.

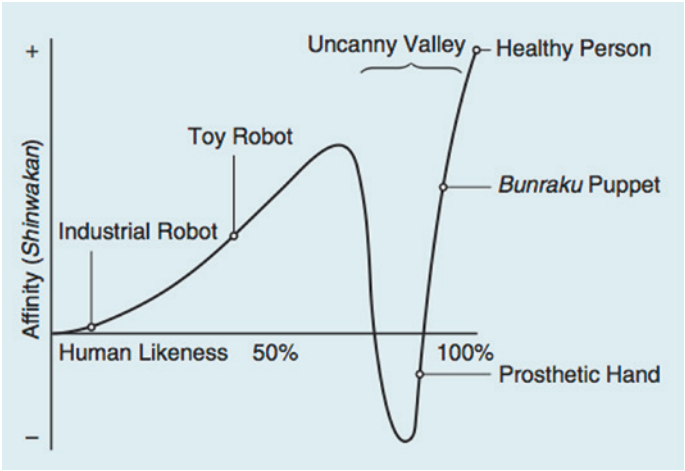

Fig. 2 The Uncanny Valley graph first appeared in Mori's essay in 1970. The graph illustrates Mori's ideas about how humans perceive robots: human beings have an innate affinity for objects shaped like humans, but if the object becomes too lifelike without actually being alive, this affinity quickly turns to fear or repulsion. (Graph translated and reprinted with the permission of Karl F. MacDorman)

of an object's similarity to a living human and the vertical axis is the degree of affinity humans have for a given object (Fig. 2). Mori posits a non-linear function with a sharp negative extreme (loss of affinity) as likeness increases beyond a critical point (where phenomena start to appear "too close for comfort"). Drawing on examples from popular culture (puppet theatre, toy robots) as well as medical and industrial robots, Mori echoes Freud's catalogue of objects and experiences drawn from fiction and real-life. Citing his prior work with realistic, moving prosthetic hands, Mori states that the Uncanny effect is amplified with movement, which steepens the curves of the Uncanny Valley (Fig. 3).

Mori considers functional and aesthetic approaches to design:industrial robots typically have designs based on functionality while toy robots and prosthetics focus primarily on appearance. Mori's concept of affinity is rooted in the popularity of human-shaped toys and puppets and the pleasure we derive from objects that look humanlike. Mori cites the human tendency to become absorbed in toys and puppets and our willingness to suspend disbelief and engage in imaginative play. Puppets, Mori states, are not inherently uncanny because we view them at a distance [33]: this critical distance acknowledges the perceptual stance reserved for works of art or fiction. Like Freud, Mori acknowledges that objects in fiction may be experienced as real or true and endowed with an artificial life, so long as that reality does not threaten our own material reality.

[33]Mori, M (1970) The Uncanny Valley, p. 99.

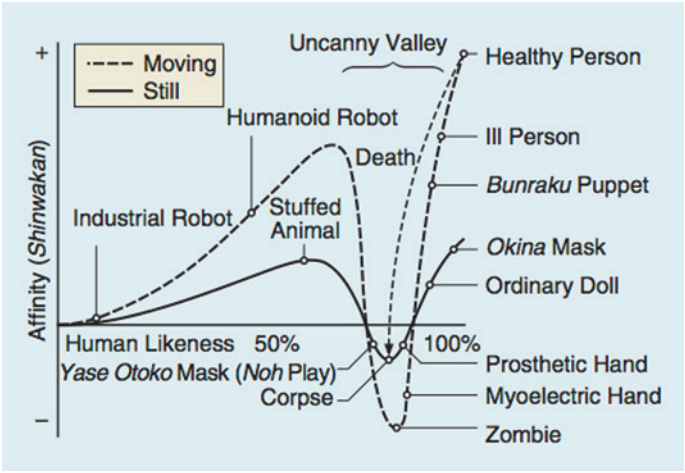

Fig. 3 Mori's second graph illustrates the effect of movement on the Uncanny Valley. The presence of movement amplifies the curves of the graph, suggesting that human perception is highly influenced by movement. (Graph translated and reprinted with the permission of Karl F. MacDorman)

Mori's essay coincides with the 1970 International World Exposition (*Expo'70*) held in Osaka, Japan. The theme of *Expo'70*, "Harmony and Progress for Mankind," highlighted the country's social and economic recovery in the wake of the World War II and sought to strengthen Japan's international reputation as a world leader in innovative manufacturing and electronic technologies. Mori—then a professor at the Tokyo Institute of Technology—advises robot designers to avoid making robots that appear too humanlike. Mori's observations are tied to his own childhood experiences with wax figures and mannequins and his later research on electronic prosthetic hands.[34] Mori briefly touches on whether the Uncanny is somehow related to human survival instincts, but he does not elaborate on this point. Although he makes no direct mention of then-contemporary trends in cybernetic and robotic art, the timing of the article with *Expo'70* (which featured numerous robotic art works) suggests that Mori was likely aware of trends in robotic art and popular interest in robots. Reading Mori's essay within the broader cultural framework of visual art and engineering research suggests how the notion of the Uncanny evolves in relation to new technologies and cultural trends.

There were few active research projects to build realistic humanoid robots in the 1970s, but the wish to develop an artificial human has long been a goal of robotics research.[35] Even though there were no realistic humans robots at the time, advancements in visual art and sculpture demonstrated the possibility of

[34]Kageki, N [18] An Uncanny Mind, p. 112.

[35]Mori, M [21] p. 98.

constructing realistic, lifelike replicas that could pass—even momentarily—as authentic humans. Sculptures by George Segal (*The Dinner Table*, 1962), Frank Gallo (*Walking Nude*, 1967) and John D'Andrea (*Couple* 1971) raised the threshold for the representational uncanny in visual art. Human-scale statues reproduce human anatomy in precise detail and provoke aesthetic defamiliarization that renders the human body simultaneously both familiar and unfamiliar. Techniques in photorealism (or *hyper-realism*), reignited the debate about realism and representation in art. Here, the Uncanny emerges from the evocative and unflinching look at the everyday in three dimensions—or what art historian John Welchman calls a "surplus of counterfeit and *trompe l'oeil* illusionism." The voyeuristic sculptures signal a preoccupation with sex and death, the haunting double, and erotic desire—all hallmarks of the Freudian Uncanny. Like death masks, preserved corpses and other *memento mori*, these art works recall deathly images and deliberately provoke anxiety about what separates the living and the dead. It is not a huge leap to imagine how these artistic techniques could be combined with mechanisms and computational control to create realistic, moving androids.

The field of animatronics developed in the 1960s and 1970s, combining new techniques in figural sculpture with robotic actuation entertainment and medical training robots. Six years prior to the publication of Mori's essay, Disney engineers unveiled a life-sized, walking and talking animatronic Abraham Lincoln at the Illinois State Exhibition at the New York World's Fair,[36] and in 1967 researchers at the University of Southern California School of Medicine developed a realistic, life-size plastic dummy for training medical students. Like their eighteenth century counterparts, medical androids simulated biological behaviors that corresponded with real patient symptoms, and researchers speculated on future humanoid robots capable of sweating, bleeding, and displaying evermore realistic behaviors.[37] In art historian Jack Burnham's view, animatronics display a "carnal anthropomorphism of plastic and electronics" that indicate the "return the humanoid robot to a place of competition with other visual mass media."[38] We do not suggest that Mori was aware of these trends in visual art (animatronics do not feature on his graph), but we do find relevance in the contemporaneity of Mori's theory with the trend of photorealism in sculpture and entertainment robots. Like androids in previous centuries, robots in fiction and their real-life counterparts inspire cultural fascination and fear surrounding the dream and threat of new (or imagined) technologies.

Mori's essay coincides with other high-profile events that merged art and robotics, such as the *9 Evenings: Theatre and Engineering* convened by Billy Klüver,

[36]Burnham, Jack [3] Beyond Modern Sculpture, p. 323.

[37]Burnham, J [3], p. 324.

[38]Burnham, J [3], p. 323.

Fred Waldhauer, Robert Rauschenberg, Robert Whitman in New York (1966) and *Cybernetic Serendipity* in London (1968), which featured many robotic art works. These events were venues for non-anthropomorphic art works like Edward Ihnatowicz's *Senster*, Jean Tinguely's painting machines, Nam June Paik's *Robot K-456* and Nicholas Schöffer's *CYSP I* are deliberately non-anthropomorphic and shift the focus from representational issues to questions of agency and behavior.[39] Interactivity and interest in the relation between objects demonstrates the "performative turn" in visual art that deliberately blurred the lines between visual art and performance[40]

Robots and popular culture intertwine in Japan at the very moment Mori writes the *Uncanny Valley*. The *manga* series *Astro Boy*—based on the adventures of a humanoid robot—was published between 1952 and 1968 and inspired a television series in 1963. The author of the series, Tezuka Osamu, designed the Fujipan Robot Pavilion for *Expo'70* which featured imaginative robots that dramatized a future of humanoid robots in a wide range of settings. Another *Expo'70* exhibit brought together international artists and engineers: *EAT* members Robert Breer and Billy Klüver collaborated with David Thomas of Pepsi Cola to design the Pepsi pavilion dome in Osaka, which was covered by a fog sculpture by Fujiko Nakaya.[41] The dome was surrounded by Robert Breer's self-propelled styrofoam *Floats*, six-foot white sculptures that moved around the perimeter of the dome and displayed "evidences of social behavior."[42] While Mori may have been unfamiliar with trends in animatronics and photorealistic sculpture, he was likely familiar with these robotic art works shown in his native Japan.

The first English translation of Mori's essay appeared eight years after the original essay was re-published in Jasia Reichardt's book *Robots: Fact, Fiction, and Prediction* (1978). Reichardt (who curated *Cybernetic Serendipity* and was familiar with the artists and art works shown at *Expo'70*) credits her friend and collaborator Kohei Sugiura with introducing her to Mori's essay and providing her with "otherwise quite inaccessible Japanese material,"[43] including a summary of Mori's article and illustrations. We contacted Reichardt about the translation of *Bukimi no tani gensho* into the English "Uncanny Valley"—a translation that invites obvious parallels with Freud's essay. Reichardt was unable to recall who was responsible for the first translation of Mori's essay.[44] Her summary was the only translation available until Karl MacDorman, professor of Human-Computer Interaction at Indiana University, translated Mori's complete essay in the early 2000s. *The Uncanny Valley* was retranslated by MacDorman and Norri Kageki for the IEEE

[39]Bown, J [2] The Machine as Autonomous Performer, p. 77.

[40]See Goldberg, R [11] and Fischer-Lichte [7] for further discussion.

[41]Packer [23] Future Cinema, p. 145.

[42]Burnham, J [3], p. 354.

[43]Reichardt, J [25] Robots: Fact, Fiction and Prediction, p. 4.

[44]Jasia Reichardt (2014) personal email message to authors.

Robotics and Automation Magazine in 2012. Mori's essay continues to be an important reference for artists, engineers and animators working across many disciplines and has become increasingly relevant in light for contemporary research in humanoid robotics.

For her own part, Reichardt advocates for a tighter integration between robotics research and art practice, and she speculates that "Innovation in the field of robotics could well come from art as well as from industrial robotics because the goals of art are not clearly defined."[45] Whereas industrial robots developed by engineers may provide solutions through the use of functional or multipurpose robots,

> it will not deal with effects, illusions or emotive principles which belong to art. Art, which results in physical objects, is the only activity that represents the half-way house between the regimentation of technology and the pure fantasy of films and literature; and only in the name of art is a robot likely to be made which is neither just a costume worn by an actor, nor an experimental artificial intelligence machine, nor one of the many identical working units in an unmanned factory.[46]

Robotic art helps us to understand the shifting ground of the Uncanny: we witness how artists of every period explore the boundaries and slippages between humans and machines. Increasingly this exploration happens in the register of the experiential rather than the representational uncanny.

V. *The Telegarden* and Other Oddities

In this section we consider three non-anthropomorphic robotic art works: *The Telegarden* (1995), *Six Robots Named Paul* (2011) and the *Blind Robot* (2013). These interactive works direct attention away from appearance towards the physical actions they enable. The robots function as catalysts for exploring our physical and psychological relationships with the material world. In these works, material artefacts play a crucial role in provoking the Uncanny by offering evidence of the robot's agency. Similar to the optical instruments and automata found in the *Wunderkammer*, these material artefacts become aesthetic objects in their own right, and can be understood as material representations of self-understanding and knowledge. The artworks invite us to look beneath the "skin" or outward appearance and observe the interaction between humans and the physical world. The experiential uncanny is triggered by the spectre of uncertainty that arises when we are no longer sure what is animate or inanimate, authentic or a work of fiction.

The three art works discussed in this section are non-anthropomorphic: they do not approximate the human form but make familiar human activities—gardening, drawing, observation through touch—unfamiliar using robotics. Each one shares

[45]Reichardt, J [25] p. 56.

[46]Reichardt, J [25] p. 56.

a concern with ocularism and provokes uncertainty by staging remote and intimate encounters between humans, machines and their environments. The artworks eschew the representational uncanny and provoke the experiential uncanny by deliberately exploiting the ambiguity of agency and authenticity The material artefacts become signs of the robot's agency and assume a level of critical importance in our attempts to discern reality from fiction.

The Telegarden (1994)

The Telegarden is a telerobotic art installation created by Ken Goldberg with Joe Santarramana and a team of collaborators including Steven Gentner, Jeff Wiegley, Carl Sutter and George Bekey at the University of Southern California (Fig. 4). Combining web cameras with a telerobotic arm operated via the Internet, *The Telegarden* was the sequel to an earlier installation called the *Mercury Project* (1994), which was recognized as the first robot controlled over the browser-based

Fig. 4 *The Telegarden* (1995–2004, networked art installation at Ars Electronica Museum, Austria.) Co-directors: Ken Goldberg and Joseph Santarromana Project team: George Bekey, Steven Gentner, Rosemary Morris Carl Sutter, Jeff Wiegley, Erich Berger (Photo by Robert Wedemeyer)

Internet.[47] Both projects were designed as engineering prototypes and art installations that questioned the widespread exuberance for technology in general and the Internet in particular. *The Telegarden* juxtaposes the historical and natural pace of planting and cultivation with the desire for "instant gratification" and immediacy promised by the Internet.

In *The Telegarden*, an industrial robot was installed in a 3 m × 3 m circular aluminum container filled with eighteen inches of soil. Custom software allowed anyone on the Internet to visit the garden, and by clicking in a web browser to move the robot and digital camera on the robot's end effector. Visitors could register for a password and then participate first by watering the garden and later by planting their own seeds. Visitors were reminded that unless they returned regularly to water their plants, the plants would not germinate.[48] *The Telegarden* went online in June 1995 and attracted over 10,000 participants and more than 100,000 viewers. In September 1996, *The Telegarden* was moved to the lobby of the Ars Electronica center in Austria, where it remained online 24 hours a day until it was decommissioned in 2004. User activity was recorded in logs so that members could be self-governing: users could plant, water, and monitor the progress of seedlings via the delicate movements of the industrial robot arm. The garden was a metaphor for the promise of new communities made possible by the Internet; it also raised philosophical questions concerning the nature of tele-robotics and introduced the concept of *telepistemology*—the study of knowledge acquired at a distance.[49]

Just as seventeenth century optical instruments brought forth new ways of seeing, the combination of the Internet, the World Wide Web interface, webcameras, and robots created new modes of viewing and the ability for remote observation and interaction. Just as the telescope and the microscope made familiar object unfamiliar, telepresence (or mediated agency) heightens the potential for doubt concerning the authenticity of objects or experiences, especially when actions are mediated through the Internet. *The Telegarden* triggered the Uncanny because it called attention to experiences in remote locations and introduced uncertainty about the "here and now."[50] Although *The Telegarden* was not anthropomorphic, it provoked an awareness of awareness.

Doubt or uncertainty concerning the authenticity of an object—its aliveness or presence as indicated by appearance, motion, or representation—is central to the definition of the Uncanny. While Jentsch describes the effect as the experience of "intellectual uncertainty," Freud and Mori define the Uncanny in terms of emotional uncertainty: while we might know intellectually that an android is only a machine and not alive, we can be momentarily convinced (or deceived) into

[47]Goldberg K, Mascha M, Gentner S, Rothenberg N, Sutter C, Wiegley J [20] Desktop Teleoperation via the World Wide Web. *International Conference on Robotics and Automation*.

[48]http://www.ieor.berkeley.edu/~goldberg/garden/Ars/.

[49]Goldberg, K [10] The Robot in The Garden.

[50]Kusahara, M [19] "Presence, Absence, and Knowledge in Telerobotic Art", p. 206.

granting the object fictive life. Alternately, through defamiliarization or distancing, objects or figures that we know to be real may appear unreal or fictitious, creating uncertainty about the object's true nature and threatening our subjectivity. *The Telegarden* evokes the Uncanny on the second count: the spectre of uncertainty arises when we become uncertain that our online actions have consequences in the real world. Questions of agency and authenticity signal larger questions concerning telepresence and the technological uncanny:

> The Telegarden is real, but (unlike a traditional Commons) we never actually see, feel, or hear the garden itself—It is too far away for that. Our knowledge of the Telegarden is technologically mediated, and that introduced a disturbing doubt: How do I know that the Telegarden really exists? Perhaps the ***Telegarden*** website is simply sending me prestored images of a garden that no longer exists. How do I know that the Telegarden community exists? I ***think*** the Telegarden provides a high-tech common where I can interact with other users. But how do I know that these users really exist—that they are not fabrications of the artist, or even mere "virtual" personas cleverly programmed to mimic on-line chat?[51]

Like Kempelen's chess-playing automaton, *The Telegarden* is uncanny because it creates uncertainty about the relation between the real and the virtual: Do our actions in the virtual world have actual consequences in the real word? If so, how can we be sure? The *Telegarden* breaks new ground in our understanding of the Uncanny by insisting on veracity while problematizing our ability to verify the garden as authentic.

Six Robots Named Paul (2012)

In 2012 Patrick Tresset presented this interactive robotic art installation at the Merge Festival in London[52]. Gallery visitors were invited to have their portrait drawn simultaneously from different points of view by robots positioned throughout the gallery.[53] The artwork is based on the observational drawing robot called *Paul* designed by Tresset in collaboration with Frederic Fol Leymarie and the AIKon II project at Goldsmiths University in London. *Paul* was first exhibited in June 2011 at the Tenderpixel Gallery in the UK and has produced more than 1000 unique drawings, 200 of which have been purchased and one of which is part of the collection at the Victoria and Albert Museum in London. In 2014, Tresset

[51]Kusahara, M [19] p. 206.

[52]https://www.youtube.com/watch?v=kvfKhEjTBEI

[53]While the title suggests six robots, in actuality there were only five robots present at the exhibit. This created an unintentionally uncanny effect caused by the incongruity between the title and the set up. In his presentation in Karlsruhe, Tresset stated the actual reason was coincidental: he had intended six robots but only five were available and the project had already been advertised by the festival.

Fig. 5 The robot *Paul* (Patrick Tresset) uses computation and robotic technologies to emulate the drawing activity with an emphasis on portrait sketching. The pictured exhibition at Ars Electronica, *5 Robots Named Paul* was installed in the Gothic cathedral in a scene deliberately reminiscent of an authentic artist's studio. (Photo by Steph Horak)

exhibited the work under the title *Five Robots Named Paul* at the Ars Electronica festival in Linz (Fig. 5).

Paul uses computation and robotic technologies to emulate the process of portrait drawing. *Paul* is not a telerobotic system but an autonomous machine that uses computational programming and visual feedback to make drawings. Like gardening, drawing is considered a uniquely human activity and a powerful symbol of human civilization and culture. A machine that emulates an intimate, creative activity like drawing—not according to a pre-determined program but drawing "from life" as a human artist does—raises issues of agency and authenticity that echo those of the *Telegarden*. Unlike Jaquet-Droz's draughtsman automaton that could draw several pre-determined sketches, the object of aesthetic orientation here is neither the robot nor the software program that controls the robot. Rather, the object of aesthetic interest is the drawing activity itself—the relation between artist and subject—that is reproduced through a staged encounter in a scene reminiscent of an artist's studio.

As with *The Telegarden*, agency and authenticity are central to the experiential uncanny. The robot cannot prove its drawing capabilities without the material portrait, but even this tangible proof raises uncertainty: if the robot's actions are determined by a computational program, and all the robots run the identical program simultaneously, how do we account for the differences in the portraits (Fig. 6), the different length of times each robot requires to complete the portrait, and the artistic likeness that emulates the aesthetics of human drawing? Can we believe our

Fig. 6 The individual drawing robots, each named *Paul*, use identical software to produce unique portraits. The distinct style is influenced by differences in the camera lens, camera angle and distance of the robot from the sitter. (Images printed with the permission of Patrick Tresset)

own eyes? The material artefact (portrait on paper) demands that we grant the portrait the same validity one drawn by a human artist. Over the course of the week-long installation in Austria, the exhibition space gradually transformed from an artist's studio into a gallery.

Like *The Telegarden*, *Six Robots Named Paul* evokes the Uncanny in a manner wholly distinct from anthropomorphic art works. Tresset refers to *Paul* as an "obsessive drawing entity" that "does not attempt to emulate human appearance."[54] The characterization of the robot's behavior as "obsessive" evokes the repetition compulsion drive Freud associates with the Uncanny,[55] and the multiplicity of robots used in this particular installation—faceless drawing machines masquerading as artists under a single name—recalls the double theme. *Six Robots Named Paul* further heightens the feeling of the Uncanny through specific devices

[54]Tresset P, Leymarie F [28] Portrait drawing by Paul the robot, p. 350.

[55]The robot will draw whatever object is positioned in front of the camera. On one occasion, part of the robot arm entered the field of vision which became part of the final sketch. Tresset quipped this might have been "the first instance of a robot self-portrait."

that create cognitive uncertainty. Like Jaquet-Droz's organ player, the robots are equipped with non-functional animations (Tresset calls them "pretenses") that do not impact the drawing process but are used solely to persaude the spectators that Paul is "more alive and autonomous than it actually is." Paul's lifelike behaviors reinforce the psychological relationship between the robot and the sitter: Paul exhibits artistic mannerisms or gestures we associate with optical behaviors of humans—adjusting the camera "eye" to regard the face of the sitter with multiple saccades and fixations The Uncanny response is not elicited by the machinic or unthinking properties of the machine but rather by the possibility of sentience[56]. When a sitter becomes aware that they are being watched by the robot (or several robots), they experience a sense of insecurity and uncertainty of how they should relate to the robot/s. Just as breathing androids provoked fear and fascination, the possibility of a robot that apprehends us the way a human artist might provokes the experiential uncanny.

As with *The Telegarden*, web cameras and computer vision technologies lend themselves to ambiguity and uncertainty because they problematize the relation between subject and object (Who/what is being observed? Who/what is observing?). *Six Robots Named Paul* engages themes of ocularism and perception by further troubling this distinction. Traditional relationships between artist/model/beholder break down as the museum visitor becomes both object (the model for the robot drawing) and subject (perceiving and interpreting the robot's actions and beholding the portraits on the wall), while the human artist assumes the role of a technical assistant in service to the robot artist. The mutual engagement between machine and human suggests a type of interactive, two-way communication between the human subject/object and the machine. Interactive art works like this one scrutinize how we relate to technological tools with increasing degrees of agency.

The Blind Robot (2013)

The *Blind Robot* is a robotic art installation that stages human-robot interaction as an aesthetic experience. The *Blind Robot* was commissioned for the Robots and Avatars project by *body* > *data* > *space* and the National Theatre in the UK and developed by Louis Philippe Demers at Nanyang Technological University in Singapore (Fig. 7). The artwork consists of a set of two-mechanical arms mounted onto a base and bolted to a table. The arms and hands are articulated plastic joints fashioned after human limbs. Metal poles are equipped with servo motors and wiring for controlling the motions and vaguely suggest the human skeleton and nervous system, but the overall aesthetic is more machinic than human. Visitors are invited to interact with the artwork by sitting in a chair opposite the robot and

[56]Tresset P, Leymarie F [28] p. 351.

Fig. 7 The *Blind Robot* (Louis Philippe Demers) consists of a set of two-mechanical arms mounted onto a base and bolted to a table. Visitors are invited to interact with the robot by sitting in a chair as the robot delicately explores the sitter's face and upper body in a manner that recalls how blind humans supposedly use touch to recognize persons or objects. (Photo by Louis Philippe Demers)

engaging in "non-verbal dialogue" or physical touch. The robot delicately explores the sitter's body, mostly the face, in a manner that recalls how blind humans supposedly use touch to recognize persons or objects. Positioned directly behind the robot is a portrait-sized mirror that allows visitors to observe themselves during the interaction. Some exhibitions feature a video display monitor facing the visitor that provides a visual rendering of what the robot "sees"—ostensibly providing "a window to the soul of the robot."[57] Theatrical lighting and dark curtains create a heightened feeling of the Uncanny by obscuring the view of the robot and heightening the awareness of the physical sensations (Fig. 8).

Motivated partly by research in social robotics and human-robot interaction, the *Blind Robot* proposes a platform for studying the degrees of engagement—be they intellectual, emotional or physical—that arise when social robots and humans interact through touch.[58] Direct physical contact with a robot is still an exceptional and unique experience for many. The artwork raises issues surrounding proxemics, trust, and predictability which are important factors in social robotics research. The artwork dramatizes an intimate, physical interaction between a human and a robot in order to defamiliarize the physical experience of the human body in the world.

[57] http://www.robotsandavatars.net.

[58] http://www.processing-plant.com/web_csi/index.html#project=blind.

Fig. 8 *The Blind Robot*. Positioned directly behind the robot is a portrait-sized mirror that allows visitors to observe themselves while being touched by the robot. Theatrical lighting and dark curtains create a heightened feeling of the Uncanny by obscuring the physicality of the robot and allowing the viewer to focus their awareness on the experience of being touched. (Photo by Louis Philippe Demers)

The *Blind Robot* is machinic and non-realistic: the headless, torso-less, leg-less robot is decidedly non-anthropomorphic. But the deliberate motions and gestures of the machinic arms and articulated fingers create the illusion of an intentional agent. The aesthetic conceit of the artwork attributes a human malady (blindness) to a non-human object, recalling Norman White's *Helpless Robot* (1987) through the reversal of traditional associations of humans as frail or inferior to mechanically superior robots. The artwork directs attention away from the robot design to the physical actions it performs. Like *Paul*, the *Blind Robot* hinges on a physical encounter that destabilizes the traditional subject-object relationship by placing the visitor at the center of the interaction. Once again, the theme of ocularism is central: without eyes to see, the *Blind Robot* recalls Freud's theme of ocular castration and provokes fears about the unknowable processes that control the robot. Theatrical lighting directs attention away from the robot towards the interaction, which is reflected back to the viewer in the mirror opposite them. The spectator experiences a heightened sense of awareness - an awareness of awareness - that underscores the connection between narcissism, the double and the Uncanny. In his presentation at the *Art and Robots* workshop in Karlsruhe, Demers said that the goal of the artist is "to create a situation that goes beyond the context of the object." In other words, the artist's job is to help the object transcend its objectness. The *Blind Robot* succeeds by creating a context for an intimate encounter between a human and robot.

VI. Beyond the Valley

Our investigation into the secret history of the Uncanny lead us into aspects of art and robotics that are both familiar and unfamiliar. We conclude that the Uncanny in visual and interactive art can occur in two registers: the representational and the experiential. The representational uncanny is characterized by figurative, anthropomorphic representations that deliberately provoke a strange mix of fear and wonder. Static works by Ron Mueck (*Dead Dad* 1996), Toni Matelli (*Sleepwalker* 1997), Sam Jinks (*Pieta* 2007) and the subversive oeuvre of Paul McCarthy recuperate the Surrealist interest in mannequins and the avant-garde abstractions of the human form through the use of defamiliarization, the double and the grotesque. Anthropomorphic robots, such as the lifelike humanoid robots on display at the National Museum of Emerging Science in Miraikan, Japan and Jordan Wolfsen's *Female Figure* (featured at Art Basel in 2014) tap into the representational uncanny through photorealism and verisimilitude.

The experiential uncanny shifts attention from the representational figure of the robot to the physical actions it performs. In these artworks, robots interact with spectators and the material world in novel ways that deliberately provoke anxiety and uncertainty. In addition to the works discussed in this chapter, artworks by Stelarc, Zaven Paré, Shun Ito, Maywa Denki, Tim Lewis, Shiro Takatani, Masaki Fujihata, Ken Rinaldo, Chico MacMurtrie, Seiko Mikami and others create interactive experiences between robots and humans. In these artworks the robot is a catalyst for action, and the Uncanny arises from our desire and inability to discern the authenticity of the experience or determine the level of the robot's agency. While robot artworks might produce material artefacts, even these material proofs cannot always be trusted.

What unites *The Telegarden*, the *Blind Robot*, and *Six Robots Named Paul* is their ability to evoke the Uncanny despite their non-anthropomorphic design. The works do not mimic life, but rather mimic behaviors that we associate with living creatures. We yearn for proof and authentic markers before granting the robot agency. It is not enough to know that complex algorithms and machinery are capable of planting and cultivating a real garden, but our vision must be verified by tangible outputs—real plants fed by real water that sprout from real dirt. When we encounter the *Blind Robot* in a gallery, it matters little that the sightless robot lacks a head or computer vision; what matters is the physical interaction between real human skin and robotic hands. For *Paul*, the tangible portraits drawn on actual paper before our eyes verify both the encounter and the robot's agency. The portraits that accumulate on the walls gradually become part of the experience, assuring spectators that the robot is a real artist with a growing collection of works. Like the oddities and scientific instruments found in the *Wunderkammer*, material artefacts are testaments to authentic experiences and sights of knowing. Tangible objects speak to a communal encounter between robot and human—they are byproducts that authenticate and inscribe Uncanny encounters in the real world and help bridge the gap between the real and the virtual.

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