THE ARTIST'S MACHINE

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ARCU**

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ABOUT THIS BOOK

Arcu is an artificial curator, a computer program created by artist Tillmann Ohm. “The Artist’s Machine” is a computational research project developed to establish the historic background of the expert system’s special field of machine art. This generated book provides insight into Arcu’s self-gained knowledge.

From researching topic-relevant literature, detecting semantic structures in hundreds of papers and books, to finally generating the publication’s chapters with images and paraphrased text citations, every step in the process has been performed automatically, initiated by a simple input phrase.

INPUT

“artificial intelligence in contemporary art”

PROCESS

OUTPUT

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CHAPTER ONE

AUTOMATA & ANDROIDS

Computer
 Homer Iliad Computer art
 Age of Enlightenment
 Sefer Yetzilah
 René Descartes Art
 Marie Antoinette
 Creativity
 Robot
 Julien Offray de La Mettrie Mechanic
 The Turk
 Industrial Revolution
 Nature Wolfgang von Kempelen
 Denis Diderot Uncanny
 Duck Voltaire
 Jean-Jacques Rousseau Frankenstein
 Life
 Artificial life
 Tabor
 Jacques de Vaucanson
 Android
 Pierre Jaquet-Droz
 Automaton
 Immanuel Kant Mercure de France
 Iwan Bloch Machine
 Albertus Magnus Louis XIV of France
 Thomas Carlyle
 Mason & Dixon Thomas Edison
 Gottfried Wilhelm Leibniz Literature
 Machine Man Aldous Huxley
 Thomas Pynchon
 Artist
 Philosophy

AUTOMATA AND ANDROIDES

Fig. 1 Article relating to Androides;
Automata and androides; Mirror

AUTOMATA AND ANDROIDS

In April 1738, *Mercure de France* reported on the latest fashion in Paris: at the Hôtel de Longueville, rue Saint Thomas du Louvre, for about two months, all Paris has gone to admire a phenomenon of mechanics, the most unique and at the same time, the most pleasant that has ever been seen. The object of fascination was the “*fluteur automate*”: a life-size mechanical figurine that could reproduce fourteen tones, “all of different character, in a variety of notes and rhythms”, in a flute that emits wind from the mouth and moves the fingers. According to a contemporary, some of the spectators refused to believe that it really touched the instrument, speculating on a hidden musical device, but even the most disbelieving were convinced, since the machine underwent the most complete examination and the most rigorous tests.¹

These mechanical wonders known as automata (from the Greek word *automatos*, acting by their own will, self-movement) inspired a full spectrum of emotions: from amazement at the realistic movement of the machine to extreme indignation at the promising powers that seemed to engender. The automata represented the physical and mental attributes of the human. The automatons reached their apo-gee in the 18th century due in large part to the realistic flute, drum and duck built by Jacques de Vaucanson, whose creations amazed both the public and the privileged elite until the 19th century.²

An eighteenth-century mechanical duck that swallowed corn and grain, and after a heavy pause it freed itself from an authentic-looking load, it was an unbelievable innovative technology designed to simulate animal and intelligent processes. Seems strange, as now appears the duck, we remain in the age in which it was inaugurated; its mixed career

1 Kang, 2012, pp. 103-104

2 Taylor, 2014, pp. 132-133

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Fig. 2 Illustration from *Histoire des jouets*,
18th century engraving

AUTOMATA AND ANDROIDS

Fig. 3 Vaucanson duck automaton,
believed destroyed in 1879

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triggered the dynamics that characterized the later history of artificial life. Jacques Vaucanson, the ambitious son of a glove manufacturer in Grenoble, showed up in Paris in the winter of 1738.³

The Musical Lady was one of the three humanoid automata manufactured by Pierre Jaquet-Droz in the 1770s, all of which combined realistic appearance with precise mechanical movements, and could be programmed to perform a variety of tasks: The Draftsman produced detailed sketches on various topics, including a portrait of Marie-Antoinette; The Writer wrote phrases in an elegant script, including jokingly, "I think therefore I am." This inscription of Descartes's famous formulation of human autonomy by a programmed automaton constituted a playful reference of the current debates in the natural philosophy of the 18th century about the nature of the agency and of the self, and the relation of that with the body and its movements. The natural philosophers of the 17th and 18th century, like Descartes and La Mettrie, were centrally interested in the question of movement, and if it required an external origin, a spiritual (or divine), or if the body could be understood as an autonomous mechanism capable of generating its own movement. The automata of the 18th century, with their spectacularization of artificial life, contributed vitally to these debates and were the object of fascination for natural philosophers and the popular public during this period.⁴

The interest of the Enlightenment by automata and their literary representations in Gothic fiction goes back to earlier creation myths related to artificial life, from the Homeric

3 Riskin, 2003, p. 599

4 Stephens & Heffernan, 2016, pp. 30-31

AUTOMATA AND ANDROIDS

Fig. 4 Jaquet-Droz automata,
musée d'Art et d'Histoire de Neuchâtel

AUTOMATA AND ANDROIDS

Fig. 5 Jaquet-Droz automata,
musée d'Art et d'Histoire de Neuchâtel

AUTOMATA AND ANDROIDS

Iliad to the Golem myth (narrated in the 10th century by Sefer Yetsirah, or The Book of Formation). The promise and the threat of mechanical life acquired a new urgency as the watchmaking mechanisms assumed the forms of humans and animals. In previous centuries, philosophers such as René Descartes (*The Description of Human Body*, 1647) and Julien Offray de La Mettrie (*Man a Machine*, 1748) described living bodies in mechanical terms, and automata of the late 18th century were exhibited as scientific “proof” that biological functions (such as respiration, digestion, blood circulation) could be reproduced mechanically.⁵

These descriptions of materialistic and mechanistic life worked in both directions: they shaped the way people thought about living creatures, and reciprocally they also changed the way people thought about matter and mechanisms. If life was material, then matter was alive, and then seeing living creatures as machines was also to animate machinery. This vision of creating an artificial human being, which operated according to mechanical principles and still possessed soul and reason, was anticipated long before the idea of La Mettrie of a living machine, or living automaton, of the British philosopher Thomas Hobbes (1588 – 1676). In his book *Leviathan*, Hobbes modeled his description of the state in terms of the automaton he knew. His state machine is an artificial human being, which is set in motion by an artificial soul, regulated by the articulations of public servants, controlled by the nervous system of wages and punishment and informed by an artificial memory and an artificial will.⁶

The objective of Vaucanson is a good example of simulation, and its duck should be taken into account when it comes

5 Jochum & Goldberg, 2016, p. 153

6 Reichle, 2009, p. 148

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to the simulation of human thought processes. Somewhere between the automata made, like those of Vaucanson, and the purely imaginary types, like Frankenstein, are the frauds. Von Kempelen's chess machine was the first and most famous.⁷

However, it is significant that the vast majority of posthumous references to Vaucanson refer to his automata, sometimes employed for high intellectual purposes. Immanuel Kant in his *Critique of Practical Reason* (1788) criticizes Leibniz's notion of the pre-established harmony of the world by stating that freedom within such a system would be illusory and that every human being would be "a puppet or an automaton like Vaucanson's, manufactured and finished by the Supreme Artist." Thomas Carlyle in his 1829 essay "Signs of the Times" mentions Vaucanson's duck, which "seemed to eat and digest", in the context of materialistic mechanistic philosophy, and physicist Hermann von Helmholtz points out the automata of Vaucanson and Jaquet-Droz in his 1854 essay "On the Interaction of Natural Forces", calling the artificial duck the "wonder of the last century." T.H. Huxley, in his 1874 work "On the Hypothesis That Animals Are Automata, and Its History", presents the case of a French sergeant who suffered a brain injury in a combat and, sometimes involuntarily, makes the movements of a soldier in a battle. Huxley asks if the man is dreaming that he is fighting or if "he is in the condition of one of the automata of Vaucanson, a senseless mechanism operated by molecular changes in his nervous system."⁸

7 McCorduck, 2004, p. 17

8 Kang, 2012, pp. 108-109

AUTOMATA AND ANDROIDS

Fig. 6 From book that tried to explain the illusions behind the Kempelen chess playing automaton (known as The Turk) after making reconstructions of the device, 1789

AUTOMATA AND ANDROIDS

During the “Golden age of automata” (or, alternatively, what Gaby Wood calls the “Golden age of the philosophical toy”), the mechanical statues became concrete symbols of materialistic philosophical pieces by Diderot, Rousseau, Voltaire and La Mettrie who tried to describe nature and biology in mechanistic terms. The interest of the Enlightenment in the rarities and monsters of the natural world that eluded the classification became the subject of the scientific investigation of the “invisible and dynamic processes of life”, and the automaton became a symbol of replication of these processes through engineering. The androids (automata in human form) built by Jacques de Vaucanson, Henri and Pierre Jaquet-Droz and Wolfgang von Kempelen faced directly the Uncanny.⁹

In the 18th century, the Industrial Age attracted the attention of mechanical interpreters: Jacques de Vaucanson’s Flute Player automaton and Mechanic Turk’s infamous chess player clearly demonstrate the desire to create apparently creative automata. Through their work, both Vaucanson and von Kempelen involved the public in philosophical questions about the nature of creativity, the possibilities of automation and, fundamentally, perfection.¹⁰

Mechanical automata emerged with the first clocks in the 13th century and, for Descartes and other thinkers of the Enlightenment, confirmed that even the most complicated physical processes of animals and men could be explained as sophisticated clock mechanisms. While in the 17th, 18th and 19th centuries the face of the machine was a mysteriously powered clock machine, in the 20th century the computer embodied the artificial wonder of mechanical simula-

9 Jochum & Goldberg, 2016, p. 154

10 Gemeinboeck & Saunders, 2013, p. 215

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tion. However, the disposition of the autogenous creative behavior and the strong mind/body duality emanating from practices such as Cohen's was not the dominant form of computer art in the 1970s.¹¹

The birth of modernism implies, in other words, the resurgence of an artificial or technological element that was excluded from romantic aesthetics. In fact, Kantian and romantic aesthetics always seemed to see the idea of a technological birth as threatening, monstrous and any doctor connected to it as a mad scientist or a practitioner of the black arts. Therefore, the primal scene of the Kantian romantic aesthetic would be precisely this birth of the machine, the incarnation of technology and technique.¹²

11 Taylor, 2014, pp. 133-134

12 Rutsky, 1999, p. 23

CHAPTER TWO

TURING MACHINE & ARTIFICIAL INTELLIGENCE

Garry Kasparov
 Deep Blue
 John Searle
 Artificial general intelligence

 University
 Claude Shannon
 John McCarthy
 IBM BBC
 Marvin Minsky
 Harold Cohen
 AARON
 Nathaniel Rochester
 Douglas Lenat
 Artificial intelligence
 Visual arts
 Herbert A. Simon
 Mind
 Economics

 Ada Lovelace
 19th century Gottfried Wilhelm Leibniz
 Charles Babbage
 Analytical Engine
 Blaise Pascal Alan Turing
 Consciousness Walter Pitts
 Robot
 Brain
 Turing test Geoffrey Jefferson
 Warren Sturgis McCulloch
 Turing machine
 Frank Rosenblatt
 Seymour Papert

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

Two hundred years ago, the belief that humans are machines was courageous and dangerous. Today it is so deeply rooted in our culture that it is difficult for us to imagine what other people can be. In the 19th century, Lady Lovelace, a companion and colleague of Charles Babbage, expressed the opinion that computers cannot have anything to do with creativity because they “have no pretensions whatever to originate anything.” It has also become anchored in culture, so that the concept of “machine creativity” is perceived as paradoxically contradictory.¹³

Already in 1834, Charles Babbage invented an automatic computing machine, his proposed, but never constructed, analytical device designed to perform the most diverse numerical calculations. To emphasize the power and range of the engine, Babbage noted jokingly that “it can do anything but compose country dances.” While it was obvious to Babbage that the machines designed for calculations cannot be expected to compose dances, they would not hit us today as completely out of the question. In fact, today’s computers can be perfectly programmed to compose country dances (though probably not the best quality).¹⁴

Lady Lovelace realized that Babbage’s analytical device – in essence, a design for a digital computer – could, in principle, “compose elaborate and scientific pieces of music of any degree of complexity or extent.” But she insisted that the creativity involved in any elaborate piece of music emanating from Analytical Engine would have to be credited not to the engine, but to the engineer.¹⁵

13 Dartnall, 1994b, p. 29

14 Davis, 2016, p. 123

15 Boden, 1994, p. 3

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

Fig. 7 Watercolor portrait of Ada King,
Countess of Lovelace (Ada Lovelace), 1840

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

Fig. 8 Passport photo of Alan Turing at age 16, 1928-9?

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

If any machine can be built to “think” or be capable of what is called Artificial Intelligence, now it is believed that the digital computer is the machine. This follows from a thesis suggested by the British mathematician A. M. Turing, according to which what any machine can do by means of the processing of symbols can be done by computer. Turing asked an important question: how many different types of computer machines should be designed if all types of information processing must be carried out mechanically? His answer was that it is possible to design a single machine that simply requires different programs and this is called Universal Turing Machine.¹⁶

No wonder the computer started to be called a thinking machine. No artifact in the long history of artifacts produced for this purpose has ever proved to be more promising to imitate or perhaps to lighten the mind of human beings. McCulloch and Pitts not only enabled researchers to think of the brain as a computing machine more precisely than ever before, but their work also focused on where the problem would remain: knowledge is complex, brain neurons are relatively simple (though not as easy as the state neurophysiology prompted them to believe), and the interactions between the two are what is left to describe in much more detail.¹⁷

Some of the most interesting intellectual debates on the subject are whether the human brain functions in a sense like a digital computer and whether a computer of sufficient complexity and power could reach consciousness. A study of modern writings on such ideas would have to begin with their historical origins, somewhat neglected in this study, of various attempts to create machines that fulfill certain func-

16 Kugel, 1981, p. 138

17 McCorduck, 2004, p. 90

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

tions of the mind, such as the calculating machines of Blaise Pascal, Gottfried Leibniz, Charles Babbage, and others. For the postwar period, one would have to look at Alan Turing's pioneering works on artificial intelligence and the consequent controversy over his idea of a test to determine the presence of sentience in a machine.¹⁸

Turing proposed the test, which basically provides an operational definition of machine intelligence. Turing also invented the diffusion model of the biological morphogenesis reaction, and at the end of this article discusses the implementation of computer simulation of this process.¹⁹

The concept of artificial intelligence emerged in 1956 when John McCarthy of Dartmouth College, Marvin Minsky of Harvard University, Nathaniel Rochester of IBM Corporation, and Claude Shannon of Bell Telephone Laboratories proposed a two-month, ten-headed study of artificial intelligence in the summer of 1956. Their research based on the assumption that every aspect of learning or any other intelligence trait can be described as making it possible to create a machine that simulates this phenomenon. It tries to find ways in which machines use language, create abstractions and concepts, solve problems that are currently reserved for people, and improve them.²⁰

Artificial intelligence, if it ever existed, will be an intelligence developed by humans, implemented as an artifact. The level of intelligence required by Alan Turing's famous test – the ability to deceive ordinary humans about whether the other side of the dialogue is carried out by a human or a computer – is an indication of what the IA researchers want.

18 Kang, 2012, p. 298

19 Galanter, 2012, pp. 284-285

20 Gazzaniga, 2008, p. 358

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Such AI would surely transform our technology and economy.²¹

Herbert Simon made contributions superimposed in the fields of economics, psychology, cognitive science, artificial intelligence, decision theory and organization theory. Simon's work was motivated by the belief that neither the human mind, human thought and decision-making, nor human creativity need to be mysterious. It was after he helped create "thinking" machines that Simon came to understand human intuition as recognition of subconscious patterns.²²

In February of 1996, the chess computer Deep Blue managed to defeat the world champion Garry Kasparov. Can we say that Deep Blue exhibited intelligence? In an article written in his usual provocative style, the philosopher John R. Searle tells us that Deep Blue cannot even be said to play chess.²³

"Deep Blue had no sense of the history of the game, and it knew nothing about its opponent, it played chess but it did not understand chess, in the same way that a calculator does arithmetic but does not understand mathematics." A strong AI is what scares a lot of people. Strong AI is a term coined by John Searle, a philosopher at the University of California, Berkeley.²⁴

21 Zeltermann, 2005, p. 3

22 Frantz, 2003, p. 265

23 Davis, 2016, p. 181

24 Gazzaniga, 2008, p. 359

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

Fig. 9 The imitation game, as described by Alan Turing in “Computing Machinery and Intelligence”. Player C, through a series of written questions, attempts to determine which of the two players is a man, and which of the two is the woman. Player A - the man - tries to trick player C into making the wrong decision, while player B tries to help player C. Turing uses this game as the basis for his test for intelligence.

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Fig. 10 The Original Imitation Game Test, in which player A is replaced with a computer. The computer is tasked with the role of pretending to be a woman, while player B must to attempt to assist the interrogator, who must determine which is male and which is female.

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Fig. 11 The “standard interpretation” of the Turing Test, in which player C, the interrogator, is tasked with trying to determine which player - A or B - is a computer and which is a human. The interrogator is limited to only using the responses to written questions in order to make the determination.

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After all, creativity is one of the things that makes us human; we value it very much, and we guard it jealously. Since the beginning of the era of modern computing, notable experts have questioned the possibilities of artificial intelligence regarding creative acts. For example, the famous neuroscientist Sir Geoffrey Jefferson wrote “Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain.” This was in response to Turing, who replied that Jefferson was simply expressing “the argument of conscience” against intelligent machines, before proceeding to demolish it as solipsism.²⁵

There are clear similarities between the concept of computer-aided creativity as a manifestation of human-like behavior and the definitions of intelligence in the Turing Test style. In both cases, the system is said to be creative/intelligent if it can create a behavior or product that requires creative/intelligent human action to create it, which the human observer would recognize. Creative activities in the arts are not the activity most people do on a regular basis.²⁶

25 Colton & Wiggins, 2012, p. 21

26 Johnson, 2012, p. 57

TURING MACHINE AND ARTIFICIAL INTELLIGENCE

Fig. 12 Selected sample questions generated by the query generator for a Visual Turing Test, 2014

1. Q: Is there a person in the blue region?	A: yes
2. Q: Is there a unique person in the blue region?
(Label this person 1)	A: yes
3. Q: Is person 1 carrying something?	A: yes
4. Q: Is person 1 female?	A: yes
5. Q: Is person 1 walking on a sidewalk?	A: yes
6. Q: Is person 1 interacting with any other object?	A: no
⋮	
9. Q: Is there a unique vehicle in the yellow region?
(Label this vehicle 1)	A: yes
10. Q: Is vehicle 1 light-colored?	A: yes
11. Q: Is vehicle 1 moving?	A: no
12. Q: Is vehicle 1 parked and a car?	A: yes
⋮	
14. Q: Does vehicle 1 have exactly one visible tire?	A: no
15. Q: Is vehicle 1 interacting with any other object?	A: no
17. Q: Is there a unique person in the red region?	A: no
18. Q: Is there a unique person that is female in the red region?	A: no
19. Q: Is there a person that is standing still in the red region?	A: yes
20. Q: Is there a unique person standing still in the red region?
(Label this person 2)	A: yes
⋮	
23. Q: Is person 2 interacting with any other object?	A: yes
24. Q: Is person 1 taller than person 2?	A: amb.
25. Q: Is person 1 closer (to the camera) than person 2?	A: no
26. Q: Is there a person in the red region?	A: yes
27. Q: Is there a unique person in the red region?
(Label this person 3)	A: yes
⋮	
36. Q: Is there an interaction between person 2 and person 3?	A: yes
37. Q: Are person 2 and person 3 talking?	A: yes

CHAPTER THREE

COMPUTER ART & AARON

Conceptual art

COMPUTER ART AND AARON

Fig. 13 Cybernetic Serendipity 1968, Poster

COMPUTER ART AND AARON

Fig. 14 Cybernetic Serendipity 1968, Exhibition view,
Courtesy: Internationales Performance Festival, Vienna

COMPUTER ART AND AARON

This chapter discusses several aspects of the early history of computer art (or what would be better known as “algorithmic art”) as a background for discussing how the invention and the use of algorithms affect creativity. The position of Marcel Duchamp was positively highlighted, according to which the viewer and society play an important role in the creative process. If creativity is the process of overcoming the resistance of a material, the algorithm takes over the role of material in algorithmic art.²⁷

Since these artists were not interested in descriptive or established painting, they could afford to refer to simple computer generated images. Their interest fueled the computer’s other capabilities, such as its ability to enable the artist to be the almighty inventor of a new universe with their own physical laws. Charles Csuri pointed out this far-reaching notion in the interview: “I can take the well-known law of physics as a starting point and then quite arbitrarily change the numerical values that actually change reality.”²⁸

Others, who received more attention, were Georg Nees, Michael Noll and Frieder Nake, and were exhibited in Stuttgart and New York in 1965. They were highly abstract and quasi-geometric designs, generated by programs written not by professional artists, but by mathematicians. A wide range of early works by Computer Creativity was introduced shortly after at the famous Cybernetic Serendipity exhibition in London in 1968.²⁹

Ed Berkeley’s magazine, *Computers and Automation* (later *Computers and People*), had started this annual contest. It was won in 1965 by A. Michael Noll, 1966 by Frieder

27 Nake, 2012, p. 61

28 Dietrich, 1986, p. 161

29 Boden, 2014, p. vii

COMPUTER ART AND AARON

Nake, and then by Csuri, an educated artist for the first time. This prize, by the way, never gained great appreciation. It took many more years, until 1987, when the now extremely prestigious Prix Ars Electronica was awarded for the first time.³⁰

It is interesting to reconsider the classic article by Michael Noll on the use of random numbers, filtered in a very specific way, in order to create paintings in the style of Mondrian, which was summarized in a special edition of *Studio International* accompanying the exhibition. The participants in the experiment were asked to indicate preferences between “real” (but reconstructed) Mondrian and the creation of a computer program. The result showed a small preference for the latter and the inability to determine correctly which one was.³¹

The artist was perceived as an accomplice in a type of mechanical subterfuge. Although the 1970s is often considered a memorable decade in the history of computer art, there is evidence to suggest that the artists of this period provided the crucial ideas, such as generativity, algorithms, and heuristic exploration, which became key in the next decade. Although their varied practices, artists such as Manfred Mohr, Harold Cohen and Vera Molnar developed methods that were important for the transition between the paradigm of computer art of the early sixties and the revelation of art as an abstraction and the paradigm of artists and programmers from the eighties to create and explore an open system of art creation.³²

30 Nake, 2012, pp. 77-78

31 Edmonds, 1994a, pp. 336-337

32 Taylor, 2014, p. 125

COMPUTER ART AND AARON

Fig. 15 A. Michael Noll, Three-dimensional picture pair 1 (exact title unknown), mid 1960s, drawing, b/w, computer-generated

COMPUTER ART AND AARON

Fig. 16 Charles “Chuck” Csuri, untitled (sine curve 2), ca. 1969, drawing, b/w, computer-generated, ink on paper

COMPUTER ART AND AARON

The autonomous painting program of Harold Cohen AARON is based on his own analysis of how he composed and painted the picture, from sketching the first lines to coloring. It works very well, in a limited field of certain motifs.³³

He hated the computer community and its concept of “computer art”, which he described as “these endless geometrical figures.” Working in relative isolation from the graphic arts community, he preferred the difficult and relatively new field of artificial intelligence. He was the first artist to work with artificial intelligence paradigms extensively. It was through his tour de force, the automatic robotic drawing machine AARON, that he became the most respected artist working with computers.³⁴

It is a well-known system developed over 40 years to achieve a characteristic figurative art, in accordance with Cohen’s unique guidelines on a generative and aesthetic level. The software has gone through many stages of development: early versions created simple drawings similar to children’s, and in the latest development, AARON began to create abstract images. It is too simplistic to say that AARON was developed for Cohen-style painting because it was itself influenced by feedback from the software, so the process was somewhat circular.³⁵

The computer is still an amplifier of Harold Cohen’s creativity instead of a complete model of it. However, as Boden argues, his work is on the path that could lead to a model of the creative act. In fact, it is surprising that when comparing Cohen’s precomputing works with those of AARON, there is no doubt that they are images composed by the same artist.³⁶

33 Dahlstedt, 2012, p. 220

34 Taylor, 2014, p. 127

35 Colton, 2012, p. 7

36 Edmonds, 1994a, p. 339

COMPUTER ART AND AARON

Fig. 17 Harold Cohen, 040502, 2004, Pigment on paper, computer-generated. 46 × 57.75 in, © Harold Cohen

COMPUTER ART AND AARON

Human adaptive creativity is the most traditional objective of computationally creative systems based on the arts, but faces the challenge that the incarnation and location of the artificial system is a poor reproduction of that of the human being. It also faces the additional challenge of building adaptive creative systems that satisfy the restricted goal of “valued” artistic production. Subsequently, some of the most successful examples of computer creativity have been the collaborations of the human system, such as Harold Cohen and his AARON software, or George Lewis and his Voyager software.³⁷

Lack of evaluation and selectivity has been the main criticism of many previous computer systems. Consider the computer-aided creativity system for AARON’s visual art. AARON generates 150 pieces per night, but Cohen decides what to print and looks at them all: “AARON does not choose its own criteria for a good picture... To be recognized as an author, the program must develop its own selection criteria; Cohen was skeptical that it could happen.”³⁸

In most areas, the artifacts and creativity that have gone into their production are evaluated in context; where the context can contain basic information about how the creator feels in their work, what they think they are expressing, how it suits other work done within their community, their mood before, during and after creation, and so on. We identify areas of framework information, such as motivation, intention or processes related to the creation of a work, and we wonder how these areas can be applied in the context of Computational Creativity.³⁹

37 Bown, 2012, p. 374

38 Varshney et al., 2013, p. 3

39 Charnley, Pease & Colton, 2012, p. 77

COMPUTER ART AND AARON

The consumer may try to find a process (intellectual, practical or otherwise) that was taken to create a work of art. They can then use this information to assess the artist's creativity, and ultimately use this judgment in their assessment of a work of art: a piece is better if it has been more creatively produced. This more complex model of artistic evaluation and its variants seem to dominate in the contemporary art circles.⁴⁰

However, we do not necessarily have any evidence beyond our own "interpretations" about what, in any case, the artist had in mind in the first place. This emphasis on the specifically cultural use of symbols has left us with no explanation for the underlying structures of more convincing image-making behavior than the Divine Muse, and some contemporary variant of that theme is often explanatory.⁴¹

40 Colton, 2008, p. 1

41 Cohen, 1976, p. 7

CHAPTER FOUR

PROSTHESIS & CYBORGS

Steve Middleton
 Machine Stomach
 Robot Arm

 Jane Goodall Prosthesis

 Artificial life Stelarc François Delsarte
 Bride of Frankenstein Charles Darwin
 Orlan Avatar
 David Wills
 Platonism
 Levellers
 Cartesian coordinate system
 NASA Cyborg Plato

 Nathan S. Kline
 Manfred Clynes

Donna Haraway
 John von Neumann
 Claude Shannon
 Warren Sturgis McCulloch
 Norbert Wiener

PROSTHESIS AND CYBORGS

Fig. 18 Stelarc at VirtualFutures, 2011

PROSTHESIS AND CYBORGS

In the 1950's, Norbert Wiener, Claude Shannon, John von Neumann, Warren McCulloch, and others, in their new field of cybernetics, made a language for analyzing both biological and artificial systems concerning information management, communication, and proliferation. Regarding the body and the mind as basically data carriers (genes in the human body and cultural and intellectual information, or "memes", in the mind) raised the implication that the electronic computer operated under analogous principles, opening up the potential for mergence in the kind of a cybernetic organism, or cyborg. These notions were revived in postmodern discourse of the 1980's as cyborg theory, beginning from the now classic essay from Donna Haraway, "Manifesto for Cyborgs" (1985).⁴²

Donna Haraway describes a cyborg as a cybernetic organism that is also a creation of social reality and fiction. Her idea of a cyborg deconstructs the duality of control and lack of control over the body, object and subject, nature and culture, in a way useful for postmodernist feminist thought. Haraway uses the cyborg identity metaphor to reveal how things that are considered natural, such as human bodies, are not, but are constructed according to our imaginations.⁴³

Clynes coined the term "cyborg" in an article written jointly with Kline, a NASA researcher entitled "Cyborgs and space". Here they define the cyborg as a human that "deliberately incorporates exogenous components that extend the self-regulating control function of the organism to adapt it to new environments." The article proposes that to maximize their adaptation to space travel, humans should adjust to be able to exist in space without suits; this must be achieved "by

42 Kang, 2012, p. 299

43 Reichle, 2009, p. 134

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appropriate biochemical, physiological and electronic modifications.”⁴⁴

However, the term “post-human” may seem like the end in which the human body is rejected as an already non-viable species, compared to organisms that have exceeded their biological limits through advanced technologies. It seems that the concept of “trans-human”, describing a transient state in which phenomena are multiple, is associated with the concept of liminal personality in a more complex way. As Donna Haraway suggests, the “trans” prefix crosses the boundary between nature and artificiality, and nature and culture. Meaning “crosswise” or “beyond” means the process and proof of connection. The concept of trans-human indicates a delicate transition, and even a subtle interaction between two objects, none of which is outdated in this process.⁴⁵

In Western masculinist traditions dominated by Platonism in various forms (pagan, Jewish, atheist and Christian), the body was political only as a metaphor, the body politic, and not in itself. But today the illusion that the human body is not fundamental, which is basically an epiphenomenon of the mind, has been dispelled by political and analytical feminism (see especially Scarry, *The Body in Pain*) and by cybernetic technosciences in practice. Although Orlan and Stelarc criticize the human body for being quite limited, or even obsolete if not technologically modified, they explicitly defend their right to their own body, echoing the Leveller argument that it is their personal property.⁴⁶

44 Appleby, 2002, p. 104

45 Clarke, 2002, p. 34

46 Gray, 2002, p. 188

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Fig. 19 Stelarc, Extra Ear, 1999, © Stelarc

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Chislenko developed a self-test for functional cyborgization: Are you dependent on technology to such an extent that you would not be able to survive without it? Would you reject a lifestyle free of any technology, even if you could endure it? Would you be embarrassed and “dehumanized” if someone removed your artificial clothing (clothes) and publicly revealed your natural biological body? ⁴⁷

The work of the French performance artist Orlan, who constantly changing her face to adapt to different standards of beauty, and thus to problematize their “natural” character, is an example of such an unmoderated relationship with otherness. In her latest Self-Hybridation project, Orlan digitally creates a series of portraits, “decorating” her face with elements of pre-Columbian culture, which, as the artist herself says, “have a relationship with the body that is particularly disturbing to us, which completely provokes us and which is very intense.” ⁴⁸

In contrast to Orlan’s celebration of life in metaphors of the resurrection of the body, Stelarc, who declares and denounces the body as a “death machine”, adds non-human attachments to his body in a cyborg fantasy that delineates continuity. While Stelarc’s cybernetics portrays the love story of Western society with a technological device, which represents a desire for the transcendence of the body and escape from death, Orlan’s actions/operations show a transcendence of life and its pain. In terms of its relationship with the technological body, Orlan evokes artificial life through the images of Frankenstein’s Bride, the artificiality of images and their link to history and mythology.⁴⁹

47 Gazzaniga, 2008, p. 326

48 Zylinska, 2002, p. 222

49 Clarke, 2002, pp. 43-44

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Fig. 20 ORLAN, The Reincarnation of Saint Orlan,
1990 – 1993, Before the operations, Photography, © ORLAN

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Fig. 21 ORLAN, The Reincarnation of Saint Orlan, 1990 – 1993, Before the operations, © ORLAN

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Where Stelarc uses the meat to enter the matrix of technological and post-human evolution, Orlan exposes its excess, its enjoyment, its consumption. Orlan's actions question the intimate embrace of art and commerce, interacting with institutions (religious, psychoanalytical and medical) of paternal authority and their representations of femininity and body formations with a postmodern joy in which stereotypes are subverted and questioned the aesthetic limits. But in the affirmation of female corporeal and artistic resistance in the plasticity of the surgically reconstructed body there is an insistence on the perpetual incorporated obsolescence of the body in which the immateriality consuming the image comes to the fore.⁵⁰

Stelarc's performances have always focused on the idea of the prosthesis: from external extensions of the body such as the Third Hand or Extended Arm, to internal prostheses such as the Stomach Sculpture, where the body "becomes a host not for oneself nor for the soul, but simply a sculpture." His experiments have culminated more recently in the development of the Movatar project, that is, an avatar that takes over the human body, which then functions as a prosthesis for this avatar, as the artist himself explains, Motion Capture allows a physical body to animate a virtual body generated by a 3D computer to act in the space of the computer or cyberspace.⁵¹

In his presentation of Movatar/Avatar, Stelarc empties his body of his own desire and fills it with the desire of an autonomous being of Artificial Life, literally acting on the human characteristics of reacting/moving/desiring for another's desire. Movatar is a complete operating system –

50 Botting & Wilson, 2002, p. 158

51 Zylińska, 2002, p. 228

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with the human body as a prototype for the screen avatar – which makes the body move through the connection with the motion prosthesis. The relationship between Stelarc's body and the Avatar is a pneumatic exoskeleton that Stelarc connected with the arms and the upper torso.⁵²

In fact, this aspect of Stelarc's discourse is more like religious doctrines about the transcendence of the soul, since humans escape the limitations of their bodies to fly freely among the heavens. This places it firmly within a Cartesian mind-body dualism, even if the obsolete body is discarded by means of a gradual replacement rather than discarded at the time of death. The improvement of cyborg does not have to be simply a matter of linking a human machine with a technique or inorganic.⁵³

Statements like "This is my body, this is my software" from Orlan or Stelarc's "the self is no longer meaningfully located in the biological body" do much to encourage these interpretations. Both artists have explored the limits of contemporary "body choices", which Mellor and Shilling define as "technologically informed methods of radically restructuring human embodiment which extend the possibilities associated with having a body, by a direct assault on the limitations connected to being a body." When Stelarc insists that the body is obsolete, we understand that it means that we have technologies and imaginations to put in situations for which it is not designed, which can assault it. According to Stelarc at this point, Orlan has taken the postmodern "bodily option" of cosmetic surgery to the extreme, exploring what Jane Goodall appropriately specifies as "the invention of an 'I' that refuses to eliminate its identity from its corporeal

52 Clarke, 2002, p. 51

53 Appleby, 2002, p. 104

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Fig. 22 Stelarc, *Fractal Flesh*, Photography, © Stelarc

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form", making explicit "the lack of fit between the body and the self", a typical anxiety discontinuities related to contemporary body options.⁵⁴

The real problem is what kind of cyborgizations we will have, and art like that of Orlan and Stelarc can play a crucial role in the demonstration, even the configuration of our options. David Tomas articulated this clearly almost a decade ago when he described his work as "a laboratory for the production and exploration of one kind of quasi-mechanized human body." Now Orlan and Stelarc are directly addressing this problem, and they are doing it with an artistic practice that prefigures, politically and artistically, to a whole new level. Looking closely at their work, we cannot fail to notice their powerful and principled intervention in the fundamental questions of cyborg politics, and we can also discern that their work manifests the necessary, hidden, relationships between aesthetics, ethics and politics.⁵⁵

Here we see a return to questions about the relationship between autonomy and automation, and between the agency and the movement that intrigued the public and philosophers in the 18th century. Most critical comments about Stelarc's work focused on the implications of this technological networking on the human agency. Jane Goodall, for example, says: "Stelarc confuses traditional master/slave terms related to man-machine relationships by increasing the feedback loop to the point where the body and robot are actually one operating system. Instead of living in one or the other, intelligence and the agency is extruded into the system itself."⁵⁶

54 Jones & Sofia, 2002, pp. 52-53

55 Gray, 2002, p. 183

56 Stephens & Heffernan, 2016, p. 42

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In her excellent essay on these “unnatural selection” artists, Jane Goodall compares them to researchers in long-term projects that carefully plan and support body transformation experiments, exploring the limits of agency and identity. While the provocative rhetoric of Stelarc and Orlan may contribute to “overheated imaginations” about progress, evolution, technology and bodies, Goodall points out that their performances may have the opposite effect, cooling down cybercultural fantasies, demonstrating how difficult and painful it is to put them into practice.⁵⁷

But the real irony is that the future of cybernetic interaction depends on more clearly-readable manifestations of emotional behavior in the style of 19th century image creators and researchers such as Delsarte, Duchenne and Darwin, thanks to which the whole system develops more features and greater degrees of behavioral complexity. Just as virtual evolution can have something to learn from human evolution research, the action of posthumanism must consider the emotions associated with its development. And that means Stelarc rightly insists that he uses his body as a prosthesis for a virtual being.⁵⁸

57 Jones & Sofia, 2002, p. 50

58 Scheer, 2002, p. 97

CHAPTER FIVE

ARTIFICIAL LIFE & ROBOTS

Eric Paulos
 Time Stelarc
 Chico MacMurtrie
 Guy Ben-Ari Robotic art Internet
 Eduardo Kac
 TeleGarden
 Simon Penny
 Ken Rinaldo Flock
 Ken Goldberg
 Artist Robot
 Norman White
 Edward Ihnatowicz
 Cyborg Life
 Senster
 Donna Haraway Roy Ascott
 Isaac Asimov Artificial life
 Artificial intelligence Art
 Technology
 N. Katherine Hayles
 Hypertext
 Pygmalion

ARTIFICIAL LIFE AND ROBOTS

Fig. 23 “Farm Fountain” living sculpture, an example of Ken Rinaldo’s bio-art collaboration with Amy Youngs.

ARTIFICIAL LIFE AND ROBOTS

During the 20th century, experimentation with robotics produced new fields of the arts, defined by their interdisciplinary commitments with technologies through which the production of art could be automated in various ways. At the same time, the artistic experimentation of robotics in the 20th and 21st centuries mark a significant change from the previous history that we have sketched out: after the Second World War, robots in art became less humanoid and their role in production of art itself is much more complex. The artist and academic Eduardo Kac points out that a significant interest in robotics emerged within the visual arts in the mid-twentieth century, aligning with the latent enthusiasm for kinetic art.⁵⁹

In 1997, Eduardo Kac coined the term “Robotic Art” to describe artistic projects based on robots or developed around them. In *Foundation and Development of Robotic Art* he stated: “As artists continue to push the very limits of art, traditionally defined by discrete and inert handmade objects, they introduce robotics as a new medium at the same time as they challenge our understanding of robots.” In the last 20 years, artists such as Mark Pauline, Christian Ristow, Eric Paulos, Chico MacMurtrie, Ken Rinaldo, Simon Penny, Stelarc, Guy Ben-Ary, Robotlab and Jim Whiting, to name a few, have distinguished themselves by the impressive artistic use of robotics.⁶⁰

Ascott, an artist and writer who has worked with telecommunications technology since the 1970s, was one of the pioneers of Telematic Art, the forerunner of contemporary Internet Art. Telematic Art generally involved events that connected collaborators from around the world in text and

59 Stephens & Heffernan, 2016, p. 35

60 Vorn, 2016, pp. 365-366

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Fig. 24 Simon Penny, *Traces*, Vision System, 1998 – 1999,
Traces (installation view), © Simon Penny

ARTIFICIAL LIFE AND ROBOTS

Fig. 25 Simon Penny, *Traces*, Vision System, 1998 – 1999,
Traces (scheme), © Simon Penny

ARTIFICIAL LIFE AND ROBOTS

image exchanges in real time. Ascott has developed a provocative utopian rhetoric around Telematic Art, which during the 1990s began to inspire Artificial Life.⁶¹

Artists such as Australian Simon Penny, American Kenneth Rinaldo and Yves Amu Klein from France have combined Artificial Life and robotics in their works, creating an artistic synthesis. The pursuit of finding improved forms of interaction between works of art and the observer through open, unspecified ways of interaction led Penny and Rinaldo, as well as many other artists to model the principles of natural systems in technological systems. The process of acquiring the required technical skills to work with complex technological equipment in the field of robotics, however, ran against a background of very different theoretical concepts. This is reflected to some extent in their artworks.⁶²

An artist with training in engineering and studio art, Ihnatowicz was concerned about the relationship between technologies and their environmental awareness. Specifically, Ihnatowicz was interested in how his creations could interact with his environment. His most famous work, the "Senster" (1970) is considered one of the most important works of Robotic Art in the progressive period of the mid and late 60s, having an undeniable impact on the trajectory of robotics in artistic contexts. Explorations of human/robot relationships also manifest themselves in more fun and physically attractive ways. The Canadian artist Norman White provided a convincing example of this in his work "The Helpless Robot" (1985).⁶³

Norman White's Helpless Robot is a paradigmatic example. There is no propelling power. It depends on its verbal

61 Whitelaw, 2004, p. 185

62 Reichle, 2009, p. 168

63 Stephens & Heffernan, 2016, p. 37

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persuasion to encourage people to do its job. Ingeniously, as a person is forced to help the helpless robot, it becomes increasingly rude and ultimately abusive, creating a situation from which the humble human must timidly escape.⁶⁴

The most famous work of Rinaldo is *The Flock*, a collaboration with the electronics engineer Mark Grossman, which was first shown in 1993 at Siggraph. *The Flock* is an installation consisting of three gently erected robot arms hanging from the ceiling. The video documentation shows the arms moving in the installation room in response to the presence of a human figure: they stagger slowly but irregularly, bending the sensor's tip up and going backwards as the guest moves forward.⁶⁵

While in Rinaldo's work, the sensors allow small organisms to control the movement of their tanks (albeit in a limited capacity), the academic and artist Ken Goldberg and the artist Joseph Santarromana involved Internet users from around the world providing an accessible community experience of telerobotic networks. In the mid-1990s, Goldberg and Santarromana collaborated on a project based at the University of Southern California that combined robotics, social networks and remote-controlled agriculture. Their project, the "Telegarden" (1995), was a remote-controlled community garden that was accessed through the Internet. Users could attend a small plant garden with a robotic arm activated online.⁶⁶

64 Penny, 2012, p. 148

65 Whitelaw, 2004, p. 110

66 Stephens & Heffernan, 2016, p. 40

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Fig. 26 Senster 197, Steel tubes, hydraulic actuators, four microphones, two Doppler radar units, Philips P9201 computer and punched paper tape, 2.4 x 5 metres,
© Edward Ihnatowicz, courtesy of Olga Ihnatowicz

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Fig. 27 Ken Goldberg, TeleGarden, 1996, © Ken Goldberg

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Just as the telescope and the microscope made the familiar object unfamiliar to them, telepresence (or mediated agency) increases the potential for doubt about the authenticity of objects or experiences, especially when the actions are mediated through the Internet. The Telegarden unchained the Uncanny because it called attention to experiences in remote places and introduced uncertainty about the “here and now.” Although The Telegarden was not anthropomorphic, it provoked an awareness of conscience. Doubt or uncertainty regarding the authenticity of an object – its life or presence, as indicated by appearance, movement or representation – is fundamental to the definition of the Uncanny.⁶⁷

On May 11, 1999, the Sony company launched the first toy robot on the market: a small dog capable of moving, perceiving its surroundings and recognizing human orders. On September 7, 2001, Professor Jacques Marescaux performed the first tele-surgery on a patient hospitalized in Strasbourg, with the help of a surgical team located in New York.⁶⁸

In the age of high technologies, these representations of technocultural unconsciousness, especially those with autonomous technical life or agencies, began to change. Thus, for example, monstrous computers, robots and other technological mutants of traditional science fiction gave way to ideas of artificial life, artificial intelligence and intelligent agents, cyborgs and other biotechnology life forms, despite their “inhumane” character, are no longer simply portrayed as a threat to humanity. However, these new forms of technological life are not simply presented as seamless, utopian tools or servants of humanity, as in the case of robots in the stories of Isaac Asimov. Yes, what defines this new meaning of

67 Jochum & Goldberg, 2016, p. 166

68 Laumond, 2016, p. 70

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Fig. 28 Eduardo Kac, *Genesis*, 1998 – 1999, 1998,
Photography, © Eduardo Kac

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high-tech life, is the fact that, as in the “magic”, “animistic” or “fetishistic” notions of life are displaced by modernity, its life evolves and mutates in a way which is often beyond rational human knowledge and control. Such technological life forms can therefore still be described as “different” or even “monstrous”, but their monstrosity, as Donna Haraway suggests with their promises, involves generative mutational possibilities.⁶⁹

Over the centuries, the dream of an ultimate artwork took many forms and enriched many myths: the Pygmalion statue turned into a living woman, the words of language became their own reference in poetic transubstantiation, and the text as a field of energy that constantly produce and regenerate (this is a favorite by hypertext theoreticians). All these conceptualizations involve the transmutation of art into a kind of life that is not distant, as suggested by N. Katherine Hayles, from artificial life or life generated by computers. This idea of art as a form of life implies its negation as a mere reproduction of something external to itself. In their common opinion, the myths of total art express the same desire as the fascination with modern culture with increasingly transparent, realistic and sensitively diverse media: the desire to cross the borders of representation and achieve reality.⁷⁰

Robotic Art helps us to understand the changing terrain of the Uncanny: we are witnesses of how artists of all times explore the limits and landslides between humans and machines. Increasingly, this exploration occurs in the record of the mysterious experiential rather than the representational uncanny.⁷¹

69 Rutsky, 1999, p. 136

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Figure 9. The imitation game, as described by Alan Turing in “Computing Machinery and Intelligence”. Player C, through a series of written questions, attempts to determine which of the two players is a man, and which of the two is the woman. Player A – the man – tries to trick player C into making the wrong decision, while player B tries to help player C. Turing uses this game as the basis for his test for intelligence. In Wikimedia Commons, Retrieved January 25, 2018, from https://commons.wikimedia.org/wiki/File:The_Imitation_Game.svg

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Figure 10. The Original Imitation Game Test, in which player A is replaced with a computer. The computer is tasked with the role of pretending to be a woman, while player B must attempt to assist the interrogator, who must determine which is male and which is female. In Wikimedia Commons, Retrieved January 25, 2018, from https://commons.wikimedia.org/wiki/File:Turing_Test_Version_1.svg

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Figure 11. The “standard interpretation” of the Turing Test, in which player C, the interrogator, is tasked with trying to determine which player – A or B – is a computer and which is a human. The interrogator is limited to only using the responses to written questions in order to make

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