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Research article

The Intellectual Turn and Cultural Transfer of "Humanoid Automata" from the Ancient World to the Enlightenment Era

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Abstract

This study examines the origin and development of the "android" in the Western world, from antiquity to the Enlightenment era. The manufacture of android automata is not only a technological advance, but also reveals an intellectual shift from the Middle Ages to the Enlightenment, involving cultural transfers from different civilizations in ancient times. "Humanoid automata" offer an insight into medieval beliefs and practices as mechanical mimesis in the investigation of the relations between art and nature. Android automata in the 18th century represent Enlightenment ideas through their affective communication. This historical context could provide an important reference for today's research on human–robot interaction.

Keywords: Humanoid automata; Enlightenment automata; Android, Robot; Human–robot interaction

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Научная статья

Интеллектуальный поворот и культурный перенос “гуманоидных автоматов” из античного мира в эпоху Просвещения

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Аннотация
В данном исследовании рассматривается происхождение и развитие “андроида” в западном мире, от античности до эпохи Просвещения. Производство роботов-андроидов – это не только технологический прогресс, но и интеллектуальный переход от Средневековья к Просвещению, включающий культурный перенос между разными цивилизациями в древние времена. “Гуманоидные автоматы” предлагают заглянуть в средневековые верования и практики как механический мимесис в исследовании отношений между искусством и природой. Автоматы-андроиды в 18 веке представляют идеи Просвещения в их аффективной коммуникации. Этот исторический контекст может стать важной отправной точкой для сегодняшних исследований взаимодействия человека и робота.

Ключевые слова: Человекоподобные автоматы; Автоматы Просвещения; Андроид; Робот; Взаимодействие человека и робота

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INTRODUCTION

"Why are they humanoids, and is it necessary to make idealized humanoid androids? Why are humans so eager to make a form similar to themselves?" The robot-detection engineer Haraway raises these doubts at the beginning of the Japanese animated cyberpunk film *Ghost in the Shell 2: Innocence* (Oshii, 2004). We posed the same questions to Japanese roboticist Hiroshi Ishiguro, wondering why he made many humanlike robots which remind us of the ideal female gynoid called "Andréide" in the novel *Tomorrow's Eve* (*L'Ève future*, 1886) written by French symbolist writer Villers de L'Isle-Adam (1886/2000). If Mary Shelley's (1818/1992) "Frankenstein's monster" is far from a humanoid creation in form, then the "Andréide" made by Edison in *Tomorrow's Eve* could be considered the most perfect humanoid robot, even better than real people. However, why build such humanlike robots or, in other words, "androids" in science-fiction narratives and in reality? What is the origin of humanoid robots? Why did the mechanical-makers and science-fiction writers incarnate human characteristics in machines? To explore these questions, it is necessary to review the origins of humanlike robots.

CULTURAL TRANSFER OF EARLY AUTOMATA IN ANCIENT CIVILIZATIONS

The predecessors of humanlike robots are "automata" which originated in the ancient world. "Automata" were to some extent imagined before they were built. The first automata in the Western tradition appeared in Ancient Greece. In Western literature the half-god Hephaestus as depicted in Homer's *Iliad* may be the first fabricator of imagined artificial beings, mobile tripodal creatures capable of attending to the gods. Automated guards and the simply giants can be found elsewhere in Greek literature. In the third century, engineers and architects in Alexandria began to design automata to illustrate their mechanical principles, documenting their creations in texts that detailed their construction (Truitt, 2015, p. 4). These fictional automata appeared in historical texts and romances, in travelogues and encyclopedias, even in the *chansons de geste*, all of which can be read as historical texts that offer insights into medieval beliefs and practices (Truitt, 2015, p. 7).

Elly Rachel Truitt (2015) established an archaeology of automata by citing many types of mechanical production, such as golden birds and beasts, robotic servants, brass horse men, gilded buglers, and papier-mâché drummers. She points out that in the Middle Ages there was no fixed term, or even a set of terms to refer to these "self-moving or self-sustaining manufactured objects" (Truitt, 2015, p. 1-2). The word "automaton" is used to describe a constructed device with powered working parts, often but not necessarily humanoid, often but not always immobile, usually unconscious. The word came into popular use in 16th century France after Rabelais (1534/1994) employed "*automate*" to denote in *Gargantua* (1534) a machine with a self-contained principle of

motion The term was further used in the 20th century to encompass a variety of more specialized terms, including "robot," "android," and "cyborg" (Truitt, 2015, p. 2-3).

Truitt used the term "robot" to refer to these actual and imagined medieval automata which implies a kind of avant-garde nature of these machines, although the mechanical machines in this period were not totally humanlike. Medieval robots identified and explored the multiple types and functions of automata in the Latin Middle Ages, which demonstrates that these objects have long been used to embody complex ideas about the natural world (Truitt, 2015, p. 1-2). The writers and mechanical makers in Latin Christian culture began to explain essential problems about the human body and cosmos within a framework of mechanical technology, which is one symbol of modernity in the 17th century. An intellectual turn occurred in the Western world through mechanistic thinking as a way of knowing the universe. Automata could be considered a link between art and nature, knowledge and technology, real and imaginary by revealing the most primitive confusions of the Middle Ages regarding about life and death, nature and manufacture, magic and science.

In addition, the manufacturing of robots in the Latin Christian West reflected the direct cultural transfer between the European world and other civilizations. Engineers and inventors from other ancient civilizations also attempted to build self-operating machines, resembling humans and other animals, and the objects built in medieval Europe were inspired by automata made in the Byzantine Empire and the Islamic world. (Truitt, 2015, p. 5) Automata appeared in the Islamic world and the Byzantine and Mongol empires much earlier than in the Latin West and entered Europe as gifts or in travelogues (Truitt, 2015, p. 8). In this process of cultural and mechanical reception, these automata were initially treated as foreign objects linked to their origins. It was not until the 15th century, following the construction of the first mechanical automaton in Europe, that automata manufacture became fully integrated into Latin culture and gradually disconnected from their foreign origin. This cultural integration predated future humanoid automata in the 18th century which no longer presented an exotic style but instead represented Enlightenment ideas.

The long history of automata in the Western world, from antiquity to the medieval period, both actual and fictional, demonstrates the ambition of designers to imitate the creations of God. These robots began to take on a humanlike appearance. In mechanical "mimesis," these humanlike automata mimicked natural forms and displayed a powerful cultural coherence among several ancient civilizations which led to the concept and manufacture of modern robots. These automata, from all civilizations, revealed their "own in-betweenness": they were "lifelike copies of natural objects, or eternal bodies that hover between life and death" (Truitt, 2015, p. 9). Humans imitated nature by mechanical means and blurred the boundaries between the natural and artificial. Consequently, this cultural and intellectual import raised a double concern: on the one hand, the introduction of foreign knowledge into the Latin Christian framework; on the

other hand, concern about mimesis and manufacture from the perspective of ethics and religion.

"ANDROID AUTOMATA" IN THE ENLIGHTENMENT ERA

This double concern continued beyond the Middle Ages into the Enlightenment period and culminated in the works of Jacques de Vaucanson. The famous French humanoid automaton inventor of the 18th century created the imitation design paradigm of humanoid automata by combining mechanics, physiology, and anatomy. His work reproduced the internal structure or physiological processes of humans or animals, blurring the boundaries between machines and humans, living and non-living. He presented three automata to the Académie des Sciences in Paris in 1738: a flute player, a galoubet player, and a duck. Under the influence of Vaucanson, the first "android" manufacturing boom in human history appeared in the Western world.

The term "android", which means "humanlike", was initially used for automata. The meaning of this word is evident through its etymological formation: the prefix "andro- (ἀνδρ-)" means "of men or male"; the suffix "-oid (-εἶδος)" relates generally to adjectives and nouns denoting form or resemblance, so the word "android" signifies "a human-like" robot. The earliest origin of the word "android" can be traced to Ephraim Chambers'(1728) *Cyclopaedia*, referring to an automaton produced by Albertus Magnus. The term "android" then appears in US patents in 1863 as miniature humanlike toy automatons. Villers de L'Isle-Adam created the "Andréide" in his novel *Tomorrow's Eve*, which greatly helped to popularize the term "android." Following the publication of this novel, the term "android" was used in a more modern sense. Adelheid Voskuhl (2013) employs the term "android automaton" to describe the humanoid robots made in Europe in this period to emphasize the humanoid appearance and human characteristics of these "android automata."

The 18th century saw the creation of a number of remarkable mechanical androids: at least 10 prominent automata were built between 1730 and 1810 by clockmakers, court mechanics, and other artisans from France, Switzerland, Austria, and the German lands (Voskuhl, 2013, p. 5). During this period, some life-size automata appeared in the public. In 1760, Friedrich von Knaus, a mechanic employed at the imperial court in Vienna, built a writing machine for the mechanical cabinet of the Holy Roman Emperor Franz Stephan. It was the first mechanical device to implement the process of writing. Father and son Jaquet-Droz, clockmakers from Switzerland, introduced in 1774, three android automata: a writer, a draftsman, and a harpsichord player. These automata are often considered the most spectacular and appealing of the entire period. A dulcimer player made by the cabinetmaker David Roentgen in collaboration with the clock-maker Peter Kinzing was presented to the public which was also a gift offered to Marie-Antoinette in 1785 (Voskuhl, 2013, p. 2). The other eight android automata we know from the 18th century display a variety of figures and activities. They were made by clock-makers, cabinetmakers, court mechanics, and other artisans with the means, skills,

and incentives to do so. Through their distinctive mechanical design, an entire setting of 18th century cultural and political activity was replicated. The creators incorporated their Enlightenment ideas into these automata, so they were not only a technical advance. Regarding mechanical complexity, these Enlightenment automata were spectacular and innovative self-moving objects and, the most sophisticated of their kind compared not only with earlier periods, but also later ones. These automata have served throughout all stages of industrialization during the 19th, 20th, and 21st centuries as eloquent metaphors for social and economic changes (Voskuhl, 2013, pp. 1-2). Android automata made during the Enlightenment have played an influential role in our understanding of modern industrial society and the human-machine boundary. As Voskuhl states:

> "Android automata, robots, and mechanical humans have been central to our understanding of the relationship between humans and machines. They are designed to look and move as human beings do and perform motions and techniques such as walking, writing, or music-making. For a spectator, it is often difficult to determine whether an android object is human or machine. Because androids so effectively destabilize our sense of the boundary between humans and machines and, by extension, our sense of our own constitution, they and their histories evoke a broad range of concerns, most significantly, perhaps, those related to the promises and perils of the modern industrial age." (Voskuhl, 2013, p. 1)

These "android automata" all represent the same concern for "mimesis." Jessica Riskin (2003a) calls 18th automata "mechanical experiments" and points out that Jacques de Vaucanson is the founder of this approach by simulating mechanistic physiology. She also explicitly indicates the "epistemological utility" of Vaucanson's flute player, because they could help us know ourselves. As mechanical replicas of humans or of animals, these android automata provided knowledge about humans' and animals' anatomy and physiology. She also argues that Vaucanson made the transition from "representation to simulation" because the mechanics of the 17th century only aimed to represent or imitate an external appearance (Riskin, 2003a, p. 616). Voskuhl (2013) names these android automata "the intersection of philosophy and clock- and instrument-making": "Android automata from this period have been thought of as products of a marriage of philosophy and craftsmanship, too, since they mimic mechanically a key part of our cosmos, the human body" (p. 16). Consequently, the Enlightenment automata provide a self-referential perspective not only for their mechanical makers, but also for the modern machine age to understand the relationship between human and machine.

These automata really attracted a great deal of attention. Vaucanson's celebrated duck excited much interest throughout Europe, as well as von Kempelen's chess player, which was exhibited after its completion "to thousands," even after it had been revealed to be a hoax. Riskin (2003b) assumes that all Enlightenment's automata were of

epistemic relevance both to their makers and to the public (p. 101). These android automata were deliberately produced for this function, and their makers promoted public exhibitions of them. In addition, mechanicians in the Enlightenment era attempted to destroy the human–machine boundary through their humanoid creation not only to imitate human appearance and simple behavior, but also by wanting their androids to communicate affects and sentiments to the audience, such as two female humanoid automata – the dulcimer player and the harpsichord player – built by German and Swiss artisans. These musical androids can move their arms, hands, and fingers to play music, but also move their heads, eyes, and torsos in rhythm with the music they play, so the automata could perform subtle and graceful body motions in addition to playing music (Voskuhl, 2013, p. 6-7). The Enlightenment, long known as the "Age of Reason," has increasingly been associated with "feeling," which has been represented by bodily senses and physiological activities following Descartes and his contemporaries. The automata's bodily motions correspond to 18th-century performance techniques to communicate affects.

The Enlightenment period is recognized as a milestone in the formation and development of modern society. Therefore, the android automata in this period are often taken to be pioneers of the modern, industrial machine age. A key concept of "modern" is "mechanized" which also symbolizes a fundamental change in the social, cultural, aesthetic, and religious constitution of human beings. This technological and intellectual shift profoundly impacted the humanoid robots that appeared in the later science-fiction narratives and the androids of today.

CONCLUSION

There exists a certain continuity between the robots recorded in the texts of ancient civilizations and the "android automata" of the Enlightenment period. They all reflect the essentially natural problems of "mimesis" of ourselves leading to the boundaries between life/death, man/machine, natural/artificial, eternity/temporality. Gaby Wood (2002) proposes that there exists a continuity connecting androids from the 18th century to the robots, science fiction figures, and artificial life of the present time. Villiers, for example, was familiar with the history of robot manufacturing prior to the 19th century. Almost all the important mechanical producers' names appear in the novel *Tomorrow's Eve*, such as Albert the Great, Vaucanson, Maelzel, and Horner. This idea inspires another one, namely that there has always been a large and interested audience for robots and that this audience's concerns and preoccupations coincide with our own current concerns the human–machine relationship in the postindustrial societies (Wood, 2002, p. 24). Both, the androids in science-fiction narratives and in real robot manufacturing are profoundly influenced by these automata in the ancient world and during the Enlightenment. Today, "robot" refers to a larger category of humanoid or anthropomorphized machines. With current technologies, it is possible to build robots with warm and soft bodies, and androids can thus elicit the most natural communication. However, what happens when androids can be completely treated as

intelligent beings similar to humans? The exploration of this human–robot interaction is what we face today.

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