Title
Aristotle on Automation – A Preindustrial Political Theory of Technology

Author
Bhorat, Muhammed Ziyaad

Publication Date
2022

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

Aristotle on Automation – A Preindustrial Political Theory of Technology

A dissertation submitted in partial satisfaction of the

requirements for the degree of Doctor of Philosophy

in Political Science

by

Muhammed Ziyaad Bhorat

2022

ABSTRACT OF THE DISSERTATION

Aristotle on Automation – A Preindustrial Political Theory of Technology

by

Muhammed Ziyaad Bhorat

Doctor of Philosophy in Political Science

University of California, Los Angeles, 2022

Professor Giulia Sissa, Chair

It would appear that our present age of advanced automation technologies is becoming less democratic. I argue that understanding the historical interaction between political thought and technological development provides insight into the relations between automation and democratic decline today. The preindustrial period serves as a foundation for this contemporary problematic, and it is Aristotle, in fact, who offers us an early political theory of automation. Moreover, we can trace the reception and rediscovery of Aristotle's theory into medieval and early modern political thought. These periods, I argue, are often completely overlooked or misunderstood in contemporary discourses about automation because of linguistic and philological barriers that separate contemporary scholars of economics and technology from premodernity. But they show the resistance of Aristotle's theory of automation throughout history.

Ideas about automation are therefore neither new nor unique to the modern period. Aristotle's *Politics* contains one of the earliest specifications of the relation between automated tools, work, and slavery in the context of political formation. Originally for Aristotle, neither automated tools nor workers required higher 'intelligence' to perform work. Aristotle's idea of automation is moreover rooted in an extreme despotism, while dubiously associating freer and more democratic regimes with the substitution of work by automated tools. By interpreting Aristotle's theory for the first time, as mediated through medieval and early Renaissance thinkers like Moerbeke, Magnus, Aquinas, Oresme, and Bruni, as well as the early modern political thought of Hobbes, I show i) the historic and enduring entanglement of political thought and technology, ii) the preindustrial period's underappreciated role in shaping contemporary technology and politics, iii) a different, technological kind of Aristotle, and iv) a corrective to the ongoing uses and misuses of Aristotle's theory in the *Politics*.

The dissertation of Muhammed Ziyaad Bhorat is approved.

Davide Panagia

Joshua F. Dienstag

Anthony R. Pagden

Giulia Sissa, Committee Chair

University of California, Los Angeles

2022

For my parents, Ebrahim and Zohra

TABLE OF CONTENTS

ACKNOWLEDGMENTS

It will be impossible to thank everyone who supported me through researching and writing this dissertation. I will name a few names, but know that I will miss far more – for this I apologize. First and foremost, however, this dissertation is a record of achievement and a labour of love not simply for myself, but for my parents, Ebrahim and Zohra. Their unwavering support has truly meant the world for me, and is incomparable. There would be no dissertation without them, nor without my beloved grandparents.

To my chair, Giulia Sissa, and members of my committee, Anthony Pagden, Joshua Foa Dienstag, and Davide Panagia, I owe an enormous debt of gratitude. I thank them for their advice, mentorship, and creating an intellectual culture and environment in which I felt I could thrive. I felt I was academically supported in the best way possible, and for this I am extremely grateful. I also thank Michael Subialka, who has functioned as a *de facto* academic advisor and confidant to me for many years, taking time out to pore over drafts upon drafts of my work even before I started my doctoral studies. I would not have been able to navigate academia without him, and I would certainly be much less the wiser for it. Similarly, I would like to thank Nils Gilman, William Beinart and Iacopo Costa for their mentorship and guidance at the Berggruen Institute, the University of Oxford, and the CNRS respectively.

My life in Los Angeles would be sunny but bleak without the friendship and love of my friends and colleagues. I would like to thank Jaclyn Whynot and Sarah Wells for taking such good care of me always. Though Abhilash Mishra and Kathleen Taylor have left the city, I miss them and thank them for the joy they brought to me in critical years of the program. I am also grateful for Chris Meek, Scott Rising, and Alex Henrichs, who chose

to be a part of my life notwithstanding the rigours and challenges of the doctorate. Their support helped me through it. To Adrian Vallens, thank you for being in, a quarter mile at a time. I thank my current and former colleagues Jennifer Joines, Kye Barker, Steve Cucharo, Joshua Campbell, Nicholas Muench, Alex Diones, Rui Zhou, Michael Stenovec, Kristofer Armstrong, Aerik Francis, Emily Herrmann, Cybele Kappos, Rachel Forgash, and Naomi Ellis – what a wild ride we have been on!

Finally, I thank Ayesha Mukadam, Marc Sevitz, Didi Mae Hand, Philippe-André Rodriguez, Fred Lessing, Ali Asad, Nicholas Corbett, Daniella Lupini, Pierre Vercueil, Tahseen Tayob, Andrew Versfeld, Travis Hubbs, Edna Goh, Tiffany Mathias, Mark Warren, and really all members of "The Eternal Kingdom" for their incredible friendship, which taught me the meaning of Aristotelian *philia*. Of course, special mention must go to my two best friends, Thato Thale and Ahmad Tayob, to whom I owe so much. I have grown up and with them, and I love them deeply. To my siblings, Ferhana, Shamima, and Ismail, and their respective families, I am grateful for a lifetime of love and support.

VITA

Ziyaad Bhorat graduated from the University of Cape Town with a Bachelor's of Business Science (Economics and Law) in 2011. His thesis, "Towards Private Enforcement of Competition Policy in South Africa – An Economic Rationale and Estimation Overview for Victims of Cartels", was supervised by Lukasz Grzybowski. The degree was awarded with First Class Honours and a Distinction in Economics. From 2012 to 2014, he studied at the University of Oxford on a Rhodes Scholarship. At Oxford he completed his MSc in African Studies in 2013, and his MBA in 2014. For the MSc, his thesis, "Madam and Eve – Using Film and Media to Re-analyse Domestic Worker- Employer Relations in South Africa", was supervised by William Beinart. He was supervised by Pamela Hartigan in the MBA program. He thereafter worked in corporate media, entertainment and technology for the Millicom Group before moving to Los Angeles to pursue a 1-Year Conservatory in Producing at the New York Film Academy in 2016. Having published on technology, human rights, and politics in general audience outlets across the USA, UK, and South Africa – including *OpenDemocracy*, *The Hill*, *Noēma Magazine*, *CNBC,* and *Business Day Live* – he began his PhD in Political Science (Political Theory) at UCLA in 2017, under the supervision of Giulia Sissa. He completed his MA in Political Science in 2019, majoring in International Relations and Political Theory, minoring in Classics. In 2021 he published his first academic article, "Automata in Hobbes: Three Heads of Cerberus" in the *History of Political Thought*, and was a visiting scholar at the *Centre national de la recherche scientifique* (CNRS), Laboratoire d'études sur les monothéismes, in Paris. In 2022, he published "Automation, Slavery, and Work in Aristotle's Politics Book I" with *Polis: The Journal for Ancient Greek and Roman Political Thought.*

Introduction – The Problem of Automation

I. Automation and the Decline of Democracy

Political thinkers have worried about the relation between automation and democratic decline for quite some time now. After World War II, this became an acute concern when Norbert Wiener – the originator of cybernetics himself – had declared that "automatic machine, whatever we think of any feelings it may have or may not have, is the precise economic equivalent of slave labor." This meant that "[any] labor which competes with slave labor must accept the economic conditions of slave labor." [1] Pamphlets were circulated by the Socialist Labor Party in 1955, citing Wiener, and declaring that the consequences of automation – increasing concentration of capital – would spell an "economic despotism [that] must sooner or later impose a political despotism on the nation".[2]

In the same year, another pamphlet was circulated by the League for Industrial Democracy, written by Warner Bloomberg Jr., who asked the following, "Even if our democracy can withstand the effect of automation from a narrow technically correct economic viewpoint which sees only the balancing of totals, the question is, can it afford

[1] Wiener, *The Human Use of Human Beings*, 1954 [1950], 162.

[2] Hass and Emery, *What Workers Should Know About Automation*, 1957 [1955]), 18; 43.

the spiritual and psychological consequences which flow from such extensive and continuing job displacement?". Bloomberg Jr. answered himself with a "no".[3]

Later in 1959, Charles Shull warned that automation had the potential to engender "ignorance of the technical on the part of the political" and reciprocally of the "political on the technical". For Shull this meant that states would be vulnerable to governments which, in "[smoothing] the path of automation", would bring about a "complete erosion of any semblance of private or free enterprise". Governments, "in connection with the intimate use of automation as the heart of modern military science and weapons… may find it easier to *direct and command* [my emphasis] in the first instance and in effect totally, rather than to mediate and thus preserve a sphere for others."[4]

Soon afterwards, theorists started to worry that automation would degrade the formation of political subjectivity and leave democracies vulnerable to authoritarianism. Lewis Mumford wrote the following in 1964:

> Let us fool ourselves no longer. At the very moment Western nations threw off the ancient regime of absolute government, operating under a once-divine king, they were restoring this same system in a far more effective form in their technology, reintroducing coercions of a military character no less strict in the organization of a factory than in that of the new drilled, uniformed, and regimented army… Through mechanization, automation, cybernetic direction, this authoritarian technics has as last successfully overcome its most serious weakness: its original dependence upon resistant, sometime actively disobedient servo-mechanisms, still human enough to harbor purposes that do not always coincide with those of the system.[5]

[3] Bloomberg Jr., *The Age of Automation*, 1955, 15.

[4] Shull, "Political Aspects of Automation", 1959, 340.

[5] Mumford, "Authoritarian and Democratic Technics", 1964, 4 –5.

For Hannah Arendt, "automation [was] a new revolution" that could increasingly replace "brain power" and so necessitated a re-evaluation of thinking as a political activity.[6] Its advent threatened to "shatter the very purposefulness of the world" and reduce human life to a state of degradation where only the "effort of consumption [would] be left".[7]

To these thinkers, automation started to present a threat to tasks requiring human cognition. Cybernetics and early developments in Artificial Intelligence (AI), including B. F. Skinner's radical contributions to the behaviorism movement – notably his infamous teaching machine – presented the possibility of intelligent artifice that could condition human behavior. The period of industrial automation inaugurated with motor mechanization and feedback control, climaxing in the Industrial Revolution, had started to bleed into and influence a new and co-extensive period which could only be possible with electricity: digital automation. As Yuk Hui suggests, "Digital objects are new forms of industrial objects", and the digital includes an orientation towards "the automation of data processing".[8]

Bernard Stiegler sums up the consequences of this bleed, and the challenge of the new period's societies of 'hyper-control', which occur "through a process of generalized automatization". For Stiegler, what characterizes this period is a loss of our 'savoir-théorique' as our "noetic faculties of theorization and deliberation are short circuited by

[6] Arendt delivered these remarks in 1964 at the Institute for Cybercultural Research. See Arendt, "Cybernetics and Automation", 1964.

[7] Arendt, *The Human Condition*, 1998 [1958]), 131; 150.

[8] Hui, *On the Existence of Digital Objects*, 2016, 54–55. Hui does not make exclusive determinations about the digital, but rather restricts his analysis to data and metadata.

the *current operator of proletarianization*, which is *digital tertiary* retention". This differs from previous periods, "as analogue tertiary retention was in the twentieth century the operator of the proletarianization of savoir-vivre, and…mechanical tertiary retention was in the nineteenth century the operator of the proletarianization of savoir-faire".[9]

Michel Foucault had already argued how "struggles against subjection, against forms of subjectivity and submission"[10] became increasingly important in contemporary society because of the automated operation of power, beyond struggles against explicit domination and exploitation. The Panopticism of modern disciplinary society assures, as he says, the "automatic functioning (*fonctionnement automatique*) of power".[11] Power disposes man into a subject that behaves as though it were being surveilled. Human oversight and physical coercion are no longer strictly necessary, since automation now takes for its object social and political relations. Distributed into automated networks of digital control, this development allowed for a new digital authoritarianism to consolidate and emerge.[12]

Perhaps these thinkers were right to be concerned. There has been an enormous technological increase in labor-substituting machines – what Bernard Stiegler has called "a *generalization of roboticization* in all economic sectors".[13] In manufacturing alone, the global average robot density reached a new record of 126 operational industrial robots per 10

[9] Stiegler, "Automatic Society - Londres février 2015", 2016, 196–197. See also Stiegler, *Automatic Society*, *passim* as a motif that reappears throughout.

[10] Foucault, "The Subject and Power", 1982, 781.

[11] Foucault, *Surveiller et Punir*, 1975, 202. Translation my own. For more on how Althusser's language of 'apparatus' is critiqued and reformed by Foucault's disciplinary *dispositif*, see Panagia, "On the Political Ontology of the Dispositif", 2019, 714–746.

[12] Alternatively, "networked authoritarianism", as coined by MacKinnon, "Liberation Technology: China's "Networked Authoritarianism"", 2011.

[13] Stiegler, *Automatic Society Volume 1*, 2016, 94.

0000 workers in 2021.[14] At the same time, our world is indeed becoming increasingly nondemocratic. If we look at empirical measures like the Democracy Index, more than a third of the world's population now lives under authoritarian rule, and "the majority of countries registered a deterioration in their average score or stagnated in 2021" – continuing a deterioration, accelerated by the global pandemic, to the worst average global score since the Index's inception in 2006.[15]

This movement is echoed by other major empirical indexes, such as Freedom House's *Freedom in the World*, which notes that 2021 marked the 16th consecutive year of decline in global freedom, and that less than 20% of the global population lives in a 'Free' country.[16] The Varieties of Democracy (V-Dem)'s *Democracy Report* also illustrates a steep global decline during the past 11 years, with a decline in liberal democracies and electoral autocracies remaining the most common regime type.[17] This marks a stark departure from the post-Cold War period's "third wave of democratic transitions" where "democratic regimes came to outnumber autocratic regimes". [18]

What then, might be the common relation between democratic decline and our industrial and digital periods of automation? In fact, we may seek answers in another period

[14] International Federation of Robotics, *World Robot Report 2021*, 2021.

[15] Economist Intelligence Unit, *Democracy Index 2021: The China Challenge*, 2022.

[16] Freedom House, *Freedom in the World: The Global Expansion of Authoritarian Rule*, 2022.

[17] Boese et al, *Democracy Report 2022: Autocratization Changing Nature?*, 2022.

[18] Marshall and Elzinga-Marshall, *Global Report 2017*, 6, which notes however that externally-directed regime change led to these states not being "sufficiently integrated for sustaining and consolidating democratic procedures", helping to "account for the near doubling of anocratic regimes". Data for this report relies on another key index, Polity IV. See Marshall, Gurr, and Jaggers, *Polity IV Project*, 2019. But see Boese, "How (not) to Measure Democracy", 2019, advocating for the use of V-Dem over Polity IV, and Vaccaro, "Comparing Measures of Democracy: Statistical Properties, Convergence, and Interchangeability", 2021, noting that "VDEM [sic] seems to "cause" also more precise estimations than the other measures", giving also the example of Hungary's commonly acknowledged democratic decline – something that V-Dem captures but Polity IV does not.

of automation that continues to underlie both. Preindustrial automation is centred around the creation of automata which did, or might in theory harness the power of nature, magic, or the divine. It is the serious idea of inaugurating a kind of artificial life in something that might replace or extend human work – often conceptualized well before the fact of its material existence. As Wiener shrewdly noticed, however, it takes for its measure one of the most abject categories of human existence: the slave. This idea has not disappeared even today. For example, prominent AI ethicist, Joanna Bryson, has most recently suggested that "robots should be slaves". [19]

In this dissertation, therefore, I argue that understanding the historical interaction between political thought and technological development provides insight into the relations between automation and democratic decline today. Preindustrial ideas about automation are a woefully neglected area in automation discourse and are often completely overlooked or misunderstood because of linguistic and philological barriers that separate contemporary scholars from premodernity. Yet premodernity is replete with rich ideas about automata, self-moving tools, the substitution of human work, and freedom. In fact, a whole interpretive tradition exists in the medieval through early modern period on the question of the requisite level of intelligence or cognition, such that automated tools might become a substitute for lower skilled workers. This interpretive tradition traces itself back to Aristotle's idea of natural slavery and automation in the *Politics*, highlighting how resistant early ideas about automation have been throughout history.

A central claim, therefore, is that automation is not a uniquely modern phenomenon, but is in fact theorized by Aristotle alongside extreme forms of despotism. As

[19] Bryson, "Robots Should be Slaves", 2010, 63–74.

Lewis Mumford suggests, while a "democratic technics" refers to the "small scale method of production, resting mainly on human skill and animal energy but always, even when employing machines, remaining under the active direction of the craftsman or the farmer", automation forms part of an "authoritarian technics" that has ancient roots "[beginning] around the fourth millennium B. C." in "physical coercion, forced labor, and slavery".[20] The preindustrial period therefore serves as a foundation for thinking about automation and politics, and an analysis of Aristotle and the transmission of his ideas about automation and slavery helps us contextualize the dangers of this way of thinking for politics and technology today.

II. The Concept of Automation

Scholars of automation typically rely on conceptualization of it that emerged from postwar, Taylorist America. As Roger Luckhurst puts it, the term was "consolidated in the English language in a flurry of debates during the early 1950s".[21] The idea that automation can be traced back to a preindustrial period – moreover classical Greek thought – might therefore seem anachronistic to some. A better way to think about this development, however, can be seen from an analogous example, taken from the theatre. Almost all Western theatre designs today can be traced back to their roots in Greek culture. This includes the many and varied novel forms that mutated over the years and periods, each with their own names and idiosyncrasies. From the Romans, to the Renaissance, to the Bolshoi, Greek ideas

[20] Mumford, "Authoritarian and Democratic Technics", 1964, 2–3.

[21] Luckhurst, "Automation", 2014, 317.

continue to influence one of our most treasured cultural formations.[22] Similarly, automation contains a social and political formation about our relations to tools and work, that has undergone many mutations over the years.

In fact, our familiar term 'automation' was created for an idea long in search of a name. Ford executive, Delmar Harder, and the industrialist, John Diebold, are usually credited with the popularization of the term.[23] Diebold, whose work Arendt cites in *The Human Condition*,[24] admitted candidly that it was really "ease of spelling" that led to the creation of the word 'automation'. He would refine the term in later work to emphasize that two types of automation should not be confused: so-called "'Detroit Automation,' which is really advanced mechanization but to a very high degree", and the revolutionary automation enabling a machine "to 'know' what they are doing" and through feedback "control their own operations, adjust their own controls, and make their own corrections" without human intervention. In short, and quite tautologically, "automation [had] come to mean both the integration of automatic operations and the process of making things automatic".

Diebold argued that despite the new terminology, the former type of automation is "nothing new". And even feedback is found "everywhere in life"- the novelty being its extension to machines.[25] He was not alone in making such arguments. Bloomberg, for example, declared the following,

---

[22] On this, see for example Leacroft and Leacroft, *Theatre and Playhouse*, 1984.

[23] See for example Veillette, "The Rise of the Concept of Automation", 1959, 1–16. For more contemporary references, see Shimon Nof, "Automation", 2009, 14.

[24] Arendt, *The Human Condition*, 1998 [1958], 148–149; 151.

[25] See Diebold, "Automation", 1955, 635–637. See also Diebold, *Automation: The Advent of the Automatic Factory*, 1952.

> Except for the electronic computer, all the elements of the automatic factory have roots reaching back into the earlier years of the modern industrial era. The principle of feedback was applied in the eighteenth century in the form of a device called the twin-ball governor which kept the old steam engines from running wild if the workload were suddenly removed.[26]

In 1955 Rep. Katherine St. George (R-NY) extended remarks that the "bogyman of automation" was "quietly and efficiently" put to rest by the words of industrialist Benjamin Fairless. Fairless had claimed, "There is nothing new about automation. The mechanics of it are older than our own American Republic". [27]

Both Diebold and Bloomberg were aware that automation, as a concept, was something difficult to define. Diebold claimed definition was "difficult" because it meant "many things to many people".[28] Bloomberg noted that "one of the prime reasons for the different points of view is the different definitions of 'automation'". He distinguishes a narrow view, "used by many economists and engineers" that automation "requires the combination and integration of once separate manufacturing processes, the use of servomechanisms and feedback control devices". This is done "to the end that a major segment of production proceeds without interruption and the materials are 'untouched by human hands' [including the] utilization of electronic computers to control the whole assemblage of machinery".[29] On the other hand, a more expansive view of automation

[26] Bloomberg Jr., *The Age of Automation*, 1955, 12.

[27] Representative Katherine St. George, extended remarks in Appendix, March 8th, 1955, 84th Cong., 1st sess., *Congressional Record* 101, pt. 11, A1521–1522, with Fairless's reproduced remarks. For more on the techno-optimist movement around this time see Elsner, *The Technocrats*, 1967.

[28] Diebold, "Automation", 1955, 635.

[29] Bloomberg Jr., *The Age of Automation*, 1955, 12.

collected "any machine which replaces a human hand or mind". In 1959, Paul Veillete declared that automation had become a "nebulous" concept whose "use varies with the user".[30]

Despite the time that has passed, it appears that automation remains a domain-specific, contested term. In Shimon Nof's 2009 edited handbook on automation, Nof notes the challenge experts faced when offering their own definitions of automation, since they were "not sure it is the same meaning for other experts".[31] Similarly, in their 2018 working paper on automation, employment, and wages, Lukas Schlogl and Andy Sumner note that automation is "more difficult to define that might seem at first glance".[32] At its core automation remains contested as to how different domains of human knowledge understand it – from engineering to computer science to economics, for example – its constituent parts, and its implications. Depending on these factors, automation could be as new as the electronic computer, or as old as artificial feedback systems.

One commonality amongst contemporary automation theorists is a preoccupation with machines, the substitution of human effort on some level, and the industrial and post-industrial periods. In their 1982 seminal work, *The Future Impact of Automation on Workers*, Wassily Leontief and Faye Duchin noted that "robotics [seemed] to be the only aspect of automation that [had] been studied at all systematically to date". Instead, Leontief and Duchin intended to "concentrate on only one – albeit the newest, most talked about – component of technological change: computer-based automation".[33] The advancement in

[30] Veillette, "The Rise of the Concept of Automation", 1959, 3–4.

[31] Nof, "Automation", 2009, 14.

[32] Schlogl and Sumner, "The Rise of the Robot Reserve Army", 2018, 5.

[33] Leontief and Duchin, *The Future Impact of Automation on Workers*, 1986, 3–6.

automation's sphere of action – from manufacturing robots to computers – presented an enlargement in the idea of automation. Contemporary economists like Daren Acemoglu and Pascual Restrepo therefore see automation as "using machines and computers to substitute for human labor in a widening range of tasks and industrial processes", which may also lead to capital productivity and labor reinstatement effects.[34] Moreover, and as we see today, the advent of digital technologies has enlarged the idea of automation into the realm of data processing itself. With the internet we can now talk about a "Web of automation", and with AI we can talk about the "automation of knowledge".[35]

Aaron Benanav offers a definition that is paradoxically both highly restrictive and expansive, considering "automation technologies" as "labor-saving technical innovations that *fully* substitute for human labor, rather than merely augmenting human productive capacities", giving examples of machines substituting for "telephone switch board operators", and "hand manipulators of rolled steel". Benanav's definition is restrictive because it would eliminate from automation anything other than complete human obsolescence for a job classification. Benanav admits however that disentangling labor-substituting and labor-augmenting technologies is "more difficult than one might suppose", but finds that both "can be expected to leave many workers without jobs" and so leaves the discussion at that point.[36] Benanav's definition is also usefully expansive – while he uses machines as examples, the idea of a labor-saving technical innovation that (fully) substitutes

[34] Acemoglu and Restrepo, "Artificial Intelligence, Automation and Work", 2018, 3.

[35] Hui, *On the Existence of Digital Objects*, 2016, 286; 280.

[36] Benanav, *Automation and the Future of Work*, 2020, 5–6.

for human labor can just as easily be applied to the hydraulic systems of the preindustrial ancient world.

Indeed, a significant problem with definitions of automation lies in a consideration of the tool in question, and what it is supposed to be doing. 'Automated technologies' or, as Diebold tautologically put it, "the integration of automatic operations and the process of making things automatic",[37] tell us very little about the tool's actions unless paired with ideas about feedback, for example. Gilbert Simondon disputes the idea that machines can be reduced to feedback and takes us further into an ontology of automation by referring to it as follows:

> Automatism, however, is rather a low degree of technical perfection. In order to make a machine automatic, one must sacrifice a number of possibilities of operation as well as numerous possible usages. Automatism, and its utilization in the form of industrial organization, which one calls *automation*, possesses an economic or social signification more than a technical one. [38]

For Simondon, automation rests on automatism, and is a social and economic signification of automatism's utilization in industrial organization. Automatism here is a way of removing indeterminacy from machines, referring to their "simple repetitive operation", and so is the lowest level of technical perfection.[39]

---

[37] Diebold, "Automation", 1955, 635.

[38] Simondon, *Du mode d'existence des objets techniques*, 1989 [1958], 11. Translation here provided by Malaspina and Rogove's edition, 2017, 17: *Or, en fait, l'automatisme est un assez bas degré de perfection technique. Pour rendre une machine automatique, il faut sacrifier bien des possibilités de fonctionnement, bien des usages possible. L'automatisme, et son utilisation sous forme d'organisation industrielle que l'on nomme automation, possède une signification économique ou sociale plus qu'une signification technique.*

[39] Hui, *On the Existence of Digital Objects*, 2016, 277.

In David F. Noble's social history of industrial automation, *Forces of Production*, he characterizes "mechanization, and, later, automation" as industrial trends "which built into machinery the muscle, the manual skills, and, ultimately, the self-adjusting and correcting 'intelligence' of production itself." This 'intelligent' machinery was deemed automatic or "self-acting", and its technological development implied a realm of freedom, "known as politics".[40] Automation is thus seen as a social and political phenomenon that synthesizes the cognates 'automatism', 'automata' or 'automatic'. To borrow the words of Georges Friedmann, it is a stage of development that in fact "illuminates the whole history of machinism."[41]

But machines, and the discipline from which machines spring – mechanics – pre-date the industrial period. As one example we may point to the Hellenistic Antikythera orrery mechanism, with its sophisticated system of moving gears, containing "mechanical features that were there for anyone to see" – often described as the 'first analogue computer'.[42] The works of Galen, Heron, and the Peripatetic *Mechanical Problems*, all contain principles of self-moving mechanisms and automata. Indeed, especially after the 4th century BCE, and as Sylvia Berryman notes, the Greek world in particular is the site of marvellous automata and machines.[43] Other than to highlight the contours and developments of specific instantiations of automation in the industrial and digital periods, there is therefore no good reason to restrict a concept of automation to these periods. Not

[40] Noble, *Forces of Production*, 2011 [1984]), 36; xiv.

[41] See Friedmann, *Problèmes Humains du Machinisme Industriel*, 1946, 168. Arendt quotes and affirms this proposition in *The Human Condition*, 1998 [1958], 3, though taking Friedmann's "l'automatisme" to imply 'automation'.

[42] Jones, *A Portable Cosmos*, 2017, 32. Jones examines the historical characterization of the Mechanism as a 'computer', 17–46.

[43] Berryman, *The Mechanical Hypothesis in Ancient Greek Natural Philosophy*, 2009.

only do machines and automata predate these periods, but so does the idea of 'intelligent artifice' more generally. Machines are simply one species of tool that we have come to develop over our long history.

In fact, some scholars have already argued that the term 'automation' did not appear only and for the first time in the 20th century US industrial context. In 1957 Margaret Marshall suggested that 'automation' is attested in English as far back as 1662. [44] According to Marshall, it could be found in a pamphlet written by Cambridge Platonist Simon Patrick, following the development of Cartesian philosophy, that the art of god (*Ars Dei)* is essentially a "great automation of the world". On closer inspection however, the text of Patrick's work refers to "automaton", and not "automation":

> Then certainly it must be the Office of Philosophy to find out the process of this Divine Art in the great *automaton* [my emphasis] of the world, by observing how one part moves another, and how those motions are varied by the several magnitudes, figures, positions of each part from the first springs or plummets, as I may say, to the hand that points out the visible and last effects. [45]

Nevertheless, Marshall and Patrick highlight how the mechanical principles and automata that arise in automation are to be found well before its terminological conception. Automation as a phenomenon comes late to its name, in the course of human technological development.

Given the above, I argue for a conception of automation that is open to its social and political dimensions, its internal contestations, its historical ambiguity, and the

[44] Marshall, "'Automation' Today and in 1662", 1957, 149–151.

[45] Patrick, *A Brief Account*, 1662), 19 (11).

changing species of things that we classify as tools. Automation, so understood, implies the conditions, limits, and consequences of substituting or augmenting human work with artificial tools capable of acting themselves to complete the relevant task. It is a marvel of human development – the ability to bestow some kind of artificial liveliness to the art that we create, so that it can produce further arts for, and often instead of us.

III. Automation Discourse

Much of the discourse on automation overwhelmingly focuses on the economic implications of the substitution of human labor by tools. From Leontief and Duchin's input-output analysis of computer-based automation, to Acemoglu and Restrepo's voluminous economic studies, to Benanav's Marxist post-scarcity challenge for those who see automation as the leading cause of job loss in an era of economic stagnation, politics plays second fiddle – or no fiddle at all – to economic concerns. Even in normative scholarship about the future of automation and society, such as John Danaher's *Automation and Utopia*, "broader political questions" are seen as "peripheral to the question of human flourishing and meaning". Danaher's decidedly neo-Aristotelian pursuit of the good life, wherein human obsolescence in work is taken as a given, includes a retreat into a virtual utopia of gaming and creativity. And while Danaher discusses issues of political importance, such as "autonomy, opacity, and agency", his treatment of automation is not interested in politics except for noting that some distribution of power in society will always be the case (except in cases of libertarian/anarchist states), and that "the mere fact that some group has

significant power is not, in and of itself, a problem" – unless it threatens human flourishing, that is. [46]

Who wields power in an increasingly automated world is an issue that Daniel Susskind precisely takes up in his attempt to help "build a world where all of us can flourish". Big technology companies, Susskind notes, will end up having an outsize political influence: "In the twentieth century, our main worry may have been the economic power of corporations: but in the twenty-first, that will be replaced by fears about their *political* power instead".[47] Susskind's formulation is a prime example of how economic concerns about automation have historically occluded thinkers from considering political ones.

Increasingly, however, scholars are turning to notice that automation has both political causes and effects that can be quite pronounced in society. Carl Frey, who offers a an incorrect quotation of Aristotle's passage on automation in the *Politics*, "When looms weave by themselves, man's slavery will end", has nevertheless argued that decisions on technological progress, including industrialization and automation, were not made earlier in history because, "The landed classes, whose members controlled the levers of political power, had little to gain and much to lose from replacing technologies, as workers might rebel against the government in fear of losing their jobs".[48] Empirically, the anxiety about automation's effects on work and employment can lead individuals to opt for "radical political change" that translates into voting behavior,[49] and influences redistribution

[46] Danaher, John, *Automation and Utopia*, 2019, 127–128.

[47] Susskind, Daniel, *A World Without Work*, 2020, 10; 6.

[48] Frey, *The Technology Trap*, 2019, 1; 24.

[49] Frey, Berger, and Chen, "Political Machinery", 2018, 439.

preferences.[50] This anxiety, stemming from the material conditions of economic production, can be a significant contributor to emerging formations of economic nationalism and populism, and can therefore upset democracy.

Algorithms, in particular, have become the source for an explosive scholarly interest amongst political thinkers. Examples include Scott Timcke's Marxist approach, *Algorithms and the End of Politics*,[51] Taina Bucher's socio-cultural exposition, *If…Then: Algorithmic Power and Politics*,[52] and Safiya Umoja Noble's intersectional critique, *Algorithms of Oppression*.[53] And yet, despite this interest, Colin Koopman is correct to note that we still "lack a political theory of data despite our widespread affirmation of the politics of data".[54] Steps have been taken in this regard, however, most notably by Davide Panagia's political ontology of the algorithmic dispositif.[55] But as Panagia notes, algorithms themselves are a symptom of automation – a precondition for their existence at all – which moreover trace a development to Aristotelian ideas:

> At the core of algorithm dispositif, then, is an account of automation for the articulation and management of futures…it barters in futures by relying on an Aristotelian aesthetic hylomorphism of the 'one action, a complete whole, so as to create a homeostatic system of negative feedback of communication and control.[56]

[50] See also Thewissen and Rueda, 2018, 171–208.

[51] Timcke, *Algorithms and the End of Politics*, 2021.

[52] Bucher, *If…Then*, 2018.

[53] Noble, *Algorithms of Oppression*, 2018.

[54] Koopman, "The Political Theory of Data", 2021, 2.

[55] Panagia, "On the Possibilities of a Political Theory of Algorithms", 2021, 109–133.

[56] Panagia, "The Algorithm Dispositif", 2020), 124.

Retrieving this underlying account of automation, I argue, generates useful insights for us to fully understand the contours of its symptomatic developments, like algorithms.

I seek therefore to decenter automation discourse as predominantly the preserve of fields like economics, computer science, and sociology, and revitalize political scientific and theoretical evaluations of the technical. This dissertation joins a growing body of technology theorists for whom *instrumentalist* theories of technology, which stress the objectively neutral position of tools, are insufficient accounts,[57] and for whom the history of technology and political thought is indispensable to evaluating contemporary technics and technology.

As Andrew Feenberg notes, most philosophy of technology can be grouped into "theories of progress" or "ontological or cultural theories of the technification of social life".[58] Instrumentalists see technology as a neutral means to progress, usually defined in economic terms like efficiency, productivity, but sometimes also in social and political terms like emancipation or human flourishing – Danaher, for example. Simondon offers another way to think of progress within the terms of the technical itself – a milieu of increasingly integrated technological and natural systems striving towards perfection and complexity.

Ontological or cultural theorists of social technification can, with the usual difficulty of overlap and boundary porosity, be grouped into *pessimists*, who argue that "technology constitutes a new type of cultural system that restructures the entire social world as an object

[57] On this see Winner, "Do Artefacts Have Politics?", 1980, 121–136; also Winner, *Autonomous Technology*, 1978, *passim*. For a materialist critique and response to Winner see Joerges, "Do Politics Have Artefacts?", 1999, 411–431.

[58] Feenberg, "*Concretizing Simondon and Constructivism*", 2017, 63.

of control". While referencing Landgon Winner's own pessimism in *Autonomous Technology*,[59] Feenberg cites Heidegger and Jacques Ellul as prominent theorists within this group. [60] He offers his own post-Marcusian Marxist *critical* theory. For critical theorists, "technology is not a destiny but a scene of struggle", and of "ambivalent" processes of development.[61] Such struggle-based approaches need not come only from Marxist sources – Stiegler, for example, offers a sophisticated treatment of technology, and his human-embedded 'neganthropic' stresses the importance and possibility of resisting the destabilization and disintegration of society brought on by automation.[62] Closely allied are *social constructivist* theories, whose resemblances are varied but stress the historically contingent, socially mediated positionality of technology. Examples here include the historical sociological works by Noble and Mumford, and methodological approaches by the likes of Trevor Pinch and Wiebe Bijker[63] or Bruno Latour (actor-network theory).[64]

Automation, within theories of technology and according to Feenberg's characterization, is subject to ambivalence as well. "Automation, "he says, "increases management's autonomy only at the expense of creating new problems that justify worker's demands for an enlarged margin of maneuver." This margin can go one way or another, "it may be opened to improve the quality of self-directed activity or it may remain closed

[59] Winner, *Autonomous Technology*, 1978.

[60] Heidegger, "Die Frage nach der Technik", 2000 [1954]; Jacques Ellul, *The Technological Society*, 1964.

[61] Feenberg, *A Critical Theory of Technology*, 1991, 7; 12–14. See also the work of Günther Anders through Babbich, *Günther Anders' Philosophy of Technology*, 2021.

[62] Stiegler, *Automatic Society*, 2016, *passim*. See also Stiegler, *Technics and Time*, 1998 [1994]. For an overview of critical theory approaches see Delanty and Harris, 2021, 88–108.

[63] Pinch and Bijker, "The Social Construction of Facts and Artefacts", 1984, 399–441.

[64] Latour, *Science in Action*, 1987. For an overview of social constructivist approaches see Brey, "Social Constructivism for Philosophers of Technology", 1997, 56–78.

to optimize control."[65] It is at this site that economic and political struggles must occur, determining the course of human and technological development one way or another. In making this characterization however, Feenberg accepts Larry Hirschhorn and Shoshana Zuboff's critiques of Diebold's Taylorist promise for automation and progress. [66] But Diebold and Taylorism were themselves influenced by prior theories of automation and technology. We should not be tempted to think that ideas about automation – and a particularly progressive brand of it – suddenly materialized in 20th century America. Doing so would fail to grasp the long history of technology's entanglement with political thinking.

IV. Aristotle and Automation

Automation points us to something prior to its terminological consolidation in the 20th century. Rooted in the Ancient Greek word *automatos*, automation and its cognates speak to a history that stretches into classical antiquity. As Mumford tells us, automation forms part of an 'authoritarian technics', which in turn is built on the back of forced labor, slavery and coercion. Simondon, referring to an "autocratic philosophy of technics" (*philosophie autocritique des techniques*), cautions against seeing tools – machines in particular – as means to power:

> One could use the term 'autocratic philosophy of technics' for a philosophy that takes the technical ensemble as a place where machines are used in order to obtain power. The machine is only a means; the end is the conquest of nature, the domestication of natural forces by means of a first act of enslavement: the machine is a slave whose purposes is to make other slaves. Such a dominating and enslaving inspiration can coincide with the quest for man's freedom. But it is difficult to free oneself by transferring slavery onto

[65] Feenberg, *A Critical Theory of Technology*, 1991, 96.

[66] Hirschhorn, *Beyond Mechanization*, 1984; Zuboff*, In the Age of the Smart Machine*, 1988.

> other beings, men, animals, or machines; to reign over a people of machines that enslave the entire world is still to reign, and every reign presupposes the acceptance of the schemas of enslavement".[67]

These 'schemas of enslavement', were a technical method of obtaining power and freedom by transferring the first act of enslavement onto another being,

Simondon is not alone in this insight. In fact, the 'schema of enslavement' he describes is an idea that Marx had also noticed with factory automatic machinery in Ch. 15 of *Das Kapital* when treating a passage in Aristotle's *Politics* Book I:

> "If", dreamed (*träumte*) Aristotle, the greatest thinker of antiquity, "if every tool, when summoned, or even by intelligent anticipation (*vorausahnend*), could do the work that befits it, just as the creations of Daedalus moved of themselves, or the tripods of Hephaestus went of their own accord to their sacred work, if the weavers' shuttles were to weave of themselves, then there would be no need either of apprentices for the master craftsmen, or of slaves for the lords." And Antipater, a Greek poet of the time of Cicero, hailed the waterwheel for grinding corn, that most basic form of all productive machinery, as the liberator of female slaves and the restorer of the golden age. Oh those heathens! They understood nothing of political economy and Christianity, as the learned Bastiat discovered, and before him the still wiser MacCulloch. They did not, for example, comprehend that machinery is the surest means of lengthening the working day. They may perhaps have excused the slavery of one person as a means to the full human development of another."[68]

---

[67] Simondon, *Du mode d'existence des objets techniques*, 1989 [1958], 126–127, (141 in translated edition): *On pourrait nommer philosophie autocritique des techniques celle qui prend l'ensemble technique comme un lieu où on l'utilise les machines pour obtenir de la puissance. La machine est seulement un moyen; la fin est la conquête de la nature, la domestication des forces naturelle au moyen d'un premier asservissement: la machine est un esclave qui sert à faire d'autre esclaves. Un pareille inspiration dominatrice et escalavagiste peut se recontrer avec un requête de liberté pour l'homme. Mais il est difficule de se libérer en transférant l'esclavage sur d'autre êtres, hommes, animaux, ou machines; régner sur un peuple de machines asservissant le monde entier, c'est encore régner, et tout règne suppose l'acceptation des schemes d'asservissement.*

[68] Marx, *Das Kapital*, 1867, 398–399. Unless otherwise specified, I use the translation by Fowkes, 1976, 532–533: *"Wenn", träumte Aristoteles, der größte Denker des Altertums, "wenn jedes Werkzeug auf Geheiß, oder auch vorausahnend, das ihm zukommende Werk verrichten könnte, wie des Dädalus Kunstwerke sich von selbst bewegten oder die Dreifüße des Hephästos aus eignem Antrieb an die heilige Arbeit gingen, wenn so die Weberschiffe von selbst webten, so bedürfte es weder für den Werkmeister der Gehilfen noch für die Herrn der Sklaven." Und Antipatros, ein griechischer*

It is the ancients, and Aristotle in particular, who is credited with the idea that slavery of one being grants the freedom of a full human development for another. For Marx, it is Aristotle who prepares the grounds for fully automated production.

Aristotle's passage in *Politics* Book I would thus form the backbone of what we might call an 'autocratic philosophy of technics' (Simondon) or 'authoritarian technics' (Mumford). It is precisely a 'schema of enslavement', a despotic, preindustrial theory of automation, and so requires a deeper analysis. Turning to this crucial passage in the *Politics,* Aristotle states his counterfactual theory as follows,

> For if each of the tools (*tōn organōn*) were able to complete its own work when commanded (*keleusthen*), or by perceiving in advance (*proaisthanomenon*), like they claim the things [statues] of Daedalus in the story, or the tripods of Hephaestus which the poet claims entered the divine assembly *automatous* — if thusly shuttles wove themselves and plectra played lyres, master-craftsmen (*architektosin*) would [now] need no [craft] subordinates (*hupēretōn*) nor masters (*despotais*) of slaves (*doulōn*).[69]

Aristotle's passage contains the term *automatous*, a variant of *automatos* from which the word automation etymologically derives. As we will see, this passage also contains strikingly relevant insights into our modern predicament with automation.

Dichter aus der Zeit des Cicero, begrüßte die Erfindung der Wassermühle zum Mahlen des Getreides, diese Elementarform aller produktiven Maschinerie, als Befreierin der Sklavinnen und Herstellerin des goldnen Zeitalters! Die Heiden, ja die Heiden! Sie begriffen, wie der gescheite Bastiat entdeckt hat, und schon vor ihm der noch klügre MacCulloch, nichts von politischer Ökonomie und Christentum. Sie begriffen u.a. nicht, daß die Maschine das probateste Mittel zur Verlängerung des Arbeitstags ist. Sie entschuldigten etwa die Sklaverei des einen als Mittel zur vollen menschlichen Entwicklung des andren.

[69] *Pol.* I. 4. 1253b33–1254a1. All translations are my own unless otherwise stated.

In fact, Aristotle's passage in *Politics* Book I continues to be cited by contemporary scholars of automation and AI. Agreeing with Ben Fowkes' translation of 'intelligent anticipation' for *vorauhsahnend* in Marx's *Das Kapital*, which in turn translates the Ancient Greek term *proaisthanomenon*, Langdon Winner notes that "[contemporary] discussions of automation echo Aristotle's conclusion. It is now possible for inanimate instruments to perform their own work 'at the word of a command or by intelligent anticipation', that is, by a computer program." Winner argues that "[this] development has led to the conjecture that the perfection of industrial technology will eventually liberate mankind from toil." Following Marx's interpretation, he moreover recognizes that the "metaphor employed by those who express this hope is the same as that introduced 2500 years ago: something must be enslaved in order that something else may win emancipation".[70]

Winner is not alone in seeing an advanced level of automation and AI contained in Aristotle's passage. Kevin LaGrandeur claims it is the "first time any writer explicitly suggests that we could replace humans with intelligent machines".[71] Michael Palmer, sees "little doubt" that Aristotle "was able, in principle, to envision the modern predicament".[72] And Fabio Bonsignorio notes that *proaisthanomenon* "is clearly a word that is attributed to intelligent, living agents…i.e. ones with cognitive abilities (!)", and that therefore it is "difficult to see the modern reading of a famous passage in Aristotle's *Politics* as a mere

[70] Winner, *Autonomous Technology*, 1978, 21.

[71] LaGrandeur, "Artificial Slaves in the Renaissance and the Dangers of Independent Innovation", 2020, 98.

[72] Palmer, *Masters and Slaves*, 2001, 8–9.

arbitrary attribution of modern ideas to an old text". Instead, for Bonsignorio, it is a "rediscovery".[73]

The purpose behind Aristotle's passage in *Politics* Book I is also a subject of scholarly contention. Shimon Nof sees Aristotle as making a "prediction",[74] while Adrienne Mayor characterizes it as a "thought experiment", and a "speculative fantasy" about the socioeconomic implications of mythological automata.[75] Arguing that the Greeks really believed in the possibility of their robots, Martin Devecka writes,

> this passage opens itself up, from the outset, to a pair of conflicting interpretations. We can read it, on the one hand, as a 'reductio ad absurdum', in which emancipation is conditioned upon a technological situation that Aristotle takes as clearly belonging to the realm of fantasy. Or, on the other hand, we can take it as describing what Aristotle takes to be a 'really possible' world, within the reach if not of present, then of future – or past – technological development. [76]

But while Devecka is content to the 'really possible' world interpretation, others are more cautionary in their reading. Sylvia Berryman forcefully argues that for Aristotle here "the idea that mechanical means could replicate the capacities of organisms is rejected as a pipedream".[77] Minsoo Kang sees this "fantasy" as a "startling" jump in Aristotle's thinking and warns against "ahistorical" tendencies to view Aristotle (and Plato) as anticipating modern industrial concerns with automatic machinery. Kang acknowledges, however, that

[73] Bonsignorio, "The New Experimental Science of Physical Cognitive Systems", 2013, 140.

[74] Nof, "Automation", 2009, 22.

[75] Mayor, *Gods and Robots*, 2018, 152–153.

[76] Devecka, "Did the Greeks Believe in Their Robots?", 2013, 55.

[77] Berryman, Sylvia, "Ancient Automata and Mechanical Explanation", 2003, 360.

from these thinkers we can still glean a persistent theme about the perceived instability of artificial beings, and fears about their revolutionary potential.[78]

I argue that Aristotle's passage theorizes what we would call automation today, using its originary cognate *automatous* instead of the word coined in the 20th century US context. Aristotle imagines an artificial liveliness created by man, and the conditions, limits, and consequences of substituting or augmenting human work with artificial tools capable of acting themselves to complete the relevant task. Malcolm Health relates one of the possible consequences of Aristotle's passage as follows, "If servile labour could be automated there would be no need for slaves".[79]

But as we shall see, however, Aristotle does not theorize cognition or 'intelligence' for his automated tools, nor is it strictly correct to say that his passage on automation can be read as either a *reductio ad absurdam* or a 'really possible' world, but not both. It is later transformations of Aristotle's text as it is rediscovered in the medieval to early modern period that inspire a level of cognition into automata. Understanding how Aristotle's despotic political theory of automation has formed part of a dominant 'autocratic philosophy of technics' or 'authoritarian technics' therefore requires us to examine it fully for the first time, drawing on both material and literary culture regarding the history of science, technology, and political thought. This dissertation aims to do just that.

[78] Kang, *Sublime Dreams of Living Machines*, 2011, 17; 21.

[79] Heath, "Aristotle on Natural Slavery", 2008, 264.

V. Outline of the Dissertation

The central argument of this dissertation is that automation – understood as the conditions, limits, and consequences of substituting or augmenting human work with artificial tools capable of acting themselves to complete the relevant task – is not a uniquely modern idea tied to machines, and that Aristotle offers a political theory of automation in the *Politics*, specifying the level of cognition attached to automated tools that might replace workers. At the core of this despotic theory of automation is slavery, and so Aristotle's theory illustrates how questions of political formation and emancipation have become entangled with technological development since antiquity.

A note on method is important here. In giving life to Aristotle's theory, I consult a broad variety of diachronic and synchronic sources, across different languages and disciplines. Turning to both literary and material culture, I aim to show how the *world* in which both political thinker and theory finds themselves is crucial for reconstruction and interpretation. Science, poetry, historical knowledge, linguistics, metaphysics – to name a few – offer us ways into this world, and allows context to speak to us from inside of it. Tracing the history of the idea of *speculation* from Aristotle to contemporary times through a wealth of extremely diverse sources, Gayle Rogers demonstrates how this 'serial contextual' approach allows us to unearth unexpected metahistorical moments, and "work through the terms that past figures used to understand novelty and change around them, [constructing] their narratives of futurity in reciprocating thought, language, and practices."[80] In this journey, therefore, readers might find themselves traversing the work

[80] Rogers, *Speculation*, 2021, 6.

of historians of science alongside literary critics, with texts as quoted evidence. Politics never stands alone, nor should it, since it deals with every aspect of our shared lives.

Chapter One begins as an examination of the world of automata prior to, and during Aristotle's time. Automata prefigure machines, the field of mechanics, and automation generally. What starts out as a spontaneous perplexity of nature for the Greeks, contained in the virtually untranslatable terms *automata/automatos*, becomes a resource for thinking about artificial life and the release from effort and labor. Automata are wondrous things that contain heavenly-inspired principles, and so present themselves as artifacts of myth and power. I examine the sources of these actual and literary automata that Aristotle directly referenced or would have been exposed to, as well as the chimeric term *automata/automatos*, by looking at the archaeological record, literature and poetry, medical texts, historical accounts, and philosophical writings. From the *hippaphesis*, to Homer and Hesiod, to Hippocrates, to Herodotus, and to Plato, the figure of *automata* that becomes instantiated in actual automata, like *neurospasta* marionettes, forms a kind of spectacle for the Greek imaginary – a 'cinematic experience' so to speak. It sets in motion the realization of a very human field that yearns to imitate the divine – creating life and liveliness through mechanics. Prior to Aristotle we find dreams that the world might produce the necessities of life for us *automata* or spontaneously, and so relieve us from labor, as well as the idea that slaves stand in for the approximation of its earthly realization.

Chapter Two thereafter builds on this understanding of Greek life and automata to explore Aristotle's own political theory of automation in the *Politics*. But this analysis and exegesis refuses to confine itself to the *Politics*, instead consulting Aristotle's broader corpus to assist in interpreting the components of Aristotle's counterfactual passage on automation. Aristotle's 'organization' of *automata* and *to automaton* in his physical works shows a

maturation of the philosophical enterprise that seeks to tame natural perplexity and use it for human gain. The statues of Daedalus or golden tripods of Hephaestus present enticing ideas of self-acting artificial things that might have been made into tools or *organa*. The reality for Aristotle, however, is that this is not possible in his time, and so the living tools – the slave and the subordinate craft workers – are necessary for humans to live well. The work they must perform is so disparaged that Aristotle treats it as a matter of perceptual and bodily ability – the cognitive demands of such work, according to Aristotle, cannot be described as liable to substitution by 'intelligent' tools, as many scholars argue. The idea that Aristotle proposes intelligent artifices as automated tools is a misplaced one. What he does seem to imply, however, is that a world where workers like slaves are not necessary is one that opens up politics for freer and more democratic regimes. The impossible ideal for the enlightened, emancipated political community is how the gods themselves regulate their affairs in their gatherings.

Chapter Three takes us well over a thousand years later into the medieval West. Such a jump in period is motivated by an important fact: Aristotle's *Politics* is one of the last texts in the corpus to be rediscovered in Western thought, and emerges from William Moerbeke's translations in the 13th century CE. William of Moerbeke's translation occurs at a time where automata began to hold an ambivalent fascination for political powers, including the Church. In literature, automata are seen as the work of sorcerers and philosophers who approach the limits of human capabilities – even crossing it impermissibly through diabolical association. The kind of automata that were actually built, however, speak also to the increasing turn towards mechanism and the work of artisans in providing pageantry and display for the visible power of the Church. I read key translators and commentators of Aristotle's *Politics*, William Moerbeke, Albertus Magnus,

Thomas Aquinas, Nicole Oresme, and Leonardo Bruni, through this contextual lens. Each Christian thinker offers something novel and compelling to say about Aristotle's theory of automation and the implied cognitive conditions of work that living *organa* must perform. Aristotle's theory is therefore complicated, transformed, and introduced to the idea of intelligent artifice after all – through the work of Aquinas especially. The weight of the medieval interpretive tradition is therefore brought to bear on the rediscovery of this theory.

Chapter Four examines the Hobbesian moment where two important breaks occur in the Aristotelian idea of automation. The first is the thrust of automata and automation into the heart of politics – the state itself as an automaton, which is something alien to Aristotle. I show how Hobbes nevertheless develops his concept of automata from Aristotelian roots and offer a new way of thinking about the determined but spontaneous moment of agreement that creates the artificial state. The second break is in the transition from a preindustrial theory to an industrial one. For Aristotle, automation can shape political formations. But for Hobbes, the automated state, i.e. the state as an automaton, is necessary for any industry – and so any subsequent automation – to occur. Hobbes therefore stands at the margin of this meeting between preindustry and industry. His automated state, endowed with its own artificial reason and will, appropriates Aristotle's despotic theory but replaces it with civil subjection.

Finally, I conclude by circling back to the Promethean crime against Zeus's divine will and plan in the Aeschylean tragedy, *Prometheus Bound*. As silent Force (*Bia*) and Power (*Kratos*) accompany the god of crafts, Hephaestus, in his binding of the titan, we witness with fresh perspective the idea that technology should be used to control, punish, and exploit errancy. Aristotle's preindustrial theory of automation aims at fulfilling this

normative idea, binding beings in place to ensure the development of political order and prosperity: the cost of political freedom for some is technological unfreedom. I reiterate the need for scholars to examine automation as a *political* phenomenon, and identify how we might intervene for a democratic technics of automation. Above all, however, my treatment of Aristotle's theory of automation aims to open the premodern, preindustrial world of technological and political thinking for contemporary issues. This is an act, through the history of political thought, of *remembering* the course of our development as technological and political animals.

Chapter One: The Figure of *Automata* in 4th Century BCE Greece

I. *Automata* in the Greek Sources

In order to examination a distinctly *political* phenomenon of automation that emerges from Aristotle's *Politics*, we should first review the influences that might have shaped its construction. An idea of Greek *automata* informs Aristotle's understanding of the tools required to substitute for human labor. Without *automata*, there can be no automation. Importantly, *automata* in the 4th BCE cover a broad field of things that are not necessarily what we might consider mechanical. We will see that Greek *automata*, in fact, prefigure mechanism. Mechanistic automata, as Sylvia Berryman has pointed out, find scant evidence in the Greek world prior to the Hellenistic period and before the works of artificers like Ctesibius and Philo of Byzantium.[81]

And yet the Greeks had come to some understanding about *automata* prior to the development of the mechanical kind. As Martin Devecka puts it, "automata, even before they were 'invented' by the new mechanics of the third century BCE, seemed plausible to Greeks living in Athens".[82] Moreover, the idea that automata are simply "…(devices that move by themselves), whose very existence offered tangible proof, more impressive than any theory, that the natural universe of physics and biology was susceptible to mechanistic explication",[83] captures only one dimension of Greek *automata* as it was understood at the time. Mechanical automata offer us one species of a general category of *automata* that

[81] Berryman, *The Mechanical Hypothesis*, 2009, 97–104 in particular.

[82] Devecka, "Did the Greeks Believe in Their Robots?", 2013, 53. See also Bosak-Schroeder, "The Religious Life of Greek Automata", 2016, 131–133, on a response to Berryman.

[83] De Solla Price, Derek, "Automata and the Origins of Mechanism and Mechanistic Philosophy", 1964, 9.

remain to be examined for its relevance to Aristotle's thought.

Linguistically, *automatos* is the root from which our more familiar notion of automata etymologically derives. As an adjective, *automatos* or its variants, including the plural form *automata*, are often translated to mean 'of its own accord', 'without intervention', or 'spontaneous'.[84] In noun form it was also used to describe material artifices – puppets and contrivances that form the historical backbone to mechanical automata. In Homer's *Iliad*, Hephaestus' golden tripods were set with wheels so that that they could enter the assembly of the gods *automatoi* as a wonder (*thauma*) to behold. [85] *Automatos* had entered into both archaic Hesiodic and Homeric traditions to mean a kind of spontaneous growth, or internal guided movement. This was often associated with an 'automatic' life in periods of ease and plenty, as *automatos bios*, which was referenced and parodied moreover in Old Comedy.[86] Its unfolding into a neutral and even positive aleatory concept of 'automatic healing' in the Hippocratic medical corpus underscores as well the intimate relation between chance and the development of crafts and technical knowledge. [87] But for philosophers, the appropriation of this concept was not uncritical or uniquely positive. In Plato, for example, intertextual analysis reveals that *automatos* can be read as a kind of "*undecidable*, a pharmakonal word" that can also take on haphazard, undirected movement "without forethought, intelligence, or guidance – that is, as merely the negation of everything that Plato values" and takes political pains to recover in texts like *The Republic, The Laws*, and

[84] See Dudley, *Aristotle's Concept of Chance*, 174–176, for a more relevant Aristotelian discussion of *automatos* and its meanings; see also Bianchi, *The Feminine Symptom*, 2014, 68–72.

[85] *Il.* 18. 376.

[86] See for example spontaneous growth in the Age of Kronos, per *Op.* 109; see also *Il.* 2. 369; 5. 749; 8. 381; 18. 376. On treatments of *automatos bios* in Old Comedy see Ruffell, "The World Turned Upside Down: Utopia and Utopianism in the Fragments of Old Comedy, 2001, 473–506; Baldry, "The Idler's Paradise in Attic Comedy", 1953, 49–60.

[87] On this see Kosak, *Heroic Measures*, 2004, 114–115.

The Statesman.[88]. In short, *automata* find themselves implicated in a world well before the advent of its mechanistic species.[89] Moreover, an evaluation of different sources can reveal operative principles that are common to *automata* in general.

Where, then, should we find some idea of this figure of *automata* on which Aristotle might have based his understanding of automation? With a focus on the idea of the 'robot', Devecka looks to the model of the slave in various sources prior to, and around Aristotle's time. Slavery certainly forms an important backbone to the discourse on the types of *automata* that are contemplated in Aristotle's formulation of automation, as we shall see, but by no means does it do so exclusively. Aristotle's own derivations from *automatos* and *automata* into his concept of *to automaton* in the *Physics* complicates an account that focuses exclusively on slavery as a model. It therefore also allows us to engage a much deeper analysis of the principles involved in *automata* and automation.

Looking also at the linguistic usage of *automata* in various fields and areas, we can review i) material evidence of, and literary allusions to actual things, ii) mytho-poetic sources, iii) the Hippocratic medical corpus, and finally iv) historical and philosophical sources. All of these sources together can help us piece together an account of the figure of Greek *automata* in the 4th century BCE beyond a narrower focus on mechanism or self-movement. What we will find is a rich Greek imaginary that saw *automata* as a kind of *cinematic experience* – a spectatorship of the unexpected in a kaleidoscope of different and

[88] See Naas, *Plato and the Invention of Life,* 2018, 60–68; 198–199. Naas examines *The Statesman*, *The Apology*, *Theaetetus*, *Meno*, *Protagoras*, amongst others.

[89] Ambrosetti, *Cultural Roots of Technology*, 2010, 14, "not only the concept, but also the word —automaton has been used inconsistently since Antiquity and, in some periods, like the Middle Ages, it is even completely missing, even though most (probably all) modern readers would identify such devices as automata. This inconsistency is even more evident if one looks for a definition suitable to include all or most of the historical automata. Unfortunately, we have to cope with the absence of a uniform definition suitable to be applied to such different historical and literary sources, in order to identify single machines or devices as automata".

changing contexts. *Automata* refer to a modality – a way things are and arise – as well as what certain objects and things are. Sometimes we see that the term *automata* or its variants are mentioned. Other times it is strictly missing but nevertheless contextually justified.

II. Puppets and Power – Material Evidence and Literary Allusions

Aristotle does mention *automata* in his corpus to reference things that actually existed in the material world around him. In the *Movement of Animals* Aristotle suggests that the animal motion is like that of spontaneous things (*ta automata*), likely puppets, or an exemplary little wagon (*hamaxion*).[90] In the *Generation of Animals*, these spontaneous things are attached explicitly to wonder *(ta automata tōn thaumatōn*).[91] And in the *Metaphysics*, these spontaneous wonders (*thaumatōn t'automata*) are the first example cited of things that inspire wonder itself, central to Aristotle's beginning of theoretical contemplation.[92] Two related questions thus presents themselves here at the outset. Firstly, to what Aristotle is referring here when he speaks of these *automata*? Secondly, what other evidence can shed light on the state of *automata* production and use in a political sense – if any – during this period?

The *automata* Aristotle mentions points us in the direction of puppetry in the 4th century BCE. This has been the standard interpretation of commentators from Galen to contemporary scholars like Martha Nussbaum. [93] But the nature of these puppets remains an open question. From the archaeological record, the closest resemblance found is to terracotta dolls dated from the 5–4th century BCE. These marionette-like dolls were crafted

[90] *De motu an.* 701b1–13.

[91] *Gen. an.* II. 1. 734b9–11.

[92] *Metaph.* A. 1. 983a11–16.

[93] Nussbaum commenting, in particular, on her translation of *De motu*, on 42, and 347–348.

with articulated limbs and strings with which to move them.[94] They certainly stand in as candidates for a comparison with the articulation of the limbs of animals in the way that they move. As Jaś Elsner puts it, these figurines "may have been 'good to think with' for Aristotle, a useful way for him to theorize conceptual differences".[95]

But Aristotle does *not* refer to these dolls or marionettes in his texts by the name they were most customarily called, *neurospasta*. In the Peripatetic text *De Mundo*, the author describes movement of the first mover, as the god of the cosmos, in the following terms:

> the most divine thing of all is to produce all kinds of result easily by means of a single motion, just like the operators of machines (*mēchanopoioi*), who produce many varied activities by means of the tool's (*organou*) single release-mechanism. In the same way too the men who run puppet-shows (*neurospastai*), by pulling a single string, make the creature's neck move, and his hand and shoulder and eye, and sometimes every part of his body, according to a rhythmical pattern.[96]

These marionette-like puppets map on well to those found in the archaeological record, and moreover are used to demonstrate a series of movements that include animal movement. They are compared with mechanical tools – as devices rather – notwithstanding the embryonic state of a coherent field of mechanics during this period, per scholars like Sylvia Berryman.[97] And they are explicitly mentioned as *neurospastai*.

---

[94] "Terracotta Ancient Greek Dolls" exhibited in the National Archaeological Museum in Athens, Room 56, 5th/4th century BCE. See also the "Corinthian Jointed 'Doll'" exhibited in the Metropolitan Museum of Art in New York, 44.11.8, 5th century BCE.

[95] Elsner, *Figurines,* 2020, 27–28.

[96] [*Mund.*]. 6. 398b14–21.

[97] Berryman, *The Mechanical Hypothesis*, 2009, *passim.*

The fact that Aristotle does not quite refer to *neurospasta* or anything more specific in the *Generation of Animals, Movement of Animals*, and *Metaphysics* therefore does leave open room for interpretation regarding his references to the type of *automata* at the time. At the very least, it supports the idea that *automata* are a general category to which specific species like mechanical devices might belong. But scholars like Jean De Groot have gone further to suggest that "that puppets are not plain marionettes" as the textual evidence indicates some sort of "drive mechanism" of the kind contemplated in Hero's theatre in the *Automatopoietica*. This raises complexity regarding the type of *automata* we might expect to find as 'puppets' in the 4th century BCE.

However, De Groot's account lacks the same level of archaeological evidence as traditional accounts, despite a persuasive theoretical argument regarding the principle of circular motion and a 'moving radius principle' that might nevertheless be operative in whatever kind of *automata* Aristotle is referencing. The idea that there might have been a drive mechanistic element to these *automata* should not readily be dismissed, however. As De Groot also notes, Hero makes explicit reference to pre-existing knowledge, attributed to the "the ancients", in explicating his own puppeteering effects.[98] What *is* clear is that both *neurospasta* and *automata* share in some kind of representation of liveliness that must have influenced Aristotle's understanding of the latter. Movement is the most reliable commonality, given the recurrence of *automata* in contexts that speak to motion in particular. But the *type* of movement involved, in particular the thesis of repetitive, circular motion as well as the ability to affect beholders, holds out promising leads into Aristotle's thinking about *automata* more generally.

[98] De Groot, *Aristotle's Empiricism*, 2014, 117–124 at 119 in particular; see also Bianchi, *The Feminine Symptom*, 2014, 67– 68; 257.

Aside from puppets, however, it is difficult to reconstruct any other types of actually existing *automata* around the 4th century BCE from the archaeological record. The material evidence we have so far simply does not allow us to do so. Focusing on the "embryonic nature" of the state of mechanics in this period, conservatively defined, Berryman nevertheless notes that the Greeks "did develop or borrow quite a number of technological devices, whether or not these found widespread application", especially when "developing devices for warfare and building and water distribution". The Greek world, therefore, "was hardly stagnant, and there is ample evidence of astrolabes, spheres and calculators, measuring instruments, surgical machinery, hydraulic implements, time-measuring devices, musical instruments and theatrical shows.[99] These devices, mechanical or simply of complex construction, need not strictly be *automata* to underscore "the fascination that self-moving automata held for the tradition of Greek mechanics culminating with Heron".[100] Moreover the 20th century discovery of the Antikythera mechanism, an orrery sometimes that could be described as world's first analogue computer, illustrates a high degree of sophistication and complexity to Greek engineering that "was far greater than that recorded in surviving texts".[101] Notwithstanding its dating to the Hellenistic period, it highlights the degree of openness we should have to the state of Greek technology in preceding periods.

Debate continues regarding the question of *why* or *whether* ancient societies like that of Greece did not 'progress' technologically and remained somewhat stagnant – so called

[99] Berryman, *The Mechanical Hypothesis*, 2009, 103.

[100] Brumbaugh, *Ancient Greek Gadgets and Machines*, 1966, 114.

[101] Berryman, *The Mechanical Hypothesis*, 2009, 42. See also De Solla Price, *Gears from the Greeks*, 1975.

technological '*blocage*'.[102] Berryman is correct to note that while "the deployment and exploitation of technology might loom large in the eyes of economic historians, the *philosophical* reception of technological devices is a different matter". [103] For our purposes, we are interested rather in the *political* reception of technological devices – in particular those that may have somehow emerged from a fascination with a prior conception of *automata*. The documented ability for *automata* to produce strong sentiments in beholders leave them liable to political appropriation both within legitimate processes of governance, and in public displays of power.

One such device is the *kleroterion*. Aristotle's school describes its operation in *The Constitution of the Athenians* for the selection of officers and magistrates:

> When he has thrown in the dice, the Archon casts lots for the tribe for each *klērōtērion*, they are dice of copper, black and white. As many white ones are thrown in as jurymen are required to be selected, one white die for each five tickets, and the black dice correspondingly. As he draws out the dice the herald calls those on whom the lot has fallen (*eilēkotas*).[104]

Archaeological finds of the *kleroterion* have not found support for the device as a sophisticated *mechanical* artifact. [105] But the use of this device in legitimating Greek processes of

[102] For relevant overviews see Berryman, *The Mechanical Hypothesis*, 2009, 39–41; Devecka, "Did The Greeks Believe in Their Robots?", 2013, 52–54; Cuomo, *Technology and Culture in Greek and Roman Antiquity*, 2007, 42; 55; Djiksterhuis, *The Mechanization of the World Picture*, 1961, 74; Finley, *The Ancient Economy*, 1973, 145–147; Landels, *Engineering in the Ancient World*, 1978, 186–198; Vernant, *Myth and Thought Among the Greeks*, 1983 [1965]), 283–284; Kevin Greene, "Technological Innovation and Economic Progress in the Ancient World", 2000, 29–59.

[103] Berryman, *The Mechanical Hypothesis*, 2009, 41.

[104] [*Ath. Pol.*]. LXIV. 3–4, also LXIII.

[105] "I 3967: Kleroterion", (American School of Classical Studies at Athens: Museum Guide, 2014), 138–139, fig. 76.

governance, as a kind of "foolproof lottery machine",[106] speaks to a dimension of *automata* that stretches deeper than self-movement. While not an example of *automata* per se, the *kleroterion* nevertheless relies on safeguarding the political process through the phenomenon of randomization and chance. A spontaneous, unpredictable outcome is at work to protect political institutions.[107] And this is not just attached to any political regime, but democracy in particular. As Aristotle says, "the selection of magistrates by lot is considered to be democratic, their election oligarchic".[108]

The role of chance in an artificial, fixed device like the *kleroterion* is somewhat paradoxical, therefore. Sortition and lot are used to guaranteed equality, social and political order, civic learning, and cooperation.[109] Brumbaugh goes so far as to claim it under the umbrella of technology designed for the "automation of honesty".[110] Chance is exploited for an ordered outcome and instantiated in a device that allows this to manifest in a legitimate political process. To the extent that a dimension of chance shares in an ancient concept of *automata*, we might expect to find this paradoxical relationship continued. As we shall see, this is certainly true generally, and particularly also for Aristotle. There is currency in the unexpected, and the ability of man to create a device that captures this in a regularized way is a powerful thing that can be appropriated for the regime and state itself.

Beyond processes of governance, *automata* can also produce spectacle and sentiments that entrench systems of power. On one hand therefore, it unsurprising that

---

[106] Brumbaugh, 1966, *Ancient Greek Gadgets and Machines*, 65.

[107] For a more details politically-oriented discussion of the *kleroterion* and chance, alongside its archaeological and literary evidence, see Kosmetatou, "Tyche's Force: Lottery and Chance in Greek Government", 2013, 235–251.

[108] *Pol.* IV. 9. 1294b7–9.

[109] Kosmetatou, "Tyche's Force", 2013, 240–245.

[110] Brumbaugh, *Ancient Greek Gadgets and Machines*, 1966, 7; 61.

given the importance of the theatre to Athenian social and political life, scholars have started to see it as a type of systematic, evolving "machine" in itself.[111] The automated theatres of Heron and Ctesibius stand as a testament to the representation of this space in the history of automata as powerful and affective spectacles.[112] But the theatre is not the only space in which *automata* could have thrived. [113] The athletic games and their associated festivals also served as a locus for the emanation of technological spectacle. Pausianas relates, in his *Description of Greece*, a mechanical marvel (*hippaphesis*) at the Olympic horse races:

> Each side of the starting-place is more than four hundred feet in length, and in the sides are built stalls. These stalls are assigned by lot to those who enter for the races. Before the chariots or race-horses is stretched a cord as a barrier. An altar of unburnt brick, plastered on the outside, is made at every festival as near as possible to the centre of the prow, and a bronze eagle (*aetos*) stands on the altar with his wings stretched out to the fullest extent. The man appointed to start the racing sets in motion the mechanism (*mēchanēma*) in the altar, [and] having been set in motion the eagle is made to jump upwards, so as to become visible to the spectators, while the dolphin (*delphis*) falls to the ground. [114]

Tatiana Bur argues persuasively that, especially through the use of the eagle symbolism, "the *hippaphesis* automaton reveals how mechanical ingenuity was used" as a way to impress upon the audience the presence and "agency of the [god] Zeus in the thauma they

[111] See for example, Lepore and Konstaninou, *Ancient Theatres*, 2015.

[112] Brumbaugh, *Ancient Greek Gadgets and Machines*, 1966, 52–53.

[113] Bur, *Mechanical Miracles*, 2016.

[114] Paus. VI. 20. 10–14, at 11–12 in particular.

witnessed".[115] In this symbolic reference to divine power, a spectacle of wonder is used within the context of a key festival that "had developed into a positive political force in the Panhellenic world".[116]

This *hippaphesis* device predates Aristotle but has no archaeological evidence to support it. Given Pausianas' reference to the inscription of Cleoetas, the historical inventor of the device, it is reasonable to assume that it might have been present at the Olympic festival around the early 5th century BCE.[117] There is no indication however of the mechanism that set the device in motion and carried the rise of the eagle with the plunge of the dolphin. Given the heavy bronze weights involved, Bur conjectures that there must have been "an arrangement of pre-positioned ropes", with the animals "drawn automatically along masts of some sort".[118] Nevertheless, what is clear is that this device speaks to the powerful affective ability of these apparently self-acting and self-moving creations.

Perhaps a clearer and more proximate reference to the political appropriation of *automata*'s affective ability is the automated processional snail of Demetrius of Phalerum. Demetrius was a Peripatetic appointed to rule over Athens around 317 BCE. This automaton is therefore dated slightly after the death of Aristotle himself. Nevertheless, it shows a clear link between power and affect in *automata* more generally. An account is given in the *Histories* by Polybius, who mentions it while defending Democharés, one of Demetrius' political opponents:

---

[115] Bur, *Mechanical Miracles*, 2016, 122. For a more general overview of the athletic games, including the Olympic *hippikos agon*, see Miller, *Ancient Greek Athletics*, 2004, 75–81.

[116] Miller, *Ancient Greek Athletics*, 2004, 216.

[117] Paus. VI. 20. 14; Bur, *Mechanical Miracles*, 2016, 125.

[118] Bur, *Mechanical Miracles*, 2016, 124.

> Demetrius of Phalerum, against whom Democharesh as made no ordinary charges in his History, claiming that he was such a governor of his country (*patridos*) that he took exaltation in political administration in the same way as a vulgar tax farmer. For he boasted that throughout his city amenities were abundant for all and many goods were sold cheaply. And indeed he boasted because an automated snail (*kochlias automatōs*) led the procession for him, emitting slime as it crawled, and with this asses were paraded through the theatre presumably because Athens yielded all the good things of Greece to others and submitted herself to commands made by Cassander. [119]

Demetrius had this automated snail lead his procession in the Great Dionysia to arrive at the Theatre of Dionysius, routing itself through Athens. We have no archaeological evidence to support this automaton either. Nevertheless, the association between the exercise of power, spectacle, and economic surplus and abundance cannot be understated in Polybius' passage. Demetrius relied upon this automaton as a symbol for this surplus and the celebration of his rule over Athens. Democharesh, as told by Polybius, uses this fact as an example of vulgarity, weakness, and extravagance. *Automata* find themselves squarely implicated in this political rivalry and symbolism.

Aside from the devices above, there are also less proximate reports of others that might have instantiated some or all of the principles of *automata* as understood by the Greeks during this period. In particular, Athenaeus describes a kind of hydraulic 'alarm clock' built by Plato for use in the academy.[120] Again however, the archaeological evidence is scant,

[119] Polyb. XII. 13. 8–12. Translation checked with Bur's in *Mechanical Miracles*, 2016, 66–67.

[120] Ath. IV. 75. For this reference I use the G. Kaibel text, (Stuttgart: Teubner, 1887), λέγεται δὲ Πλάτωνα μικράν τινα ἔννοιαν δοῦναι τοῦ κατασκευάσματος νυκτερινὸν ποιήσαντα ὡρολόγιον ἐοικὸς τῷ ὑδραυλικῷ οἷον κλεψύδραν μεγάλην λίαν. καὶ τὸ ὑδραυλικὸν δὲ ὄργανον (*organon*) δοκεῖ κλεψύδρα εἶναι.

and there is no specification of how the device worked. [121] Noting how important clockwork was to medieval and Renaissance Europe "as devices of automation and regulation of public life", Berryman nevertheless admits that even "simple timekeepers might have had a social impact" despite the apparently low level of automation during this period.[122]

Finally, Archytas, the 4th century BCE Greek mathematician, philosopher, and politician, is said to have developed a mechanical flying dove by the philosopher Favorinus, as reported by Aulus Gellius in the *Noctes Atticae*:

> For not only many eminent Greeks, but also the philosopher Favorinus, a most diligent searcher of ancient records, have stated most positively that Archytas made wooden likeness (*simulacrum*) of a dove with such mechanical (*mechanica*) ingenuity and art that it flew; so nicely balanced was it, you see, with weights and moved by a current of air enclosed and hidden (*occulta*) within it. About so improbable a story I prefer to give Favorinus own words: 'Archytas the Tarentine, being in other lines also a mechanician (*mēchanikos*), made a flying dove out of wood. Whenever it lit, it did not rise again. For until this…' [text breaks off].[123]

Berryman is skeptical of considering this device truly *mechanical* given the sparse details of its operation and the fact that it is described by Gellius as likeness (*simulacrum*) while Favorinus' own words are more direct.[124] Nevertheless, the Greeks and Latins certainly used terms like *mēchanikos* and *mechanica* to refer to these devices notwithstanding our sense-

[121] For an early conjecture Diels, "Über Platos Nachtuhr", 1915, 824–830.

[122] Berryman, *The Mechanical Hypothesis*, 2009, 79–80.

[123] Gell. X. 10. 8–10.

[124] Berryman, *The Mechanical Hypothesis*, 2009, 96, "The difference is not trivial, as it was common to call complex constructions, especially war engines and their parts, by the names of animals – crane, ram, tortoise, crow, scorpion, raven, dolphin – without implying that the devices were simulacra. If the story is about a device called a 'dove', rather than a model of a dove, it could refer to catapult, or more likely the projectile it launched."

making attempts to define the field for them. Similarly, with a more general concept of *automata*, we should dig further into other sources to understood how the Greeks understood it in context.

III. Mytho-Poetics – Legends of *Automata*

Automata also appear on the border between history and fantasy – at the site of myth and legend. Many of these *automata* are found in poetic sources. By the 4th century BCE Greek culture had already developed a rich imaginary filled with various things that could be considered *automata*. Sometimes these things were explicitly referred to as such, and sometimes not. And yet they all seem to belong to a more general category of spontaneous things or events signalled by the term itself. For Aristotle, the importance of myth and poetics cannot be overstated, especially for its affective ability to generate wonder. As he says in the *Metaphysics*, "the myth-lover is in a sense [indeed] a philosopher, for the myth is composed of wonders".[125] Accordingly, we should turn our attention to this enduring site of wonder in Greek myth and poetics.

Talos

An early example of a fabricated, 'robotic' being of legend is the bronze colossus, Talos. As some accounts of the legend go, Talos was created by Hephaestus and given to the Cretan

[125] *Metaph.* A. 982b18–20.

king Minos, in order to protect the island from invaders.[126] Talos is said to have been filled with an arterial system full of divine ichor, kept from seeping out by a bolt at his ankle. One of the most notable appearances of this legend is near the end of Apollonius of Rhodes' *Argonautica* from the 3rd century BCE, where Jason and Medea must overcome the colossus in order to return to Crete with the Golden Fleece. Although Hephaestus is not mentioned as Talos' creator in this version, it is nevertheless stated that Talos is made (*tetukto*) of bronze. Importantly, he is moreover imbued with a circular motion as he is set to circle (*dineunonta*) Crete three times a day.[127] It is only through thwarting the mechanics of his construction, namely removing the bolt keeping his ichor in place, that the colossus can be defeated.

One of the earliest references to Talos comes from a fragment attributed to lyric poet Simonides who lived between the 6th and 5th centuries BCE. Described as an ensouled (*empsukhon*) guard (*phulaka*), the scholion reference here also mentions that the story appears in Sophocles' lost tragedy, *Daedalus*. [128] Additionally, the pseudo-Platonic text *Minos* references a mention to Talos in Hesiod, but this cannot be found directly in the surviving texts of Hesiod today.[129] Surveying both literary and archaeological representations of Talos – the latter including Minoan-era seals, coins, Attic vase depictions, Etruscan mirrors – Adrienne Mayor suggests that the Talos myth could be much older than the 5th century BCE. While critiquing the narrow approaches of both Kang and Berryman in the identification of automata during this period, Mayor argues that "Talos is outstanding among mythic artificial beings because ancient writers and artists represented Talos as an

[126] *Bibl.* I. 9. 26.

[127] *Argon.* IV. 1635–1688, at 1644–1645 in particular.

[128] Simon. 568, scholiast on Plato's *Republic*.

[129] *Minos*, 320c–320d.

automaton, a 'self-mover', a bronze statue animated by a 'an internal mechanism,'". This mechanism consisted in "the single tube or vessel containing a special fluid, a system that was described in biological, medical, and machine-like terms".[130]Though the idea of a 'self-mover' is certainly a dimension of *automata* as understood at the time – it is not quite identical with it. Nevertheless, Mayor's expansive approach to the idea of *automata* at the time, as a general category, strikes closer to what we see in the sources themselves.

A point of further interest in the case of Talos is that this mythical being embodied protective power. Guarding Crete from invaders, Mayor also notes how Talos became a positive, heroic figure to the Etruscans who faced the reality of early Roman invasions.[131] This speaks to the ability of *automata* to assure power beyond their affective ability. King Minos was able to rely on Talos to control entry to his territory. Serving as a bulwark against the outside world, Talos substituted for a border wall or boundary army.

Pandora and Hephaestus' Beings

Other animated beings are also relevant for us in our review of a concept of *automata*. In particular, in both Hesiod's *Work and Days*, as well as *Theogony*, we are presented with the fabricated, animated being Pandora. As Mayor correctly notes, Pandora is "a being that was *made*, *not born*". [132] From the *Work and Days*, Hesiod tells us:

> And he bade (*ekeleuse*) famous Hephaestus make haste and mix earth with water and to put in it the voice (*audēn*) and strength (*sthenos*) of humankind, and fashion (*eiskein*) a sweet, lovely maiden-shape, like to the immortal

[130] Mayor, *Gods and Robots*, 2018, 7–30 at 22 in particular.

[131] Mayor, *Gods and Robots*, 2018, 19.

[132] Mayor, *Gods and Robots*, 2018, 160.

> goddesses in face; and Athena to teach her the work (*erga*) and the weaving (*huphainein*) of the varied web… Forthwith the famous Lame God moulded (*plassen*) clay in the likeness (*ikelos*) of a modest maid, as the son of Cronos purposed.[133]

Hephaestus is ordered by Zeus to fabricate Pandora and bestow her with human-like qualities. This fabrication is emphasized in the *Theogony* as well, where Pandora in her raiment is described as a "wonder to behold" (*thauma idesthai*), "Forthwith he made an evil thing for men as the price of fire; for the very famous Limping God formed of earth (*sumplasse*) the likeness (*ikelon*) of a shy maiden as the son of Cronos willed."[134]

Hesiod's descriptions of Pandora, as Mayor also notes, strike closely to other mythological animated beings that Homer in fact references in the *Iliad*.[135] The golden assistants busied about Hephaestus are described there as follows:

> And in support of their master moved his attendants. These are golden (*chruseiai*), and in appearance like (*eioikuiai*) living young women. There is intelligence (*noos*) in their hearts, and there is voice (*audē*) in them and strength (*sthenos*), and from the immortal gods they have learned how to do things (*erga*).[136]

Just as with Pandora, Hephaestus' assistants are made of some substance, in this case, gold, and endowed with human-like qualities. They are taught how to do things (*erga*) to be useful

[133] *Op*. 60–71.

[134] *Theog*. 575–581.

[135] Mayor, *Gods and Robots*, 2018, 155.

[136] *Il.* 18. 417–421.

in some way. And they are specifically gendered in these ends – assisting the divine master-craftsman himself, carrying out Zeus' plan, and weaving, for example. They are also not the only wrought animated beings to be mentioned in Homer – Hephaestus is also said to have fashioned (*eteuxen*) gold and silver dogs (*chruseioi kai argureoi kunes*) for Alcinous of the Phaeacians.[137] While none of these things are referred to as *automata* as such, nevertheless they illustrate for us a very possible, concrete manifestation of the concept.

Daedalus' Statues

Similarly, we may examine the mythical statues of Daedalus, which are a repeat reference not only throughout the literary record, but also in material culture representations.[138] Aristotle mentions Daedalus' statues in his *Politics* – to be discussed within the context of his formulation of automation in the next chapter – and in *De Anima*. In *De Anima* he relates that Philippus, the comic poet, once explained how Daedalus' wooden Aphrodite was filled with quicksilver to facilitate its movement. Quicksilver's fluctuance is imparted to move the figurine. Aristotle quickly rejects this Democritean explanation for the motion of the soul with respect to the body, since some act of mind (*noēseōs*) and deliberate choice (*prohaireseōs*) generally (*holōs d'ouch*) appear to be needed to move living things. [139]

Didorus Siculus' 1st century BCE account of Daedalus in the *Bibliotheca Historica* is perhaps the fullest:

[137] *Od.* 7. 81–95. See also Mayor, *Gods and Robots*, 2018, 143–144; Collognat and Choppin, *Ex Machina*, 2020, 75.

[138] Mayor, *Gods and Robots*, 91.

[139] *De an*. I. 3. 406b17–26. The Philippus here probably refers to one of Aristophanes' sons who was also a comic poet.

> Daedalus was an Athenian by birth and was known as one of the clan named Erechthids, since he was the son of Metion, the son of Eupalamus, the son of Erechtheus. In natural ability he towered far above all other men and cultivated the building art (*tektoninkēn technēn*), the making of statues, and the working of stone. He was also the inventor of many devices which contributed to the advancement of his art and built works in many regions of the inhabited world which arouse the wonder (*thaumazomena*) of men. In the carving of his statues he so far excelled all other men that later generations mythologized (*mythologēsai*) the story about him that the statues of his making were quite like their ensouled (*empsukhois*) models; they could see, they said, and walk and, in a word, preserved so well the characteristics of the entire body that the beholder thought that the image made by him was a being ensouled with life (*emsukhon zōion*). And since he was the first to represent the open eye and to fashion the legs separated in a stride and the arms and hands as extended, it was a natural thing that he should have received the admiration of mankind; for the artists before his time had carved their statues with the eyes closed and the arms and hands hanging and attached to the sides.[140]

As Bur suggests, this account is deflationary with respect to the statues' ability to be self-movers. Here, Daedalus' statues are simply realistic and lifelike. Earlier accounts of self-movement are dismissed as myth. Examining other similarly deflationary accounts, Bur notes that Daedalus' statues are never called *automata* and denies that they inspired "any actual historical automata". But curiously, Bur also admits that accounts of the statues of Daedalus "expose[d] that to the ancient mind, statues of human manufacture could conceivably move".[141] Indeed it is precisely this that we might argue results from a Greek concept of *automata,* and which forms and important backbone to the development of our familiar mechanical automata more generally.

---

[140] Diod. Sic. IV. 76. 1–4.

[141] Bur, *Mechanical Miracles*, 2016, 46–50. See also Berryman, "Ancient Automata and Mechanical Explanation", 2003, 352–354. For other deflationary accounts of Daedalus' statues see Aesch. *Fragments*, 78a; Aristotle's alleged contemporary Palaephatus, *Peri Apiston*, 21; *Imag.* I. 16; Eur. *Fragments (Eurystheus*), 372. See Mayor, *Gods and Robots*, 2018, 91–96.

Indeed for Plato, a generative reference to Daedalus' statues occurs in both the *Meno* and *Euthyphro*. There Socrates, under Plato's pen, appropriates Daedalus' works towards philosophical explanation. There is no interest in the manner or mechanism of their movement. But it is the fact that they *can* move that makes them, as human products of technics or craft, so amenable to comparison. Moreover, they don't *just* move – they can run away, evade control, and fail to remain in place. In *Euthyphro* Socrates tells Euthyphro that his words are like Daedalus' statues which run away (*apodidaskei*) and do not want (*ethelei*) to remain (*menein*) wherever they might be placed.[142] In the *Meno*, Socrates begins his explanation by asking Meno a question. Responding to Meno's puzzlement, he asks, "So, do you know why it is that you wonder (*thaumazeis*), or might I tell you?" Meno invites Socrates to answer him but the latter does not do so immediately. Instead, he questions further whether Meno knows about Daedalus's creations. He compares Daedalus' statues to human runaways (*drapetēn anthrōpon*). If they have been let loose, their worth (*axion*) is not very high, since they do not remain (*ou paramenei*) but flee instead. They need to be bound or tied down (*dedemenon*) in order to be possessed (*ektēsthai*) as something of worth. Without their ties, they run away like *true* opinion (*tas doxas tas alētheis*) does without reasoning about causes.[143] The human runaways that Socrates references are most likely runaway slaves given the contextual elements of the dialogue.[144]

Explaining the statues' movement is clearly not exactly what Socrates is after here in the *Meno*. Socrates wants Meno to understand the worth (*axios*) of literally binding or

---

[142] *Euthyphr*. 11c.

[143] *Meno*, 97d–98a.

[144] Namely, the discussion of virtue as regards the slave (*doulos*) in Plato, *Meno*, 72a; 73d; and the demonstration with one of *Meno*'s household attendants (*akolouthōn*) at 82a–85a.

tying down (*deein*) the flight of true opinion with reasoning about causes (*aitias logismō*).[145] But in both the *Meno* and the *Euthyphro* he uses the example of errant artificial creations that can move about. Implicated in these passages are slavery, wonder, errancy, and how binding or tying down these things can create worth (*axios*) for possessors. For Plato, the mythic human master-craftsman, Daedalus, creates beings with the potential for all of this.

Rhodean Statues

But Daedalus' statues are not the only seemingly animated statuesque works of art for which we have references. In the lyric poet Pindar, from the 5th century BCE, we find a reference to the superior handiwork skills found in the works at Rhodes:

> but the Gray-eyed Goddess herself gave them every kind of skill to surpass mortals with their superlative handiwork. Their streets bore works of art in the likeness (*homoia*) of beings that lived (*zōoisin*) and moved (*herpontessi*), and great was their fame.[146]

This gift to the Heliades of Rhodes raises an issue of attribution that situates political stakes in a technological imaginary. As Sandra Blakely notes, "Pindar's praise of Diagoras of Rhodes in *Olympian 7* offers a few brief lines referring to the creation of animated statues by Rhodean autochthones whom he identifies as Heliades, but which scholars since the nineteenth century – and presumably Pindar's contemporaries recognized as the Telchines of Rhodes.". The poetic context immediately gives way to a political project, "one in which Pindar seeks to validate Argive claims to the island…Pindar's strategy for accomplishing

[145] *Meno*, 98a.

[146] *Ol.* VII. 50–55.

this includes the repression of the Telchines' name, and the description of a capacity for magical statues that is not otherwise clear in their record". As a result, the "power of animation provides, in the structure of Pindar's verse, a poetic analogue to the autochthonous status that remained the most potent symbol of the right to possess the land."[147] The Telchines themselves are described by Mayor as "blacksmith wizards of magical metallurgical lore, fabled to be the original inhabitants of Crete and Rhodes".[148] Their erasure from Pindar's verse takes part in the legitimation efforts towards the line of Argive colonists that usurped them. And it is by emphasizing the divine gifts of animation bestowed upon them that this is done.

Technically, however, their gifts are still those of creating *likeness* (*homoia*) through craft. The statues are not said to *actually be* self-movers or *automata* per se This should not be confused with any kind of mechanical engineering of creating actual automata with which we might be familiar today. But it highlights the extent to which myth and legend supports an imaginary that could prefigure this kind of engineering. As Clara Bosak-Schroeder rightly cautions, "scholars who conflate the magical and mechanical in ancient sources are not applying a worked out theory of automata and robots (one that would, perhaps, question the common association of robotics with electronics and computers), but are, rather, revealing an unconscious outcome of human cognition, the result of how having technology changes the way people see the world.". As an example, Bosak-Schroeder points to Hephaestus' tripods: "[when] scholars call Hephaestus' tripods "robots," they are absorbing these objects into their own technological frame of reference. Because they live

[147] Blakely, *Myth, Ritual and Metallurgy in Ancient Greece and Recent Africa*, 2006, 215–226 at 215–216 in particular.

[148] Mayor, *Gods and Robots*, 2018, 94.

in a world in which electronic, computer-programmed robots do exist, they have a tendency to project this technology onto objects that look similar to them".[149]

Our task, however, is to explore the figure of *automata* before and during 4th century BCE Greek thought to see how it is that it could possibly bear on Aristotle's idea of automation. This means giving force to the terms and descriptions *that the Greeks themselves used*. So far in our review of ancient mytho-poetic sources Talos, Pandora, Hephaestus' golden assistants, the seemingly-moving statues of Daedalus, and those of Rhodes were not explicitly referred to as *automata*. It is therefore important for us to examine the appearance of this term in these sources along with relevant derivations.

Hesiod

In Hesiod, to whom Aristotle makes reference in setting up his natural vision of the political community in *Politics* Book I,[150] we find an archaic conception of *automata* as "a principle of natural or spontaneous growth", as Michael Naas puts it.[151] *Automata* here certainly signal something pre-mechanical and echo a kind of mythological life associated with abundance and plenty. Hesiod relates the Age of Kronos and the golden race of men who lived during this blessed period as those who "lived like gods without sorrow of heart (*akēdea thumon*), remote and free from toil (*ponōn*) and grief (*oizuos*)". The hardships of labour were not visited upon this golden race because they had available to them all the good things (*esthla panta*): for the earth bore them fruit *automatē* - abundantly (*pollon*) and without stint (*apthonon*).[152]

[149] Bosak-Schroeder, "The Religious Life of Greek Automata", 2016, 131–132.

[150] *Pol.* I. 4. 1253b23–27.

[151] Naas, *Plato and the Invention of Life*, 2018, 63.

[152] *Op.* 114–118.

The earth itself is said to produce fruit as if it were involved in some kind of impulsive process of growth. In doing so, it relieved the golden race of having to cultivate the land itself. The connection between work and *automata* therefore stretches far back indeed, even though the kind of *automata* mentioned here are not devised as technological objects.

Hesiod mentions a similar principle of spontaneous growth, although without direct reference to *automata*, elsewhere in the *Work and Days*. The heroes living at the ends of the world at the blessed isles are said to have been given, by Zeus son of Kronos, "honey-sweet fruit flourishing thrice a year" from the "grain-giving earth". Again, there is no need for these heroes to cultivate the land themselves. Divine intervention assures that the earth satisfies man's need of its own accord. [153] Elsewhere, Hesiod addresses his brother Perses and cautions:

> Neither famine nor disaster ever haunt men who do true justice (*ithudikēsi*); but light-heartedly they tend (*erga*) the fields which are all their care. The earth (*gaia*) bears them victual (*bios*) in plenty (*polun*), and on the mountains the oak bears acorns upon the top and bees in the midst.[154]

Now in the age of iron, common men can no longer rely on the earth producing *automatē* for their needs. Zeus' divine gift is replaced with the need for tending or working (*erga*) the fields. The men who do so with care, a light spirit, and who are moreover just, are the ones who are spared ill-fortunes and who are able to gain some organic semblance of the plenty that was 'automatic' to the golden race and heroes. Only then will the earth bear them what they need, and the oaks yield acorns and place for honey-giving bees. Implicit in

[153] *Op.* 166–173.

[154] *Op.* 230–233.

Hesiod's genealogical narrative of degradation is that man must progressively *do more* – work more – to achieve what was previously afforded freely and divinely to their god-like ancestors. Justice appears as a corrective towards a simulacrum of this state. Only the just deserve a state in which the earth produces goods in some diminished, but comparable way when compared to the production *automatē* of old.

Homer

Turning now to Homer, we see again the idea of the earth producing sustenance in a spontaneous way. In the *Odyssey*, Homer describes the courtyard in the palace of Alcinous where a wide variety of fruits are available, and watered by two springs, all year around. Such things are described as "glorious gifts of the gods" (*theōn esan aglaa dōra*). [155] Later, in a description of the Cyclopes, it is said of them that they are

> an overweening and lawless (*athemistōn*) folk, who, trusting in the immortal gods, plant nothing with their hands nor plough (*oute phuteuousin chersin phuton out'aroōsin*); but all these things spring (*phuontai*) up for them without sowing or ploughing, wheat, and barley, and vines, which bear the rich clusters of wine, and the rain of Zeus gives them increase. Neither assemblies for council (*agorai boulēphoroi*) have they, nor appointed laws (*themistes*), but they dwell on the peaks of lofty mountains in hollow caves, and each one is lawgiver (*themisteuei*) to his children and his wives, and they reck nothing one of another.[156]

Living almost like Hesiod's golden race, the Cyclopes have found no need of laws to regulate their affairs. They trust in the gifts of the gods and are provided in kind, needing

[155] *Od.* 7. 113–132.

[156] *Od.*, 9. 109–115.

no work to cultivate the land. Similarly, in the mythic land of Syria the land is said to be abounding in wheat (*eubotos*), and no famine or sickness falls on the people dwelling there.[157]

But in none of these places does Homer refer to this occurrence as *automata*, *automatē* or any variant thereof. It is in the *Iliad*, rather, that we see mention of *automata* proper. Homer describes Menelaus as coming *automatos* to the sacrificial offering arranged by Agamemnon with the other leaders of the Argive host. Menelaus is said to know in his heart (*kata thumon*) what his brother was busied with, leading to his appearing at the offering. A kind of unexpected, instinctual movement is therefore at work in this description.[158] But this movement is not completely random. Menelaus is operating with a kind of advance awareness of what he needs to do.

Similarly, when Homer describes the Olympian gates of heaven opening *automatai* upon Hera's approach we do not see some purely random, mysterious drive at work. The gates still act in the way that they are supposed to in that given moment and are moreover specified to be under the charge of the Horai, goddesses of seasons and timekeeping. The association with time and a critical moment of action is significant here – the gates themselves are responsive *in time* to a stimulus, and open or close dependent on that stimulus. It is therefore a bit overstated to say, as Emanuela Bianchi does, that we might reveal "*automaton* as motile drive, acting beyond conscious thought…[moving] through the world, and [moving] through us, in a way that exceeds our conscious control or the gatherings of *logos*".[159]

---

[157] *Od.*, 15. 403–409.

[158] *Il.* 2. 408–409.

[159] Bianchi, *The Feminine Symptom*, 2014, 72.

In the *Iliad* we find another, crucial instance of *automata* applied to a device designed by the gods and set for specific task. Homer tells us about Hephaestus' golden tripods that he is said to craft and make, and which move *automatoi*:

> since he was working on twenty tripods (*tripodas*) which were to stand against the wall of his strong-founded dwelling. And he had set (*thēken*) golden wheels (*kukla*) underneath the base of each one so that *automatoi* they could wheel into the divine gathering (*theion agōna*), and return to his house: a wonder to behold (*thauma idesthai*).[160]

By now we have already seen that ability of something acting *automatos* – of *automata* generally – to create wonder in a spectator suffuses the literary record. Homer's golden tripods in the *Iliad* are explicitly said to be wonders (*thauma*) to behold (*idesthai*), set as they were with circular wheels (*kukla*), and designed by Hephaestus to a specific task of coming and going to the gods' assembly.[161] We should take this mention of circularity seriously, as Aristotle tells us a bit about his own method of interpreting Homer in the *Poetics*, namely that the latter teaches how to lie (*pseudē*), but also conceals what is out-of-place (*atopos*) by sweetening the drama with his other good qualities.[162]

We find circularity and reflexivity inscribed in this overall scene in the *Iliad,* beyond the wheels set underneath the golden tripods. Hephaestus tells us he laboured nine years, hidden by Thetis and Eurynomē, working on all manner of curved and circular ornaments. Surrounded by the waters of Oceanus on either side, Hephaestus describes Oceanus'

[160] *Il.* 18. 373–377.

[161] *Il.* 18. 376.

[162] *Poet.* 1460a19; 1460b1–2.

waters as ever flowing back from whence they came (*apsorroou*).[163] This circular motif is repeated a few lines later in the ekphrastic description of Achilles shield, which Hephaestus states will engender wonder (*thaumassetai*) in some of those people of the *polis* who might behold it (*idētai*).[164]

The description of the shield's figures begins with a cosmological description of the earth, heavens, sun and moon. Homer describes the turning motions (*strephetai*) of the star constellation *Arkton* (The Great Bear - Ursa Minor), which he says is also called Hamaxan (The Wagon).[165] When he turns next to man in the two *poleis*, the description of the first *polis* begins the scene of lively action. Young men spun around (*edineon*) in the dance (*orchēstēres*) as the processional bridal rites were performed, and the women stand watching by their doors in wonder (*thaumzon*). [166] This scene is contrasted with the scene in the *agora*, where strife is underway (*eneikeō*) over a matter between two men. The elders are said to be sitting on, and adjudicating from smoothened stones in the sacred circle (*ierōi kuklōi*).[167] In the third scene, Homer describes the agrarian ploughing fields, where ploughmen are spinning (*dineuontes*) their yokes around and turning them (*strepsantes*) this way and that.

In the fourth scene we find the king's laborers reaping the land with curved sickles (*drepanas*) and binding the harvest around with bind-ropes (*elledanoisi*). The fifth scene begins with a description of a great vineyard ripe with heavy clusters of grapes, while the sixth

[163] *Il.* 18. 395–405.

[164] *Il*. 18. 466–467. *Polis* does not take on quite the same defined notion in the classical period as it does in the archaic. For more on this discussion see Scully, "The Polis in Homer: A Definition and Interpretation", 1981, 1–34.

[165] *Il.* 18. 483–489.

[166] *Il.*18. 493–495.

[167] *Il.* 18. 496–505.

ends with hounds turning back (*apetrōpōnto*) from their lion chase.[168] The seventh begins with an enclosed pasture (*nomon*) for sheep, while the eighth tells us about the circular dancing (*edineuon*) in the *chora* made by Daedalus.[169] Finally, Hephaestus ends the ninth scene where the reason for his granting of favour to Thetis first began: surrounded by the waters of Oceanus. Circularity is etched into Hephaestus' crafted scenes of life and his *automatoi* tripods, and both are wonders unto themselves.[170]

Old Comedy

Automata are not only confined to epic poetry, however. The idea of an idyllic state of plenty and the associated connection with – in particular the release from – labour finds itself the subject of comedic intervention. Old Comedy, particularly that of Crates and Aristophanes, seems to have problematized these ideas quite explicitly. In a fragment attributed to Crates, a natural state of abundance and plenty is emphasized:

> "And in addition, *automatē* it produces spurge and sage apples, asparagus and tree medick, while asphodels flourish in the valleys, and mullein ungrudged, so as to be available for all the country-folk."[171]

[168] *Il.* 18. 561–562; 18. 585–586.

[169] *Il.* 18. 590–593; On the circularity of this space itself, see Gutzwiller, "Homer and Ariadne", 34.

[170] See Oliver Taplin's seminal exposition, "The Shield of Achilles Within the 'Iliad'", 1980, 3, who argues, "The decoration of the shield is derived from poetic invention not from history"; at 5, that it is "not even clear that the shield is to be envisaged as decorated with five concentric circles"; Moreover, at 12, that the shield is a "microcosm, not a utopia". To this analysis I add that of the principle of circular motion.

[171] Crates, *Fragments*, 363.

This fragment is of uncertain origin. However, scholars like Ian Ruffell have speculated that it is "almost certainly" from Crates' comedy regarding the wealth gods, the *Ploutoi*. Ruffell does so by drawing on the Hesiodic Age of Kronos and various interspersed themes of what he calls "automatism" or an "automatist utopia". *Ploutoi* not only reinforces "dominant ideologies of both political power and wealth" but also a "means of articulating popular grievances and popular dissent". As Ruffell continues, "By abolishing economic differences, the automatist utopia, it seems to me, poses radical questions to the economic *status quo* at Athens".[172]

More acutely for our purposes, Crates' other play, the *Beasts*, contains an extended description of everyday household items coming to be animated somehow in order to replace the labour of slaves. These fragments are taken from Athenaeus' *Deipnosophists*, in an extended discussion about how the poets of Old Comedy discussed life in ancient times and claimed that no one relied on slaves:

> (A.) Then absolutely no one will get a slave man (*doulon*) or woman (*doulēn*), but an old man will have to be his own servant (*diakonēsei*)?
> (B.) No! I'll make (*poiēsō*) everything able to walk.
> (A.) But what good is that to them?
> (B.) Each of the utensils will come to you by itself (*proseisin auth'ekaston*), when you call it. "Appear beside me, table! Set yourself! Grain-sack, knead the dough! Ladle, pour! Where is the wine cup? Go and wash yourself! Up here, bread-dough! The pot should spit out those beets! Come here, fish! <But I'm done only on one side yet>. Then turn yourself over, and baste yourself – with a little salt"

[172] Ruffell, "The World Turned Upside Down", 2000, 476; 480; see also Baldry, "The Idler's Paradise in Attic Comedy", 1953, 52–54. Ruffell's usage of 'utopia' to describe this state of affairs could be critiqued on the grounds however that utopian projects are more precisely political and more descriptively extended in this regard.

After this description relating the substitution of slaves and slave labour with self-moving tools that are explicitly commanded to perform their tasks, Athenaeus then interjects to introduce the response:

> (A.) "Well, try this on! To counter you, first I'll bring hot baths for my people on top of pillars like in the Paionion, to flow from the sea into everyone's tub; the water will say <you can turn me off now> ; then the perfume-bottle will march right up *automatos* along with the sponge and sandals." [173]

Now the water itself talks, whereas before it was a dead fish. And we see *automatos* applied to the movement of the perfume-bottle (and/or sponge). This time, no commands are specified, but these things simply know what they need to do.[174]

Translating these fragments from the *Beasts*, Ian Story refers to the speakers agonistically discussing these fantastic worlds and "whether [they] will be an "automatic" utopia or a luxurious excess".[175] Whether the emphasis in Athenaeus' discussion of various plays and fantasies is on slavery or things happening *automata*, is open to interpretation. Baldry, for example, suggests that "the presence or absence of servants" is not the focus, rather, "The central idea in them all, carried to heights of hyperbole typical of Old Comedy, is to portray circumstances in which things happen of their own accord, without involving human toil. The key word is *automatos*".[176] Devecka, on the contrary, suggests that

[173] Crates, *Fragments*, 16–17; also in Ath. VI. 267e–268a. For this reference I make use of the translation offered by Konstan, "A World Without Slaves", 2012, 13–15. Athenaeus's discussion takes place from 267e–270a more generally.

[174] Crates, *Fragments*, 16–17.

[175] 215 in the Loeb translation.

[176] Baldry, "The Idler's Paradise in Attic Comedy", 1953, 50.

"Athenaeus gives a number of parallels from the fifth and fourth centuries that make the obviation of slavery by automation look almost like a trope of Greek comedy".[177] Indeed it seems difficult to extricate the emphasis on slavery from *automata*, which capture one important dimension to its deployment in these texts. David Konstan moreover emphasizes that these passages are forward-looking, not simply backward-looking towards Hesiod. He argues that in the *Thêria*, Crates "took that extra step and did at least intimate the creation of a society in which slavery had been abolished, and did not simply evoke a primitive mythical age prior to political life and social stratification."[178]

There are therefore interpretative difficulties with the appearance of *automata* in these particularly ironic, comedic texts. And yet what is common is that *automata* are presented alongside themes of work, slaves, and desirable worlds of spontaneous growth and plenty. As a result, *automata* are situated in the throes of social and political commentary about the status quo. And this must have been *funny* to spectators at the theatre. To imagine these counterfactual, absurdist worlds with the unexpected movements of otherwise mundane everyday items served as a powerful stimulus for *both* humor and critique.

Turning now to Aristophanes, we are also presented with the recurring idea of tools somehow endowed with a sense of agency, or at least a desire for this to be so. In *Plutus,* Blepsidemus protests against the character, Poverty (*Penia*) when the latter attempts to argue that she is the sole cause of all blessings. Blepsidemus addresses two tools for help, "oh

[177] Devecka, "Did the Greeks Believe in Their Robots?", 2013, 63–64.

[178] Konstan, "A World Without Slaves", 2012, 13.

cudgel and rope's end, won't you come to my help?".[179] In the *Ecclesiazusae*, the first male character speaks to a number of objects:

> Come hither, my beautiful sieve, I have nothing more precious than you, come, all clotted with the flour of which I have poured so many sacks through you; you shall act the part of Canephorus in the procession of my chattels. Where is the sunshade carrier? Ah! this stew-pot shall take his place. Great gods, how black it is! it could not be more so if Lysicrates had boiled the drugs in it with which he dyes his hair. Hither, my beautiful mirror. And you, my tripod, bear this urn for me; you shall be the water-bearer.[180]

These household items, usually tools in the preserve of women and slaves in the house, are now commanded directly by the first male character to perform their tasks. Similarly, in the *Wasps*, Bdelycleon calls upon various kitchen utensils to be witnesses in his case: a plate, a pestle, a cheese knife, a brazier, a stew-pot, and other "half-burnt" utensils.[181]

But Aristophanes also uses variants of *automata* directly. We find occurrence of the term *automatos* in connection with divine action. In *Plutus*, the character Chremylus describes the arrival of Zeus as follows, "Zeus the saviour is present there, coming *automatos*". This is contrasted with how Plutus is to arrive, namely by being summoned or called (*kalei*).[182] There is a parallel here with how Menelaus is said to have arrived at the sacrificial feasts in the *Iliad*. Like Menelaus, Zeus arrives when he is supposed to, without being explicitly told to do so. There is no pure randomness at work here either. Zeus' arrival

[179] *Plut.* 1189–1198.

[180] *Eccl.* 730–745.

[181] *Vesp.* 936–939.

[182] *Plut.* 1189–1198.

might not have been called for, but his arrival coincided with his priest's desire to go and see him.

In the *Acharnians*, the Chorus praises Dikaiopolis for his conclusion of peace between the Athenians and Spartans:

> Have you seen him, all you people, the smart (*phronimon*), and exceedingly sagacious man (*hupersophon*), seen what fine merchandise, thanks to his truce, he's got for sale? Some of his things are useful (*chrēsima*) around the house (*okiai*), while others should be eaten hot.
>
> Chorus Leader: "To this man all bounties (*pant'agatha*) are supplied *automata*".[183]

Because of his good virtues Dikaiopolis is able to reap good things in abundance. Much like what is required of Hesiod's iron age men to achieve a simulacrum of what happens 'automatically' in the Age of Kronos, Dikaiopolis must rely on his own virtue and not divine gift.

Euripides

Finally, it is worth mentioning an important appearance of *automata* in the one of Aristophanes' chief sources for parody, Euripides. In Euripides' *Bacchae*, a servant relates the ludicrous circumstances surrounding the capture of the Stranger/Dionysius, including how the Bacchae found themselves released:

> And the Bacchae whom you shut up, whom you carried off and bound in the chains (*kadēsas en desmoisi*) of the public prison, are set loose and gone,

[183] *Ach.* 971–976.

> and are gamboling in the meadows, invoking Bromius as their god. *Automata*, the chains (*desma*) were loosed from their feet and keys opened the doors without human hand (*aneu thnētēs cheros*). This man has come to Thebes full of many wonders (*thaumatōn*).[184]

Automata are related here to the release from capture – from the literal binding down of the Bacchic women. And this in turn is a wondrous event. But again these events are not purely random, as much as they might appear to Pentheus and his servant. When the chains are said to loose themselves *automata* we know that they are doing something they are supposed to be doing in that given moment, thanks to Dionysius.

IV. Hippocratic Corpus – 'Automatic Healing'

Aside from myth, poetics, and material evidence or allusions thereto, *automata* also appear in the Hippocratic corpus. We know that Aristotle, the son of a physician, frequently cites medical examples throughout his own works. He also tells us of the renown attached to Hippocrates, in the *Politics*, while discussing the appropriate measure of the greatness of a state. Hippocrates is said to be greater (*meizōn*) than other men as a physician (*iatron*), while not necessarily being greater in bodily size.[185] While much of the Hippocratic corpus was written before or around Aristotle's time, there remain significant difficulties in attributing the authorship to the texts themselves, as well as the access Aristotle might have had to them. We do know, for example, that Aristotle quotes text appearing in *On the Nature of Man* and *On the Nature of Bones* in his *History of Animals*, attributing it to Hippocrates' son-in-law,

[184] *Bacch.* 443–450.

[185] *Pol.* VII. 4. 1326a15-7.

Polybus.[186] Moreover, the *Generation of Animals* strongly presupposed knowledge of the Hippocratic text, *On Generation*. Nevertheless, it is instructive for us to see how *automata* appear in this corpus and prevailing medical knowledge at the time, from which Aristotle undoubtedly borrowed and with which he was familiar.

In the context of this medical knowledge, *automata* occur predominantly as a mode in which the body seems to heal of itself. 'Automatic healing', as Jennifer Kosak puts it, is synonymous with the "natural healing process" of the body. "Healers", Kosak suggests, "are necessary when the disease is too strong for the body to handle through the resources of its own nature". [187] For example, the author of the *Appendix* to *Acute Diseases* lists a number of conditions where pharmacological intervention would be deleterious to the natural healing process:

> Take note of patients with headaches that have arisen from physical exercises, running, walking, hunting, some other untimely exertion, or venery, and of those with poor colour, a sore throat, disease of the spleen, lack of blood, asthma, a dry cough, excessive thirst, flatulence, stoppage of the vessels, tension of the hypochondrium, sides and back, numbness, dullness of vision, ringing in the ears, loss of command over the urethra, jaundice, the passage of undigested stools, excessive bleeding from the nose or through the anus, tympanites, or an attack of severe pain they do not overcome: do not treat any of these with a medication (*pharmakeuein*), for that would be dangerous (*kindunon*), and your effect would not be to help (*ōphelēseis*) the patient, but only to deprive his crises (*krisias*) of their spontaneity (*apo tou automatou*).[188]

[186] *Hist. an.* III. 3. 512b11–513a7.

[187] Kosak, *Heroic Measures*, 2004, 112–113.

[188] *Acut.* [*Appendix*], 55 (23 L.).

In *Ancient Medicine*, a similar sentiment is expounded before the situations are clarified under which medical intervention *is* necessary. The author of this text is discussing how the body produces a fever in response to the chills, in order to neutralize its opposite:

> What important or serious consequence, therefore, could come from that thing on which quickly supervenes in this way its exact opposite, annulling its effect *apo tōutomatou*? Or what need has it of elaborate treatment?[189]

In these situations, the body's healing processes *apo tou automatou* bring about positive change that should not be interfered with. But some outcomes in these processes, like those effects after the body produces inter alia bile, fever, menstruation, vomiting,

> occur or do not occur, not through any ignorance (*amathiēn*) or knowledge of physicians (*sophiēn iatrōn*), but *apo tou automatou* and by fortune (*apo epitychiēs*); and, when they do occur, it may help or harm (*ōpheleei ē blaptei*); likewise, when they do not occur, it may help or harm.[190]

In essence, the body's natural healing process produces both good and bad (*agatha kai kaka*) outcomes and effects quite spontaneously.[191] Moreover, they appear in an aleatory modality associated with luck or fortune.

Other examples where *automata* appear include bowel movements that occur

[189] *VM*. 16.

[190] *Morb*. I. 7.

[191] *Morb*. I. 7.

automatē;[192] fortunate spontaneous occurrences (*eutychēma tōn automaton*) relieving older women of painful conditions and swellings;[193] post-purging (*katharsies*) relief of the pains of pleurisy;[194] lesions that (cannot) come together *automata*;[195] spontaneous swellings in the feet and other parts of the body;[196] breakage of an abscess of itself;[197] rising of bone fragments of themselves after certain traumatic head injuries;[198] purgation (vomiting and bowel movements) generally;[199] and symptoms of spontaneous (*automatoi*) weariness;[200] In all of these cases the body is said to behave in a certain way that can either be beneficial or not for the overall healing process, but needs no direct human intervention to actually occur.

But sometimes the healing process cannot resolve a condition of itself. In certain joint dislocations, for example:

> Because some think they have cured patients whose vertebrae had fallen inwards with complete disarticulation; and there are even some also who think this is the easiest distortion to recover from, not even requiring reduction, but that such injuries get well *automata*. There are many ignorant (*agnoeousi*) practitioners; and they profit (*kerdainousin*) by their ignorance, for they get credit with their neighbours (*tous pelas*).[201]

---

[192] *Internal Affections*, 21; *Acut.* XIX.

[193] *Mul.* II. 7. 116 L.

[194] *Acut.* XIV.

[195] *Ulcers*, 8.

[196] *Ulcers*, 24.

[197] *Art.* XII.

[198] *On Wounds in the Head*, XVII; XXI.

[199] *Aphorisms*, I. 2; IV. 2.

[200] *Aphorisms*, II. 5.

[201] *Art.* XLVI.

Here, the craft of the medical practitioner is required to intervene and bring the body back to health. And the medical practitioner can moreover intervene and complement the body's natural process – for example forcibly (*biasasthai*) extending an external laterally dislocated forearm so that it thereafter goes in *automatōs*.[202]

Automata in the medical Hippocratic corpus are therefore strongly associated with a natural bodily process. Healing, through its various mechanisms which sometimes misfire and tend towards pathology, can occur *automata*. And because this is associated with a patient's outcomes, *automata* find themselves implicated in the world of fortune and luck as an aleatory concept. It is the body itself that sets the healing process in motion, in response to some kind of pathology, and this is in fact a miracle and wonder in and of itself. But this can only go so far – the medical craft intervenes to complement or supervene over situations where the body's response is insufficient or even counterproductive to restoring health.

V. Historical and Philosophical *Automata* – Nature and Spontaneity

We also find *automata* treated in the course of historical and philosophical development. These *automata* are not confined to mechanical devices or self-moving objects of craft more generally – quite the opposite. Instead, we see it used to describe a mode of existence for things in the world – usually as distinct from modes over which human or divine control is more proximal and pronounced. *Automata* appear as something quite unexpected and imbued with a sense of 'of itself'. Examining *automata* in Herodotus, Thucydides, and Plato, therefore allows us to consider their place in both historical and philosophical discourse prior to, and during Aristotle's time.

[202] *On Fractures*, XLIII.

In the *Poetics*, Aristotle tells us that the difference between the historian (*historikos*) and the poet (*poiētēs*) lies in the basis of telling what happened (*ta genomena*) in the case of the former, and what might happen (*oia an genoito*) in the case of the latter. Herodotus, he says, could just as well have had his histories put into verse, since this is not the true difference between the two forms.[203] Aristotle's way of interpreting history – in particular the *Histories* – therefore, is revealed to us as way of paying attention to specific happenings. This is significant because, for Aristotle, it anchors the treatment of *automata* in historical sources *within* the realm of specific, concrete occurrences. And so we should turn to examine these occurrences within sources themselves.

Herodotus

Herodotus, in a number of places, speaks to the occurrence of *automata* in natural things. In describing the life of the Egyptians, he says:

> At present, of course, there are no people, either in the rest of Egypt or in the whole world, who live from the soil with so little labor (*aponētotata*); they do not have to break the land up with the plough, or hoe, or do any other work (*ergazomenoi*) that other men do to get a crop; the river rises *automatos*, waters the fields, and then sinks back again; then each man sows his field and sends swine into it to tread down the seed, and waits for the harvest; then he has the swine thresh his grain, and so garners it.[204]

[203] *Poet*. 1451a36–1451b11. For a discussion of this claim see for example Sicking, "Aristotle and Herodotus", 1998, 147–157; Thompson, *Herodotus and the Origins of the Political Community*, 1996, 22–28.

[204] Hdt. II. 14.

Herodotus' description of the people of Egypt recalls the blessed heroes or men in the golden Age of Kronos who are gifted abundance and plenty in nature, and do not need to labour for their sustenance. The Nile rises *automatos*, and this drives a natural chain of events that allows the Egyptians to take advantage of the ensuring natural fertility and productivity. Similarly, the Scythian river Borysthenes is said to be the most productive (*poluarkestatos*) aside from the Egyptian Nile. Amongst many other wonders (*polla thōmasai*), boundless (*apletoi*) salt crusts form *automatoi* at the river mouth. Elsewhere, Herodotus talks of a type of berry plant (the *kiki*), that grows wild (*agria phuetai*) and *automata* in Greece. Cultivated in Egypt, it bears abundant fruit (*karpon pollon*).[205] The Indians, who are said not to cultivate crops (*speirousi*) nor have houses, have a millet grain that they gather as it arises *automaton* from the earth (*ek tēs gēs ginomenon*).[206] The Thracians have a type of hemp that grows *automatē* but also *alternatively* through human cultivation (*speiromenē*), which they use for garments.[207] Roses are said to grow *automata* in the gardens of Midas, son of Gordias, in Macedonia.[208] *Automata* here, then, are tied intimately to the productions of nature for human use, plenty, and the release from labour and cultivation.[209]

But we also find *automata* used in slightly different senses elsewhere in the *Histories*. Herodotus describes the curious ritual amongst the Egyptians when a household cat has died. If the cat dies *apo tou automatou*, then members of the household shave their eyebrows.

---

[205] Hdt. II. 94.

[206] Hdt. III. 100

[207] Hdt. IV. 74.

[208] Hdt. VIII. 138.

[209] See also Hdt. III. 18 where Herodotus refers to the Ethiopian legend of the Table of the Sun (*trapeza tou hēliou*), where meats (*krea*) are set out in a feast for all and are ever produced of the earth of itself (*tēn gēn autēn anadidonai hekastote*).

The implication here is that *automata* refers to what is aleatory, causal and natural. If the cats die through some happenstance of nature and not through an act of human agency, then humans mourn in a specific way.[210] Similarly, Herodotus explains the circumstances around the reconstruction of the temple at Delphi when it had burnt (*katekaē*) down *automatos*. No human hands caused the burning. Rather, the burning was a spontaneous natural accident. [211] Importantly, *automata* are not simply related to impulses of life and growth, but also death and destruction. The 'of itself'-ness, so to speak, covers a mode of existence quite distinct from direct human agency. As if to emphasize this fact, Herodotus relates Mardonius' speech to Xerxes before the invasion of Greece and the Battle of Thermopylae as follows:

> But against you, O king, who shall make war? You will bring the multitudes of Asia, and all your ships. I think there is not so much boldness in Hellas as that; but if time should show me wrong in my judgment (*gnōmēi*), and those men prove foolhardy enough to do battle with us, they would be taught that we are the greatest warriors on earth. Let us leave nothing untried (*apeirēton*); for nothing happens (*ginesthai*) by itself (*automaton gar ouden*), and all men's gains are the fruit of adventure (*all'apo peirēs panta anthrōpoisi phileei*).[212]

Mardonius' claim stresses his judgment and the agency of men more generally. Nothing happens in the world *automaton*, he tells us. Men must insert themselves into the world through their own efforts and attempts to change it – only then do things happen. We see

[210] Hdt. II. 66.

[211] Hdt. II. 180.

[212] Hdt. VII. 9.

here an unmistakable echo of historical *ta genomena* that we found in specified in Aristotle's *Poetics*.

Finally, Herodotus does mention man-made objects of craft in connection with *automata*. During the Persian invasion, divine intervention is speculation in the favour of the Greeks:

> Now when the barbarians (*barbaroi*) drew near and could see the temple, the prophet, whose name was Aceratus, saw certain sacred arms, which no man might touch without sacrilege, brought out of the chamber within and laid before the shrine. So he went to tell the Delphians of this miracle, but when the barbarians came with all speed near to the temple of Athena Pronaea, they were visited by miracles yet greater than the aforesaid. Marvellous (*thauma*) indeed it is, that weapons of war (*hoopla arēmia*) should *automata* appear (*phanēnai*) lying outside in front of the shrine, but the visitation which followed was more wondrous (*thōmasai*) than anything else ever seen. When the barbarians were near to the temple of Athena Pronaea, they were struck by thunderbolts from the sky, and two peaks broken off from Parnassus came rushing among them with a mighty noise and overwhelmed many of them. In addition to this a shout and a cry of triumph were heard from the temple of Athena.[213]

The weapons of war mentioned here are not somehow *mechanical* things designed to move themselves in their intended function. Instead, it is their unexpected appearance outside the temple that is said to be *automata*. Put another way, these tools aren't crafted to perform their tasks *automata*, but appear somewhere in this way. Moreover, they do so through speculated divine agency, which in itself causes wonder. Again however, it is not through man's own efforts that this situation comes to be.

[213] Hdt. VIII. 37.

Thucydides

If we turn now to Thucydides, we find something quite similar in the realm of *automata* and *ta genomena*. While Aristotle does not mention Thucydides by name anywhere throughout his corpus, there is some evidence to suggest he was familiar with at least part of his work.[214] Notwithstanding this, the 5th century BCE war *historikos* provides us with further clues as to how the Greeks understood *automata* prior to, and during Aristotle's time. Unlike Herodotus, however, Thucydides' references to *automata* are much fewer in number. Where they do occur, however, they similarly stress natural spontaneity and its distinction with direct human agency.

As Thucydides recounts the conflict between the Peloponnesians and the Plataens in Book II, he mentions the emergence of two kinds of fire:

> Having therefore brought faggots, they cast them from the mount into the space between it and their new wall, which by so many hands was quickly filled, and then into as much of the rest of the city as at that distance they could reach and, throwing amongst them fire, together with brimstone and pitch, kindled the wood and raised such a flame, as the like was never seen before made by the hand of man (*cheiropoiēton*). For as for the woods in the mountains, the trees have indeed taken fire; but it hath been by mutual attrition and have flamed out *apo t'automatou*.[215]

The fire set by Peloponnesian forces falls within the category of those things created by man's efforts – the hand of man. It was so great in this instance that it rivalled those naturally-occurring fires that ignite themselves spontaneously through mutual attrition of

[214] On this point see Marchant, *Thucydides*, 1905), xxi–xxii, "many passages in his [Aristotle's] works show that he was well acquainted with the Proem)".

[215] Thuc. II. 77. 4 (134).

tree wood.

Similarly, when the Syracusans deliberate in their assembly, Athenagoras dismisses Hermocrates' warnings of an Athenian invasion as rumours designed to sow fear in the public:

> or they that are afraid of anything themselves will put the city into affright that they may shadow their own with the common fear. And this may the reports do at this time, not raised *apo t'automatou*, but framed on purpose by such as always trouble the state. [216]

It is conspiratorial men who are responsible for these rumours – they do not simply arise of themselves or in some aleatory way by chance.

Finally, Thucydides also acknowledges the way in which nature creates useful resources *automata*. When Alcibiades speaks to the Spartans in their assembly, he emphasizes the benefits they will reap if they fortify Deceleia:

> As for the commodities which yourselves shall reap and deprive the enemy of by so fortifying, letting much pass, I will sum you up the principal. Whatsoever the territory is furnished withal will come most of it unto you, partly taken and partly of its own accord (*ta men lēphthenta, ta d'automata*). [217]

The implication of course is that the land itself will furnish some things quite naturally without human work or effort. Again, human agency is placed alongside but distinct from

[216] Thuc. VI. 36. 2 (399). The phrase 'on purpose' however, does not strictly appear here in the Greek as Hobbes translates it.

[217] Thuc. VI. 91. 6–7 (432).

automata.

Xenophon

If we turn to Xenophon, who occupies a position in Greek thought that straddles both history and philosophy, we find *automata* yet again. As Leo Strauss notes, Aristotle does not mention Xenophon in his works, but there is evidence to suggest that he relied upon Xenophon's *Hellenica* for the *Constitution of the Athenians*.[218] The *Hellenica*, as we know, begins where Thucydides leaves off. Xenophon later narrates Euryptolemus' speech, which describes a storm that essentially disabled both Spartan and Athenian efforts:

> This much, however, I can say in defence of both parties, that the storm absolutely prevented them from doing any of the things which the generals had planned. And as witnesses to this fact you have those who were saved *apo tou automatou*.[219]

Again, an aleatory conception of *automata* is at work, precisely where man is helpless. Elsewhere, he describes how "reports were brought to them [the Athenians] from the city that all the temples were opening *automatoi*, and that the priestesses said that the gods revealed victory." [220] Divine action is speculated as an intervening force to explain something strange and unexpected, namely the temples opening.

---

[218] On this see the recorded transcripts of Strauss' lectures edited by David Janssens – Strauss, *Plato's Apology of Socrates & Crito*, 1966, 330.

[219] *Hell.* I. 7. 32.

[220] *Hell.* VI. 4 7.

In the *Anabasis* Xenophon echoes Euripides' *Bacchae* somewhat when he describes his dream wherein he finds himself bound (*dedesthai*) by fetters (*pedais*) which subsequently loosen *automatai*.[221] But he also describes the movement of men in particular using *automata* or more specifically, *apo tou automatou*: army troops breaking into a run without being told specifically to do so; [222] speakers arising to express their views unprompted; [223] men gathering [*automatous*] rather than through any direction to do so; [224] a man who happened to arrive the previous day by ship.[225] In these latter instances it is human action itself that displays a kind of natural automatism or spontaneity, caught up in an aleatory sense of the unexpected.

In the *Cyropedia*, Xenophon creates a conversation between Cyrus and his grandfather as follows:

> "Tell me, grandfather," said he [Cyrus], "if one of your servants (*oiketōn*) runs away and you catch him again, what will you do to him?"
>
> "What else," said he, "but put him in chains (*dēsas*) and make him work? (*ergazesthai anangkasō*)"
>
> "But if he comes back again *automatos*, what will you do?"
>
> "What," said he, "but flog him to prevent his doing it again, and then treat him as before?"[226]

[221] *An.* IV. 3. 8.

[222] *An.* I. 2. 17

[223] *An*. I. 3. 13.

[224] *An.* V. 7. 3.

[225] *An.* VI. 4. 18.

[226] *Cyr.* I. 4. 13.

Here again we see an association between a (household) slave, work, bondage, and *automata* in way different to the scene set by Plato in the *Meno*. A slave that returns *automatos* rather than through the effort of capture is to be punished less harshly for running away. Much in the same way Homer's Menelaus joins the sacrifice unbid, the slave here acts with an advance awareness of what should be done and is rewarded for it with a less severe punishment. The agency involved here is basic, but not absent.

In his more philosophical works, Xenophon develops the idea of *automata* in the sphere of human action and knowledge as basic and normatively inferior. We need to *work* and put effort in developing both our minds and bodies. In the *Memorabilia* Socrates notices the poor physical condition of one of his companions, Epigenes, and stresses the importance of bodily exercise and development:

> Besides, it is a disgrace (*aischron*) to grow old through sheer carelessness before seeing what manner of man you may become by developing your bodily (*toi sōmati*) strength and beauty to their highest limit (*kallistos kai kratistos*). But you cannot see that, if you are careless (*amelounta*); for it will not come *automata*.[227]

For Socrates it is really shameful not to attempt to develop one's body and its potential. It shows a lack of care, because bodily development requires effort and does not arise *automata*. It is not a spontaneous event, but instead requires deliberate activity.

[227] *Mem.* III. 12. 8.

Similarly, when discussing the art of statesmanship, one of Socrates' companions asks whether it was through association with one of the wise, or through nature (*phusei*) that Themistocles became a great political leader. With a mind also to stimulating Euthydemus, who was considered to have had the best education (*paideias tēs aristēs*), Socrates responds as follows:

> If in the minor arts (*oligou axias technas*) great achievement is impossible without competent teachers (*didaskalōn hikanōn*), surely it is absurd to imagine that the art of statesmanship (*to proestanai poleōs*), the greatest of all accomplishments (*ergon*), comes to a man *apo tautomatou*.[228]

Socrates dismisses the idea that one can simply become great in the arts, not least in the greatest of all *erga*, *automata*. Political greatness is not achieved through natural spontaneity or ability, but rather takes preparation (*paraskeuēs*) and careful attention (*epimeleias*). It does not arise suddenly (*exaiphnēs*) and *automatoi.*[229] "Know thyself", as Socrates will continue explaining, is an undertaking of the examined life that requires exertion not automatism.

Plato

Finally, we see a similar general treatment of *automata* in Plato. In the *Laws*, Plato's Athenian Stranger refers to the Age of Kronos as one in which divine beings were set over men as rulers to keep them in a state of bliss (*makarias*) and without stint (*apthona*) – everything arose

[228] *Mem.* IV. 2. 2. See also 2. 4 for the use of *apo tautomatou* in a similar sense.

[229] *Mem.* IV. 2. 6.

automata (*automata pant'eichen*). [230] Notably, these beings are required above and beyond the type of spontaneous growth and plenty we typically associate with the Age of Kronos. In order to *keep* man in this bliss, we need a form of rule through superior beings to direct affairs appropriately. This general idea that *automata* itself is normatively inferior or insufficient on its own for human life plays out in the *Statesman* too. There the Stranger said of man in the Age of Kronos:

> God himself was their shepherd, watching over them, just as man, being an animal of different and more divine nature than the rest, now tends the lower species of animals. And under his care there were no states (*politeia*), nor did men possess wives or children; for they all came to life again out of the earth, with no recollection of their former lives. So there were no states or families, but they had fruits in plenty (*apthonous*) from the trees and other plants, which the earth furnished them *automatēs*, without help from agriculture (*ouch hupo geōrgias*)."[231]

Life in this period, where fruits arose *automata*, belonged to a converse moment of cosmic revolution that occurred under the guidance of the god. [232] Man here lives a life of spontaneity (*automatou peri biou*), [233] where food is offered up *automatēs*.[234]

In the Age of Zeus, however, the whole cosmos itself revolves (*sungkuklei*) backwards after the god lets it go:

---

[230] *Leg.* IV. 713c.

[231] *Plt.* 272a.

[232] *Plt.* 271d.

[233] *Plt.* 271e.

[234] *Plt.* 274c.

> and *automaton* it turns backward in the opposite direction, since it is a living creature (*zōion*) and is endowed with intelligence (*phronēsin*) by him who fashioned (*sunarmosantos*) it in the beginning.[235]

Here the cosmos is described, along with circular motion, as revolving in an Age that no longer corresponds to the guidance of the god, spontaneously of itself. It is like a living creature that does so without direction from a superior being, although it has been fashioned with the capacity to do so. For Michael Naas, who surveys *automatos* and *automata* throughout Plato's corpus, this indicates that "the term *automatos* in the *Statesman* seems to mean not only spontaneously or of its own accord but unguided, undirected, and unoriented, set adrift, like a ship without its navigator, or a disciple without his master, or a son without his father." This, for Naas, has a negative connotation: "[whether] or not another discourse, one of life and spontaneity, perhaps coming from Hesiod, perhaps from elsewhere, has been superimposed on Plato's language or allowed to echo within it, the negative valuation of *automatos* is nonetheless unmistakeable."[236] Note again however that *automata* are not some fully random thing or event – the cosmos and its capacities were *fashioned* by the god. But clearly some aleatory element is at work here and is moreover associated with reflexivity in the circular motion of the heavens.

In the *Sophist*, the Athenian Stranger gets Theaetetus to agree that in fact everything must arise forth from some creative thought one way or another:

> Stranger: "There are all the animals (*zōia*), and all the plants (*phuta*) that grow out of the earth from seeds and roots, and all the lifeless (*apshukha*) substances, fusible and infusible (*tēkta kai atēkta*), that are formed within the

[235] *Plt.* 269c–269d.

[236] Naas, *Plato and the Invention of Life*, 2018, 67.

> earth. Shall we say that they came into being, not having been before, in any other way than through God's workmanship (*theou dēmiourgountos*)? Or, accepting the commonly expressed belief –"
>
> Theaetetus: "What belief?"
>
> Stranger: "That nature (*tēn phusin*) brings them forth from some *automatēs* cause (*atias*), without creative intelligence (*dianoias phuousēs*). Or shall we say that they are created by reason (*logou*) and by divine knowledge (*epistēmēs theias*) that comes from God?"[237]

This is a strong rebuttal to the idea that *automata* are somehow a primary cause or arise *ex nihilio*. Ultimately then, even the reversing cosmos, the living produce of the earth in the Age of Kronos, and nature itself can be traced back to one or other kind of art – divine (*theiai technēi*) or human (*anthrōpinēi*).[238]

It is little wonder then that Plato, like Xenophon, writes Socrates to speak to the idea that *automata* are also inferior in the sphere of human action and knowledge. In the *Euthydemus*, Socrates asks Cleinias whether wisdom (*sophia*) is teachable but (*alla*) does not accrue to man *apo tautomatou*, and he is pleased when Cleinias responds affirmatively.[239] In the *Protagoras,* Socrates chastises Pericles for not teaching his sons civic arts (*tēn politikēn technēn*) and undertaking to make men good citizens (*andras agathous politas*).[240] By not training them himself or committing them to the guidance of another they "go about grazing at will like sacred oxen, on the chance (*peritychōsin*) of their picking up excellence (*tēi aretēi*) here or

[237] *Soph.* 265c.

[238] *Soph.* 265e.

[239] *Euthyd.* 282c.

[240] *Prt.* 319a.

there *automatoi*".[241] While it seems that now Socrates says it is possible they might do so *automatoi*, it is nevertheless his preference that they be educated and exert themselves towards it instead of behaving like aimless beasts in this pursuit.

Similarly, the calibre of requisite philosopher kings who are bred and trained to rule Kallipolis in *The Republic* might grow up (*emphuontai*) elsewhere in other city-states *automatoi* and without the intention (*akousēs*) of the regime in each – in which case they have no duties to these regimes.[242] In tyranny, it is in fact also the tyrant's base companions who will flock to him *automatoi* like 'drones' (*kēphēnas*) if he pays their wages (*ton misthon didōi*).[243] Socrates also recognizes and further amends a proverb in the *Symposium* that he claims Homer not only corrupted but debauched (*hubrisai*) as follows:

> "What if they go (*iasin*) *automatoi*,
> The good men (*agathoi*) to our Good Man's (*Agathōn*) board?"

The original proverb suggested that good men go *automatoi* to the feasts of the good man – Socrates is therefore playing on Agathon's name as 'Good Man'.[244] He accuses Homer of allowing Menelaus, who is said to be an inferior man to Agamemnon, go to the latter uncalled for (*aklēton*). He makes direct reference to the passage in Homer's *Iliad* where

[241] *Prt.* 320a.

[242] *Resp.* VII. 520b.

[243] *Resp.* VIII. 567d.

[244] *Symp.* 174b. See also Ath. I. 14: ἀγαθὸς πρὸς ἀγαθοὺς ἄνδρας ἑστιασόμενος ἦκον. Naas, *Plato and the Invention of Life*, 2018, does not mention this invocation of *automatoi* in the *Symposium* in his treatment and general survey of *automatos*.

Menelaus joins the sacrifice unbid (*automatos*).[245] Not only does he interpret *aklēton* as a synonym for *automatos* in this specific context, but he seems to approve the modality of good men going *automatoi* to their counterparts. It might however be objected that Socrates is being ironic here. But even if we don't think this to be the case, he does not mean that men should *become* good *automatoi* – for Plato and Socrates this still preferably requires preparation, training, and effort. Rather, once they are good they might *go* of themselves with a similar advance awareness of what they need to do – just as Menelaus did in the *Iliad*.

VI. *Automata* as a 'Cinematic Experience' in the 4th Century BCE

Having surveyed the evidence for *automata* during and prior to Aristotle's time, we see that it is a concept that extends beyond a narrow focus on mechanism and mechanics. Instead, *automata* are found to appear in places as varied as inventions, medical writings, the theatre, and historical or philosophical explanation. We see it as a modality – a way things are and arise – as well as in descriptions of objects and things. Sometimes the term *automata* or its variants are explicitly used. Other times it is missing but the cultural and literary context renders this ascription inescapable. In this way, the Greeks during this time understood *automata* as a kind of *cinematic experience* – a spectatorship of the unexpected in a kaleidoscope of different and changing contexts. *Automata* appeared to the Greeks as a way to make sense of the inherent tensions in life itself – how an ordered regularity and unexpected errancy can nevertheless occur in a reflexive self.

[245] *Symp.* 174c. Cf, *Il.* 2. 408–409.

A singular definition of *automata* is therefore bound to prove inadequate and slippery. We might nevertheless follow various scholars who offer taxonomies that offer useful categorizations to manage the concept. For Kang, automata can refer to mythic things created either by 1) humans or 2) the supernatural. They can also refer to 3) "actually constructed or explicitly described in terms of their mechanical operation", and 4)"speculative objects, or ideas of possible self-moving devices".[246] Monica Pugliara identifies four categories in antiquity corresponding to 1) perfect copies of living things, 2) statues able to lose immobility, 3) artfully speaking simulacra, and 4) self-moving statues (*automi*).[247] Nadia Ambrosetti conducts a review and thematic analysis of 'automaton' to identify associated, and ordinally ranked concepts of mechanism; self; life; control; movement; generic action; power; imitation; shape, respectively. This reveals automaton as "a multifaceted concept, not necessarily attributable to a single object behavior and activity". Ambrosetti therefore chooses to analyse automata along descriptive dimensions as 1) built/imagined; static/moving; useful/useless; things/beings; simulacra/automata; seriousness/fun; duty/entertainment; input visbility/invisibility.[248]

Nevertheless, these taxonomies can misdirect us from the question of *automata* properly understood to the Greek mind. They were not Aristotle's classifications nor available to him in this form during his time. From our review, certain characteristics do emerge that Aristotle must have understood in order to systematize and organize his own concepts of *to automaton* and *automata* in his works. *Automata* appear in affective association with moments of wonder and miracle, imputed ultimately to divine agency whether

[246] Kang, *Sublime Dreams of Living Machines*, 2011, 15–18.

[247] Pugliara, *Il Mirabile e L'Artificio*, 2003, 67.

[248] Ambrosetti, *Cultural Roots of Technology*, 2010, 14–20.

mediated via natural causality or not. They were able to produce strong sentiments in beholders, leaving them liable to political appropriation. *Automata* speak also to the unexpected as an aleatory concept that is nevertheless not fully random, and which serve purposes and functions that turn out to be perfectly defined and often (but not always) fortuitous. We also see them associated with circular motion – whether as the wheeled tripods of Hephaestus, the revolution of the cosmos in Plato's Age of Zeus per the *Statesman*, or the articulated and rotational limbs of *neurospasta* puppets.

In many of their appearances, particularly along the vein of thinking inaugurated with the Hesiodic Age of Kronos, we see *automata* appear as a way for humans to relieve themselves of work and toil. To imagine and laugh at the idea that *automata* might locate themselves beyond the spontaneous agricultural offerings of the earth to the affairs of the household and beyond, then, is simply to extend a line of thinking deeply embedded in the cultural imaginary of Greek thought at the time. It is a way of taking a joke to its limits, and thereby enlarging the field of imagination into *technē* and the technological. This must stand as one of the great innovations of Greek comedy.

We saw also how *automata*'s slipperiness as a phenomenon started to prove difficult for the ordered, human-centred world of action and thinking that philosophers like Xenophon and Plato theorized. For philosophy and ethics to emerge in man as *automata* was to admit errancy and unpredictability into what should be a life led in accordance with self-development and virtue. The cinematic experience of *automata* begged for a world of purposeful human agency to reinstate itself and realize its superiority. We shall see, therefore, how Aristotle follows this experience and philosophical line of thinking to organize for us a distinctly *political* idea of automation. Automation is a culmination of

thinking about automata – one that brings the latter into the social, political, and economic orbit of mankind.

Chapter Two: Aristotle on Automation

I. The Counterfactual in *Politics I*

What, then, does Aristotle have to tell us about Greek *automata* and automation? As he says in the *Politics*:

> "for if each of the tools (*tōn organōn*) were able to complete its own work when commanded (*keleusthen*), or by perceiving in advance (*proaisthenomenon*), like they claim the things [statues] of Daedalus in the story, or the tripods of Hephaestus which the poet claims entered the divine assembly *automatous* — if thusly shuttles wove themselves and plectra played lyres, master-craftsmen would [now] need no subordinates nor masters of slaves."[249]

This is Aristotle's critical passage on automation. It tells us the conditions, limits, and consequences of substituting human work with artificial tools capable of acting themselves to complete the relevant task. *If*, as Aristotle says, there were tools that were able to complete their work, like the *automatoi* tripods of Hephaestus or the statues of Daedalus – *if* there were things like self-weaving shuttles or self-striking plectra – *then* master-craftsmen would not need subordinates nor masters need slaves. This passage in the *Politics* imagines *how* the substitution of human work by artificial tools might have occurred. A careful exegesis of its components is important to understanding the specified theory. We will therefore firstly examine how Aristotle appropriates and organizes the Greek cinematic understanding of *automata*. Here we see Aristotelian metaphysics at work, bringing conceptual order to what really is at work in the 'automatic' beings contemplated by the

[249] *Pol.* I. 4. 1253b33–1254a1.

works of Daedalus and Hephaestus. Secondly, we will examine how Aristotle understood tools or *organa*, as a building block of his political thought. Thirdly, we will take a deeper look into disjunctive conditions tools must fulfil to substitute for subordinate craft workers and slaves: being commanded (*keleusthen*) or perceiving what to do in advance (*proaisthanomenon*). Notably, these tools are meant to perform work requiring perceptive faculties – Aristotle does not contemplate noetic substitution. Finally, we will see what it means for Aristotle to theorize the consequences of a world where master-craftsmen have no need of subordinate craft workers, nor masters of slaves. Ultimately, the unreality of automated tools reiterates the foundational role of dependence on living tools in Aristotle's political thought, as well as what Adriele Trott has termed, albeit challenged, as the "extremity of natural slavery in the Politics".[250] In general, Aristotle's passage on automation also emphasizes how he disparages slave and craft subordinate work for activities like political deliberation, philosophy, and master-craftsmanship.

A preliminary note must first be made about the general construction of Aristotle's passage as a conditional. The grammatical construction of this conditional is unreal and makes use of the imperfect tense within a present counterfactual. It is important to note that Aristotle is not strictly making a *prediction* about the future here. Instead, he is saying something more to the effect that if servile labour could be automated, there would *at that time* – namely *his* time – be no need of slaves or subordinates to masters and master-craftsmen, respectively. The implication is that such automation was not the reality at the time, and so masters do need slaves and master-craftsmen do need subordinates.

Martin Devecka is quite correct to note that this passage can be construed as a

[250] Trott, *Aristotle on the Nature of the Community*, 2013, 178.

reductio ad absurdum that utilizes a fantastic premise, *or* as a 'really possible' world within the reach of the past or future if not the present. [251] But while Devecka argues for a version of the latter, and both Heath and Devecka refer to the 'utopian' nature of this passage more broadly, neither of them explore these consequences in the way Aristotle might have intended it with reference to his broader corpus. Both routes for interpretation are plausible even though they conflict, because it is precisely this intractability that makes this passage so powerful as a suppositional and impressionable thought experiment. Instead of utopianism, Aristotle offers something provocative and strange to generate political and philosophical thinking about work and technology.

This passage does not form a complete, deductive syllogism for Aristotle. Conditional counterfactuals of this nature are moreover suppositional. David Ebrey suggests "[there] are reasons for him [Aristotle] to treat the conditionals in such arguments as agreements or other things following under the category of supposition, and so only having a place in dialectic." This is because the conditionals he mentions "do not tell us *why* p leads to q. They ask us simply to accept this fact…Aristotle says that in a syllogism from a hypothesis the conclusion is not deduced but rather agreed upon. [252] These conditionals therefore serve an important preparatory role in dialectic, pushing us to work through our thoughts and resolve apparent *aporia* or blockages in the way forward. [253] Moreover, we know that Aristotle's own reasoning is not restricted to actual-world truth

[251] Devecka, "Did the Greeks Believe in Their Robots?", 2013, 55.

[252] Ebrey, "Why are There No Conditionals in Aristotle's Logic?", 2015, 198. As Ebrey also notes, Aristotle treats deduction as the alternative to agreement in the *An. pr.* I. 24. 41a38–41; 44. 50a17–19; 44. 50a25–6.

[253] On the relation between the dialectical method and *aporia* in Aristotle see Rapp, "Aporia and Dialectical Method in Aristotle", 2018, 112–136.

even in his invention of logic – particularly in the treatment of modal syllogisms.[254] Counterfactuals play an important role in thinking things through and stimulating our reasoning. As Dorothy Edgington writes, "We have here an immensely valuable form of thought, without which our thinking would be immeasurably diminished.[255] Aristotle clearly understood this.

We should also note that the suppositional counterfactual conditional is not only relevant to dialectic but also to rhetoric, where "talk of the *pithanon* [probable] and the *eikos* [likely] in the positive sense is at home". [256] For as Aristotle notes, rhetoric is a counterpart (*antistrophos*) to dialectic.[257] The inherent vagueness, indeterminateness, and context-dependent aporetic difficulty of counterfactual conditional thinking makes it useful not only in dialectical preparation, but also methods of rhetorical persuasion. [258] Since all men desire by nature to know by nature, and they begin wondering initially at things out of place (*atopōn*) and close to hand (*procheira*) like spontaneous wonders (*thaumatōn t'automata*), Aristotle furnishes both the *atopos* and *automata* in his counterfactual in the *Politics*.[259] His aporetic counterfactual is designed to persuade, to get us to think, and then to follow the process of inquiry.

---

[254] Rini, "Aristotle on the Necessity of the Consequence", 11–28. Discussing Aristotle's example in *An. pr*. I. 18. 37b36–8 in particular. Rini notes at 26–27 that "The supposition that these premises are true then involves a counterfactual assumption. That is, for these terms to work, we must suppose that every man is healthy, that every animal is healthy, that every horse is healthy."

[255] Edgington, "I–Counterfactuals", 2008, 1–28.

[256] Allen, "Aristotle on the Value of "Probability," Persuasiveness, and Verisimilitude in Rhetorical Argument", 2014, 53. For more on the relationship between rhetorical enthymemes and dialectical or scientific syllogisms see Burnyeat, *Explorations in Ancient and Modern Philosophy,* 2012, 152–201.

[257] *Rh.* I. 1. 1354a1ff.

[258] *Rh.* I. 1. 1355b14–18.

[259] *Metaph.* A. 1. 980a1ff; 982b10–18; 983a11–16.

On one hand, therefore, Aristotle is providing the argument that in the empirical absence of a mythic level of automation, subordinates and slaves are indeed necessary (*edei*) to master-craftsmen and masters, respectively. This fits and justifies the context of *Politics* Book I, the details of which are heavily focused on a discussion of slaves and the different relations found in the household (*oikos*). This *reductio ad absurdum* 'proof' is not completely specified, however, and is not one based on a strict logical contradiction. Instead, the evidence for the necessity of slaves and subordinates to masters and master-craftsmen comes from a supposed empirical impossibility of automated tools completing the required work at the time. These facts in the world must supplied and/or supposed by the audience. Since these facts are liable to change from time to time, what might seem empirically impossible at a given time, for the purposes of rhetorical or dialectical argument, can hold in that time but still be subject to revision. Put another way, Aristotle's strategy here is an appeal to a reduction grounded in what is empirically absurd or out of place, not what is logically impossible or contradictory.[260]

At the same time, Aristotle leads a preparatory way into thinking more deeply and philosophically about work and technology. What might seem an impossibility in an age of slaves and subordinates might not always have been, or might not always be so. Aristotle offers us an aid to thought here, for which no terminus or conclusive answer is given. Thinking along with him therefore requires us to examine the components of his counterfactual more closely. But it also asks more than this – it asks us to do so again and again so that the relations he specifies in this unreal world can be assessed his and against

[260] On Aristotle's notion of logical impossibility see Castelnérac, "Impossibility in the *Prior Analytics* and Plato's Dialectic", 2015, 303–320.

ours. It remains therefore to examine the components of this counterfactual in more detail.

II. Metaphysical Muses: Automata, *To Automaton* and *Automata*

In his counterfactual, Aristotle references two examples to illustrate *how* automated tools might have substituted for slaves and subordinates in this unreal world. Respectively, these are a) Daedalus's things (*ta*) – taken to mean his statues and animated creations – as well as b) Hephaestus's tripods in Homer's *Iliad*. It is in connection with the latter that a variant of *automata* is mentioned, from which we know both contemporary automata and automation etymologically derive. The types of *automata* involved in the references to Daedalus and Hephaestus differ, although both are mytho-poetic and not actual historical examples. The former are creations of a human inventor, while the latter are divine in origin.[261] And yet, in referencing both types, Aristotle clearly contemplates that human and divine crafts are intertwined for his elucidation of what it means for an automated tool to replace human labour. It is therefore worth examining each example in further detail.

Daedalus's things

Aristotle references the mythic statues of Daedalus to illustrate how humans might themselves be said to create their own artificial moving beings. He does not talk about animation or Daedalus' creations as having a soul per se. Nor can it be said that he invokes any particular mechanical theories when making this reference. But as we saw in the previous chapter, there is no reason to suppose that ideas of automation and automata

[261] Kang, *Sublime Dreams of Living Machines*, 2011, 15–17, reads Aristotle as a kind of speculative futurist here which is by no means immediately clear when we take his broader works into account. Moreover, Kang notes that Aristotle "cites examples from myths" in his 'speculation' but Kang himself does not examine the relation between these myths and Aristotle's idea of automated tools *within* this passage as a whole.

require these mechanistic theories to qualify as such. Put another way, mechanical automata can be considered a species of automata. Daedalus's things – his statues and artificial beings – might tell us very little about mechanism and its physical principles. But his creations certainly tell us something about the social and political relations implicated in a world of tools that that perform their own work. The tools in question in the *Politics* must somehow have an internal principle of movement such that they might have substituted for slaves. And that internal principle of movement is the work of man's own craft.

The tripods of Hephaestus, which the poet claims entered the divine assembly automatous

A key question that arises from this component in the counterfactual concerns how Aristotle understood the concept of *automata*, given what we have learnt in the previous chapter. In Aristotle's own speculative etymology '*auto*' and '*matēn*' mean 'a thing itself' that is 'pointless' or 'fruitless' and *apparently* a-teleological.[262] But this reference emerges from Aristotle's discussion of *to automaton* as an aleatory concept in the *Physics*. John Dudley has offered a magisterial analysis of this concept, drawing extensively from Aristotle's full corpus and the interpretative tradition that surrounds it.[263] For Dudley, *to automaton* as it appears in Aristotle's *Physics* should be translated as chance, as it is Aristotle's specific transformation and derivation from the adjective *automatos*. According to Dudley, *Physics* II. 4–6 concerns Aristotle's own progressive development of the concept of chance derived primarily from *tychē*, often imperfectly translated as luck or fortune. Therefore, in order for us to better

[262] *Ph.* II, 6. 197b22–24 in particular.

[263] Dudley, *Aristotle's Concept of Chance*, 2012, 20–21; 174–176, for an overview of scholarly translation choices for *automatos* and *tychē*.

evaluate Aristotle's reference to Hephaestus' tripods in his counterfactual in the *Politics*, we must examine his specific understanding of *to automaton*, as well as his general use of *automata.* Both of these concepts give descriptive depth to the example of Hephaestus's tripods in Aristotle's work. It will allow us to discern an operative principle in the counterfactual more generally.

a) *To automaton:* an errant core

Aristotle's peculiar concept of *to automaton* in the *Physics* is seen as a late addition to his work. Dudley speculates that a later editor retrofitted the term to a concept of chance initially grounded on a broader notion of *tychē* that is found in the rest of Aristotle's relevant works.[264] But this is not satisfactory or, I think, descriptively adequate. Dudley's approach reduces *to automaton* in the *Physics* to a hasty afterthought. While he tells us much about a concept of chance in Aristotle, we learn comparatively little about Aristotle's concept of *to automaton,* or indeed *automatos*, beyond chance as something analytically prior to *tychē.* Emanuela Bianchi offers a promising avenue for examining *to automaton* in her recent feminist deconstruction of Aristotelian aleatory matter. For Bianchi,

> Aristotle's notion of [*to*] *automaton* carries with it a schematized rendering of these contradictions – on the one hand that which causes wonder, is marvellous and illusory but nonetheless ultimately designed and therefore reasonable, teleological and knowable; on the other that which proliferates senselessly, and appears as a disruptive, aleatory, and going nowhere.

[264] Dudley, *Aristotle's Concept of Chance*, 2012, 63; 71.

For Bianchi, the 'feminine symptom' is the "inexplicable *coincidence (sumptōma)* of causal orders" at the site of aleatory matter. [265] More generally, *to automaton* in Aristotle can be characterized by coincidence, a general lack of deliberation, and teleological frustration.

Firstly, *to automaton* is coincidental. For Aristotle, something that occurs *to automaton* is never alone or *ex nihilo* insofar as it is always causally accompanied.[266] *To automaton* and *tychē* belong to coincidental causation. These causes do not sit well within Aristotle's ordered cosmos. He notes that others before him, likely Democritus or Leucippus, had argued that the cosmoses and heavens came into being *to automaton* whereas plants and animals somehow had determinate causes in nature (*phusin*), mind (*noon*), or something else of the sort (*ti toiouton heteron*). For Aristotle all of this is strange and literally without a place (*atopon*).[267] A great deal of ambiguity lies at the site of Aristotle's coincidental causes. Whereas some of his examples in the *Physics* can be read to support *to automaton* as acting external and coincidental to events as a kind of derivative efficient cause, his biological theories on spontaneous generation support the operation of *to automaton* as a kind of material cause internal to the process. This "ambiguity of interiority and exteriority" has perplexed Aristotelian scholars for centuries.[268] But it highlights again the way in which *to automaton* is indefinite and literally without its own proper place in, and for Aristotle – as something gnawing on his otherwise ordered cosmos.

---

[265] Bianchi, *The Feminine Symptom,* 2014, 4; 73. For a more sympathetic, albeit critical, treatment of Aristotle's approach towards gender and female animals, see Connell, *Aristotle on Female Animals*, 2016.

[266] See Sissa, "La Génération Automatique", 1997, 98, who argues that *automatos* does not proceed *ex nihilo* for Aristotle: "*«Automatique» doit être entendu comme un attribute possible – aléatoire – et de la génération naturelle et de l'artifice*".

[267] *Ph.* II. 4. 196a24–196b8.

[268] For an overview of scholars who see Aristotelian *automatos* either as internal to the process or external to the event, see Bianchi, *The Feminine Symptom*, 2014, 73–75. Bianchi examines translators and commentators who come down on different sides of this debate, before siding finally with Aquinas and Apostle on internalism.

Secondly, in Aristotle's treatment of *to automaton* he argues that it generally stands outside of the world of deliberation. In the *Iliad*, Hephaestus creates his *automatoi* golden tripods cunningly (*daidalea*), foreshadowing the mythic inventor Daedalus who will be mentioned by name a few lines later.[269] Recall Aristotle's mention of Daedalus's statues in *De Anima*. We saw that some act of mind (*noēseōs*) and deliberate choice (*prohairēsis*) generally (*holōs d'ouch*) appear to be needed to move living things. But this is not always the case. Parts can be coincidentally moved (*kata sumbebēkos*) through displacement of the whole, for example. Aristotle is clear however that things occurring *to automaton* generally lack deliberate choice when they do so, except in the restricted set of *tychē*. *Tychē* directly concerns what can be done by free human action (*praxis*) and deliberate choice.[270]

The restriction of deliberative choice to *tychē* as a subset of *to automaton* is telling. Aristotle states in the *Nicomachean Ethics* that *prohairesis* is a deliberative desire (*bouleutikē orexis*) that makes a choice within our power (*tōn eph'hēmin*). It allows us to become like hegemonic archaic Homeric kings who deliberated, chose, and then proclaimed their decisions to the people.[271] In *De Anima*, he argues that the process of deliberating (*bouleusis*) is in fact a kind of desire (*orexis*) itself, although *orexis* does not necessarily imply the faculty of deliberation (*to bouleutikon*).[272] In evaluating this physicalist cognitive psychology, Giulia Sissa puts it succinctly that "the essential point is that agency hinges on deliberation", more acutely on

[269] *Il.* 18. 390–395.

[270] *Ph.* II. 5. 197a1–10; 6. 197b1–14; *Metaph*. K. 8. 1065a30–32; see also *Rhet.* I. 10. 1368b7–1369a8; 1369a12–1369b13.

[271] *Eth. Nic*. III. 3. 1113a9–11.

[272] *De an.* III. 10. 433a23–26; 11. 434a12–a16.

the appetitive "executive impetus of the process".[273] This agency is compromised where deliberation meets an impediment that obstructs *prohairesis*, [274] and simply cannot exist when the faculty of deliberation (*to bouleutikon*) is lacking. The most notorious case of the latter is of course Aristotle's impaired natural slave, possibly the furthest human from his Homeric king figure.[275]

It appears curious therefore that Aristotle does not mention slaves when suggesting in the *Physics* that *tychē* cannot concern beings like the beast (*thērion*), the young child (*paidion*), and the inanimate thing (*apsukhon*), insofar as these beings are not subject to *prohairetic* human action.[276] Human deliberative choice can bring these beings into the orbit of *tychē* – of luck or fortune. It is in this way therefore that *tychē* can be said to be a libidinal "encounter with the real" (*rencontre du réel)* for Lacan. Desire saturates *to automaton* particularly when it appears as *tychē*, in the realm of deliberative human agency. Outside of this, yet still within the indefinite world of coincidental causation, stands a world of things and beings from which a meaningful sense of choice and agency have been emptied.[277] This boundary has no fixed interiority and exteriority, intertwined as it is with the sphere of human action. Moreover, some of these beings and things are necessarily so intertwined with deliberative human agency that they can never exist independently. Aristotle's slave is

[273] See Sissa, "Bulls and Deer, Women and Warriors", 2018, 168–169. For an excellent discussion of deliberation, thumotic appetite, and the natural slave, see also Heath, "Aristotle on Natural Slavery", 2008, 243–270.

[274] Women and children, for example. See *Pol.* I. 13. 1260a7–24.

[275] *Pol.* I. 13. 1260a12ff; III. 9. 1280a30–35.

[276] *Ph.* II. 6. 197b6–7.

[277] And yet Aristotle's theorization of deliberation and choice is not quite that of modern rational choice theorists. For more on this, see Hauptmann, *Putting Choice Before Democracy*, 1996, 37–58.

one such example – separated (*kechōrismenos*) physically but still a part of the master's body (*meros tou sōmatos*).[278] Slaves have, as it were, the luck of the master.

Thirdly, *to automaton* is teleologically frustrated for Aristotle. In the *Physics*, he offers his own speculative etymology of *automatos*. He tells us that the root '*matēn*' in *automatos* signifies (*sēmeion*) a thing (*autos*) that comes to be 'pointless' or 'fruitless', apparently a-teleologically.[279] We may consider *autos* as a definite, intensification (*to*) that connotes a sense of self and stable identity. Ernst Risch suggests that *autos* itself is composed of the Greek word *aū*, which carries with it a sense of recurrence and repetition.[280] This accords well with Lacan's characterization of *automatos* as "the return, the coming-back" (*du retour, de la revenue*). [281] On the other side, Emanuela Bianchi surveys various conflicting etymological treatments surrounding *matēn* to conclude [*to*] *automaton* as a "motile drive, acting beyond conscious thought".[282] But since *to automaton* contains the subset *tychē* for Aristotle, in general it is better construed as a coming-to-be without an independent purpose or meaning. For Aristotle this realm of the accidental and causally unexpected is

[278] *Pol.* 1. 6. 1255b10–15.

[279] *Ph.* II. 6. 197b22–31. The question of *to automaton* and teleology is a vexed one. See Balme, "Development of Biology in Aristotle and Theophrastus, 1962, 96, who argues that 'spontaneity [*to automaton*] "implies the absence of natural (teleological) causation"; also Lennox, "Teleology, Chance, and Aristotle's Theory of Spontaneous Generation", 1982, 238, who argues that the "*essence* of Aristotle's concept of natural spontaneity is the incidental, that is, nontelelogical, production of a result that might have been teleologically produced"; at 231 Lennox footnotes the claim that "Aristotle appears simultaneously committed to saying (i) that chance processes are for the sake of something and (ii) that they are not for the sake of what results.". For more on this see Lennox, "Aristotle on Chance", 1984, 52–60. Dudley, *Aristotle's Concept of Chance*, 2012, 23–27 criticizes both Lennox's characterization of Aristotle's view here, "chance [which he takes here to mean *automatos* and *tychē*] is *not* for a purpose, but pertains to the area of that which is for a purpose, i.e. is that which *might* have been done for a purpose, but *was not*". Chance events for Dudley are "neither necessary nor usual, but which nonetheless *appear* [my emphasis] meaningful" to the intellect as a mental recognition of something contrary to our expectations.

[280] Risch, *Wortbildung der Homerischen Sprache*, 1974, 312.

[281] Lacan, *The Four Fundamental Concepts of Psychoanalysis*, 1998 [1973], 53.

[282] Bianchi, *The Feminine Symptom*, 2014, 69–73. Aside from Aristotle's *matēn* as pointless, we see Homer's *memona* (desire, yearn, strive for); *menos* (might, force), *mnēmē* (memory), even the Sanskrit cognate *manas* (spirit, passion).

a frustration of the world of definition and ordered purposiveness. [283] *To automaton* deals with what is unexpected, even wondrous,[284] yet teleologically derivative. But more precisely, it is only said to do so when it is recognized that things miss the mark and err (*hamartia*) in deviating from how things are always or for the most part. [285]

Aside from Aristotle's own direct signification of the term *matēn*, we see a relevant poietic specification in the Aeschylean tragedy *Prometheus Bound*. Here Hephaestus, our archetypical deity of crafts, and Power (*Kratos*) discuss the literal binding (*dēsai*) of Prometheus for his crimes against the Zeus in support of man. With them is Force (*Bia*) whose silent presence is not marked by any direct speech. Hephaestus laments that he must use his handiwork (*cheirōnaxia*) to bind his kinsman. He finds himself affected with compassion (*katoiktizai*). But as Power reminds him, failing to heed Zeus the father's *logos* (*logous patros*) is a weighty disregard.[286] Power, accompanied by silent Force, tells the god of crafts that labouring (*ponei*) with such lamentation is *matēn*, pointless or fruitless, because no one is free (*eleutheros*) but Zeus.[287] Moreover, Power, before disappearing for the rest of the drama, recites for us a typical refrain of technological neutrality: Hephaestus' crafts (*technē*) are not to blame (*aitia*) here. In fact, his crafts are directed as a form of necessary corrective justice to the Promethean frustration of Zeus' plans.

---

[283] *Ph.* II. 6. 197b23–24.

[284] Wonder, which also brings about pleasure, as Aristotle notes in the *Poet.* 1460a17–19, can be produced from a plot (*mythos*) where things occur purely *to automaton* or by *tychē*. But it is *better* produced in plots having unity and a determinate sense of causation because even amongst things that occur in this way, the most wonderful (*thaumasiōtata*) are those that *appear* to have come-to-be in a planned, purposive way (*epitēdes*), per *Poet*. 1452a1–10.

[285] *Hamartia* appears here in the *Ph.* II. 8. 199a33–199b7 aside from, and in addition to its well-known specification in the *Poet.* 1453a10; 1453a16 and *Eth. Nic.* V. 7. 1135a15–25 (cf II. 6. 1106b28–29).

[286] *PV*. 15–17; 40–41.

[287] *PV*. 50.

b) *Automata:* wonder, desire, and the principle of circular motion

The same wonder (*thaumazetai*) and circularity that we saw inscribed in Homer's description of the golden tripods and Achilles' shield, in Chapter One, also begins the Peripatetic text *Mechanical Problems*, where it is further specified that craftsmen (*hoi dēmiourgoi*) use the principle inherent in circular motion (*en tōi kuklōi*) to make an instrument (*organon*) that hides (*kryptontes*) the principles of movement in a mechanical device (*mēchanēmatos*). This is done so that the wonder (*thaumaston*) of the device is apparent while the cause is unclear (*adēlon*).[288] The circle is specified as the beginning (*archēn*) of all action *(praxai*) needed to engender an effect contrary to nature (*para phusin*).[289] As such it is said that there is "nothing *atopos*" in the fact that the circle itself is said to be a beginning of all wonderful things.[290] And it comes together as well said that those wonderful things made by craftsmen, having their origin in the yet more wonderful (*thaumasiōtaton*) circle, are thus concretized by the most wonderful (*thaumasiōtaton*) fact that the circle generates opposites – the moving (*kinoumenou*), and the stationary (*menontos*) together within itself.[291]

While contemporary consensus is that this text was not written by Aristotle,[292] it follows principles that Aristotle himself references. Recall the *Movement of Animals* where

[288] [*Mech.*]. 847a1–15; 848a34–38.

[289] [*Mech.*]. 847b16–17 read with 847a15–16 and 848a11–15.

[290] [*Mech.*]. 848a11–12.

[291] [*Mech.*]. 847b16–21.

[292] For an overview of scholarly opinions on authorship see Bottecchia Deho*, Aristotele, Problemi Meccanici*, 2000, 16; 28–51. See also Ross, "Aristotle", 1923, 11–12 who suggests Strato as a possibility; Similarly, Drachmann, *The Mechanical Technology of Greek and Roman Antiquity*, 1963, 10; 95; and Lloyd, *Early Greek Science*, 1970, 135. For views that still take this text to be Aristotle's, see Krafft, *Dynamische und Statische Betrachtungsweise in der Antike Mechanik*, 1970, 143; also Ferrari, "Meccanica 'allargata'", 1982, 225–96; For the view that this text was in fact written by Archytas, see Zhmud, *The Origin of the History of Science in Classical Antiquity*, 2006, 97–98. More recently, Berryman, *The Mechanical Hypothesis,* 2009, 91–94, has argued against attributions to Archytas on the basis that a systematic, theoretical conception of mechanics as found in the *Mechanical Problems* was not yet available to him, and cannot be reliably attributed to him. Berryman makes a similar argument to claim that Aristotle was likely not the author.

Aristotle compares animal motion to that spontaneous things (*ta automata*), likely puppets, or the little wagon (*hamaxion*) – both of which contain principles of circular motion (*kuklōi*).[293] In the *Generation of Animals* and the *Metaphysics,* these spontaneous things are attached explicitly to wonder *(ta automata tōn thaumatōn*).[294] To wonder, for Aristotle, is pleasant (*hēdu*), and passion (*epithumia*) for what is pleasant is a type of desire (*orexis*).[295] All humans, Aristotle famously tells us, desire to know by nature (*oregontai phusei tou eidenai*), using the perfect form, *eidenai*, of the same linguistic root that weaves knowledge and sight together in Homer's beholding (*idesthai*) of Hephaestus' tripods. Things moving *automata* thus inspire wonder because, borrowing from Seth Bernadete, they "shows the hiddenness of the unhidden".[296] The principle of divine circular motion, set into Hephaestus' tripods, is mysteriously appropriated by the sublunary world into things that move *automata*. Master-craftsmen (*architektonas*) in particular know this because they understand the causes *(aitias*)[297] hidden to the spectator's eye.

In the *Metaphysics*, Aristotle gives a tripartite comparison between the handicraftsman, inanimate things, and the natural element fire. He does so to illustrate that

---

[293] *De motu an.* 701b1–13. See Berryman, *The Mechanical Hypothesis*, 2009, 72–74; 93; 110, who acknowledges that circular motion was theoretically available in the 4th century BCE but concludes that "the *Mechanica* analysis of forced [circular] motion [*dinēsis*] seems to be incompatible with central Aristotelian doctrine". Berryman's cautiously restrictive conception of 'mechanical' finds limited application in Aristotle precisely because *technē* is a prior theoretical concern, cf the approach taken by Schiefsky, "Art and Nature in Ancient Mechanics", 2007, 67–108; see also the response by Groot, "*Dunamis* and the Science of Mechanics", 2008, 46, who separates "the principle of movement of unequal concentric circles" from "the explanation of it drawn from the geometry of the circle and utilizing composition of rectilinear movements" to conclude that "the evidence is strong that Aristotle was fully knowledgeable of the first but not the second". For more on Jean De Groot's empiricist Aristotle see De Groot, *Aristotle's Empiricism,* 2014, 20, "mechanics…was not foreign to Greek science and the natural philosophy based on it."; also 21–50 in particular.

[294] *Gen. an.* II. 1. 734b9–11; *Metaph.*, A. 1. 983a11–16.

[295] *Rhet.* I. 11.1370a5; 1371a21–1371b22.

[296] Bernadete, "On Wisdom and Philosophy", 1978, 214. For a reading of Aristotle's *Metaphysics* that relates inaugural wonder to the Hesiodic tradition see Kenaan, "*Thauma Idesthai*", 2011, 13–26.

[297] *Metaph.* A. 1. 981a29–981b1.

what distinguishes the handicraftsman from the superior master-craftsmen (*architektonas*) is knowledge of the causes relevant to their work. As he says:

> by contrast the handicraftsmen (*cheiroteknai*) are moreover like some of the inanimate things (*apsukhōs*) that produce (*poieī*) not knowing (*eidota*) what they produce, in the way that fire (*to pur*) burns. But while inanimate things produce each of these things by some nature (*phusis tis*), the handicraftsman [does so] because of habit (*ethos*). [298]

Aristotle does not fully specify the inanimate things he mentions here. In the *Meteorologica* he notes however that both the celestial body, and the elements produce meteorological effects. The celestial body produces heat (*poieī tēn thermotēta*) in the region below the heavens because of the fiery reaction its circular motion (*kuklōi*) causes with this region.[299] Moreover, nature always wants *(bouletai*) to produce (*poieīn*) the cyclical meteorological effects brought on by the interaction of the four elements with the sun. [300] Aristotle also specifies instruments of production (*organa poiētika*) in the *Politics*.[301] Aristotle's point in the *Metaphysics* therefore is that these things, including inanimate things, produce their effects without causal knowledge. To put it another way, they simply go through the motions.

The motion of the heavens is circular, whereas the sublunary world merely instantiates this circular motion in wondrous things and beings that are otherwise subject

[298] *Metaph.* A 1. 981b1–5.

[299] *Mete.* I. 340a12–14. On the circular motion of the heavens see also *Cael*. I. 2. 268b11–269a19; II. 3. 286a10–13. On the circular heavens singly as ensouled or animate (*empsukhos*) things see *Cael.* II. 2. 285a29; 12. 292a20. On the stars as lacking soul individually see *Cael*. II. 10. 291a19–27 - cf Höffe, *Aristotle*, 2003, 108, on this point.

[300] *Mete.* II. 354b25–34.

[301] *Pol.* I. 4. 1254a1–5.

to rectilinear motion. The wonder of *automata* for Aristotle can therefore be described as a wonder at the particular instantiations of heavenly circular motion in an otherwise rectilinear world. We now we truly see the Aristotelian unhiding of Homer's Hephaestean tripods: the principle of circularity and circular motion, and a frustrated errancy that almost begs our intervention for orderly correction. It is the raw material of our working technological miracles.

III. *Organon*: The Perfect Tool

Next, we must ask how the wondrous errancy of *automata* can be 'captured' for a productive purpose. This means asking what Aristotle means by a tool or *organon*. In the *Politics*, Aristotle's counterfactual considers a tool as a type of *organon* that completes its work, task, or function (*ergon*).[302] In its most general sense, it is an instrumental means for an end and a basic unit of sense-making in the world in all its different instantiations. It gives order to those things considered *automatos*. In *De Partibus Animalium* Aristotle illustrates how the *organon* not only maps onto parts of the body, but also the relationship between body and soul:

> And since every *organon* is for the sake of something, while each of the parts of the body is for the sake of something, but the *organon* is for the sake of some action (*praxis*), it is apparent that the body as a whole must exist for the sake of some complex action. For sawing did not come to be for the sake of

[302] A translation of *ergon* depends on the context. For more on this see Adkins, "The Connection Between Aristotle's Ethics and Politics". 1984, 36–37: "To sum up this discussion of *ergon*, a noun, common in the earliest extant-unphilosophical-Greek, which Aristotle nowhere defines. It is evident that the word is not used solely of biological function, or solely in technical senses (indeed, it is doubtful whether an undefined term may be said to possess a technical sense); that the sense of "task, work" is frequently appropriate; and that in the contexts in which the translators render *ergon* as "function," that sense is felt as being derived from the sense that the word has in ordinary Greek. Accordingly, the connotations of "task, work, job" are always present, even in metaphysical and biological contexts, as the versions of the translators inadvertently indicate".

> the saw, but rather the saw came to be for the sake of sawing. For sawing is a certain usage. So too in a certain way the body exists for the sake of the soul, and the parts for the sake of those functions (*ergōn*) for which each is naturally adapted.[303]

What the saw shares with the body is that both are there *for* something else: sawing, and the soul, respectively. For thinkers like Heidegger, this is precisely why an examination of the *organon*'s Latin equivalent, *instrumentum*, becomes an existential question about our technological relation to the world.[304] But even before Heidegger, Ernst Kapp had looked to Aristotle for an account of tools as projections of our organs, placing particular emphasis on the hand:

> Amongst the extremities, the hand counts as an organ in the strong sense, given its threefold determination: first, it is the human being's inborn tool (*angeborene Werkzeug*); second, it serves as the prototypal image (*Vorbild*) for all his mechanical tools; and third, because of its substantial involvement in the production of the material after-image (*stofflichen Nachbildungen*), it is, in Aristotle's words, the 'tool of tools'.[305] The hand is therefore the natural tool (*natürliche Werkzeug*), from whose activity the artifactual (*künstliche*), the hand tool (*Handwerkzeug*), proceeds…As the human being makes use of the objects 'at hand' („zur Hand") in its immediate vicinity, the first tools appear as extending (*Verlängerung*), strengthening (*Verstärkung*), and intensifying (*Verschärfuing*) the human being's bodily organs. [306]

---

[303] *Part. an.* I. 5. 645b15–21.

[304] Martin Heidegger, "Die Frage nach der Technik", 2000 [1954] 8.

[305] *De an.* III. 8. 432a2–3; *Part. an.* IV. 10. 687a21; *Pol.* I. 4. 1253b33–34.

[306] Kapp, *Grundlinien Einer Philosophie der Technik*, 1877, 41-42. Kapp's interpretation of this enigmatic phrase, 'tool of tools' (*organon pro organōn*), occurring in *De Anima*, *De Partibus Animalium*, and the *Politics* points to the hand (or a slave in the latter text as a separated natural equivalent) as a primary, natural tool from which material after-images can be made into artificial tools as extensions thereof. On the occurrence of this phrase in the *Politics*, see Brunt*, Studies in Greek History and Thought*, 1993, 387 who translates it as 'tool before tools'. See also Karbowski, "Aristotle's Scientific Inquiry Into Natural Slavery", 2013, 338, who approves Brunt's translation but terms tools like brooms and plows as "first-order tools" who "cannot do the work automatically", while slaves or assistants are considered "second-order tools". In fact, I argue, and per Kapp, the reverse is true – Aristotle clearly conceptualizes the hand and living tools like slaves as first-order tools, whereas tools like plows and brooms come into being derivatively.

The hand here is a kind of paradigmatic model of, and for what we subsequently term a 'tool'. Put another way, it realizes its status as a natural, primary tool only after it has inaugurated those things that we represent to ourselves through the linguistic term 'tool'. It is from this understanding of the hand's role in tool formation and use that the role of a subordinate's (*hupēretēs*) relation with tools must derive, as it does in *Politics Book* I.

For Aristotle an *organon* can have a soul (*empsukha*) or not (*apsukha*), just as a look-out boatsman or the handle of the rudder are respective types of *organa* to a ship's pilot. [307] He also maintains a technical/artificial (*technikois*) or natural (*phusikois*) distinction.[308] In the context of the *Politics* their end is work (*ergon*), which differs according to the technical area involved. Aristotle focuses on household formation, and household management (*oikonomias*) in Book I as a precondition for politics and of indeed living well (*tou eu zēn*) but notes that the other defined craft areas also need their proper tools to complete their work.[309]

Given the central position it occupies in Book I, we may consider the *organon* as the building block that makes Aristotle's politics possible. In Book I he distinguishes two types of coupled associations (*sunestēkuia koinonia*) necessary to a political community. In discussing household formation, he points out the need for the female (*thēlu*) for generation (*geneseōs heneken*) and the slavish (*doulon*) for preservation (*dia tēn sōtērian*). At this level they are

[307] *Pol.* I. 4. 1253b28–29.

[308] *Mete.* IV. 3. 381a11.

[309] *Pol.* I. 2. 1252b30; 4. 1253b23–27.

abstracted forms that are nevertheless instantiated in the woman and the slave respectively. Aristotle confirms this by quoting Hesiod's *Works and Days*, "first a house, and a woman, and an ox for ploughing," noting that it is poor persons who have an ox instead of a household slave (*ant'oiketou*).[310] The female and the slavish each have different ends and they therefore may accomplish their tasks most finely when compared with artificial tools, like a kind of Delphic knife created by smiths, which are made to serve many tasks instead of one. The latter are thus made poorly (*penichrōs*). For Aristotle, technical or artificial multifunctionality is no match for the sufficiency of natural specialization.[311]

Aristotle's Delphic knife comparison could lend support to the idea that both women and slaves are essentially *organa*.[312] This might be true of the female taken in a most general sense of *organon* as any means to an end, but Aristotle does not strictly make this claim. The female is categorically and essentially different to the slavish, and women are different to slaves – this is a point that Aristotle insists upon quite forcefully. Of course, women can be, and were slaves, but it is not the essential nature of either the female or a woman to be one. Instead of pursuing a line of thought that sees women as tools, Aristotle

[310] *Pol.* I. 2. 1252a25–1252b12; *Op.* 405–415. Hesiod's text in this place is precisely concerned with the importance of self-sufficiency and work (*ergon*). Aristotle will first describe this self-sufficiency as *autarkeia* at *Pol.* I. 2. 1252b29.

[311] *Pol.* I. 2. 1252b1-6. See Humphrey, Oleson, and Sherwood, *Greek and Roman Technology*, 1998, 333: "his [Aristotle's] prejudice against it [the knife] is based on philosophical principles rather than considerations of practicality or expense". These authors moreover translate the phrase in the *Politics* as "Nature makes nothing in a stingy fashion"; Johnson, *Philosophy and Politics in Aristotle's Politics*, 2015, 38–39, takes this as Aristotle laying down a general law from which there are only rare exceptions, "things would seem always to have one 'natural' or 'proper end'", moreover claiming that 'the precept that nature is not stingy appears definitely not to be true at all in the case of one group of natural entities: human beings" as "Nature, then, appears to have assigned two purposes to humans: reproduction and engaging in speech/reason about the just and unjust". However, Aristotle's point here is to emphasize that the ends of the slave and the female are different by nature, which he further underscores by criticizing *barbaroi* societies where this distinction is not found. Nature does not make things poorly, namely insufficiently, such that they need to perform multiple functions. Put another way, nature makes things fit for purpose, and does not *necessitate* they serve multiple ends although they are certainly not excluded from doing so (cf *De an.* II. 18. 420b17–18 on the tongue for speech and tasting; *Part. an.* II. 16. 659a20–25 on the multiple functions of an elephant's trunk, IV. 10. 690a1–4 on the multiple uses of tails).

[312] For example, Parker, "Aristotle's Unanswered Questions: Women and Slaves in Politics 1252a-1260b", 2012, 80, "Slaves and women are different tools".

instead devotes explicit discussion in the *Politics* to categorizing slaves as tools or *organa*. Although functional subordinates more generally (*hupēretēs*) like the look-out boatsman are also examples of *organa* in the class of technics, the slave's condition is even more acutely specified than this. The slave is actually a possession (*ktēma*) of the master.[313] Indeed Aristotle moreover suggests that the slave is a part (*meros*) of the master, a part of his body – animate yet separate (*kechōrismenon*).[314] The slave, as an *organon*, is therefore like the detached hand of the master, performing the work as required.

In the *Nicomachean Ethics*, Aristotle again categorizes slaves as tools, claiming the reverse relation as well. Moreover, he denies any essential basis of friendship between masters and slaves resting on these conditions alone, or towards inanimate things generally:

> For in those cases where there is nothing shared by the ruler and the ruled, there is no friendship (*philia*), since there is no justice (*dikaion*) either, as in a technician (*technitēi*) in relation to a tool (*organon*) or in a soul in relation to a body or in a master in relation to a slave; for while all these things are helped by those who use them, there is no friendship toward things without souls, nor without anything just. And neither is there towards a horse or a cow, nor towards a slave as a slave. For there is nothing in common, since the slave is an animate tool, as a tool is an inanimate slave. Insofar then, as he is a slave, there is no friendship towards him, though there is insofar as he is a human being (*anthrōpos*), for there seems to be something just for every human being toward all those who are capable of sharing in law and contractual agreement and so there is friendship too, to the extent he is a human being. [315]

[313] *Pol.* I. 4. 1253b33. An important note here is that for Aristotle the slave is a natural (*phusei*) species of subordinate (*hupēretēs)*. Another kind of *hupēretēs* is a rower for example, and Aristotle clearly means for kinds of subordinates like these to belong to this grouping by craft knowledge (*tais technais*) per I. 4. 1254a30–31.

[314] *Pol.* I. 6. 1255b11–13.

[315] *Eth. Nic.* VIII. 11. 1161a33–1161b8. Sachs notes at p. 158 of his translation, referring to Aristotle's affirmation of the possibility of *philia* between masters and slaves in *Pol.* I. 6. 1255b12–15, that "if slavery rests on force and custom alone, it is wholly unjust and disadvantageous on both sides, but if it has a natural basis there is a friendship like that of parent and child". Any such *philia* would be based on mutual advantage, and not for the sake of the slave qua slave.

Slaves are *organa* and *organa* are slaves. What separates them in this specification is a soul that animates the former. It is hard not to observe therefore, as Langdon Winner phrases it, that "the tools are much more than tools".[316] Aristotle's concept of *organon*, at very least in the context of tools and technics, carries the slave relation with it.

Aristotle makes a further distinction within *organa* that is of interest to us. Referring in his counterfactual to weaving shuttles (*kerkides*) and plectra (*plēktra*) used for musical instruments, Aristotle calls them tools of production (*organa poiētika*). On the other hand, possessions (*ktēma*) are to be considered tools of action (*praktikon*). This distinction is important because tools must be fit for purpose. Because there is a difference between production (*poiesis*) and action (*praxis*), different tools are needed for each, and so these tools will be necessarily different from each other in kind. Aristotle tells us in particular that a slave is a type of subordinate worker who, unlike the weaving shuttle or plectra, exists within the class of tools for action.[317]

Because *organa* can refer to living human beings who are subordinates (*hupēretēs*), we might say that it can refer to immaterial, cognitive and psychological faculties. This question is important for identifying the limits to Aristotle's conception of a tool. But for Aristotle, this is only an indirect coincidence Especially in the case of living *organa*, it is their bodies and what they can do with them that is emphasized. The soul is anyway not an

[316] Winner, *Autonomous Technology*, 1978, 30.

[317] *Pol*. I. 4. 1254a1–9.

organon of anything itself, while it organizes the body in turn.[318] Aristotle certainly emphasizes the hands in the case of handicraftsmen and handymen, and states moreover that in the case of slaves, "bodily assistance for necessary affairs arises from both: slaves and domestic animals" as the "need differs little" of one relative to the other. Nature always or for the most part makes the body of a slave different to that of a freeman.[319] Aristotle's slavish type does not wholly have the deliberative faculty (*holōs ouk echei to bouleutikon*),[320] and does not have reason (*logou*) but rather shares in it to the extent of perceiving (*aisthanesthai*) it per the dyadic master – slave association (*koinonōn*).[321] So while it might be correct to say that this general class of subordinates contains immaterial, cognitive and psychological faculties at the disposal of the master, it is really only in an indirect way.

For Aristotle, these subordinates are there primarily for their physical brawn and experience in craftwork, not their noetic faculties. This fact does not mean they are

---

[318] *De an.* II. 1. 412b5–6. See also Bos, *The Soul and Its Instrumental Body*, 2003, who offers a persuasive reinterpretation to claim that this latter part should be read as 'of an instrumental body' rather than 'of a body having organs'. In explaining this definition, Aristotle in fact turns to a hand-tool, the axe (*pelekus*), as some kind of natural body amongst *organa* at II. 1. 412b11–18. See also III. 10. 433b19–28 on *orexis* using the body as an *organon*, moreover the comparison with wheels and ball-and-socket joints. However, what is clear is that Aristotle makes no claim that the soul itself is an *organon*.

[319] *Pol.* I. 5. 1254b17–1255a2. Of course, sometimes deviations occur, which Aristotle notes.

[320] This can be rendered alternatively that the slave lacks the deliberative faculty entirely, per Kraut, *Aristotle: Political Philosophy*, 2002, 285–286. But see Dobbs, "Natural Right and the Problem of Aristotle's Defense of Slavery", 1994, 80: "A properly circumspect reading of the phrase *holôs ouk echei to bouleutikon* would conclude that the natural slave possesses the deliberative capacity at best in some partial or one-sided fashion, i.e., 'not wholly.'" I am in agreement here, as we know that slaves at the time occupied a range of tasks and functions, differing in complexity, that would have at least required a technical deliberation about means to ends. Public slaves (*dēmosioi*), for example served in inter alia treasury mints, verifying coinage as *domikastēs*, as security, as archivists and scribes. See Ismard, *La Démocratie contre les experts*, 2016, 63–94. While an argument could be made that Aristotle is strictly concerned with slaves in the household (*oikos*) in *Politics* I, and not *dēmosioi*, this would constitute a significant restriction to his conception of slavery more generally; cf also Simpson, "Aristotle's Defensible Defence of Slavery", 2006, 99: "Slaves tilling the fields, no less than slaves doing chores about the house, are involved in doing rather than making"; Armstrong, *The Logic of Slavery*, 2012, 10.

[321] *Pol.* I. 5. 1254b21–24. But this cannot be interpreted in an unrestricted sense. See Heath, "Aristotle on Natural Slavery", 2008, 243–270, who points to the evidence of forms of reason present amongst non-Greek peoples that were available to, and referenced by Aristotle despite his insistence of their slavish nature. He argues and concludes, at 253, "Natural slaves, then, suffer from an impairment that is limited in several ways: it is an impairment of the capacity for practical (not technical or theoretical) reasoning; it is an impairment of the capacity for deliberation (not a conceptual or motivational failure); it is an impairment of the capacity for *global* [my emphasis] deliberation".

completely ignorant or unintelligent, however. [322] But for Aristotle it means that the work they must perform requires something cognitively inferior to, for example, political deliberation, philosophy, and master-craftsmanship more generally. Of course, there is a very delicate line here between the types of cognitively more demanding tasks that actual subordinates and slaves historically performed, and the kinds of people that Aristotle seems to describe as natural slaves in particular. But as Jill Frank puts it, for Aristotle "being a slave is to be understood in terms of slave activity".[323] The types of work that slaves and craft subordinates perform determines them as such and insofar as that work does not require unimpaired deliberation and/or independent reason, for Aristotle it still remains subordinate to political deliberation, philosophy, and master-craftsmanship.

Because of its relation to contemporary programming language, a final point must be made regarding the *organon*'s relation to analytics or what we now know as logic. The idea that logic can be a tool in itself is captured by the title given to arrangements of Aristotle's analytic works, the *Organon*. This has historically opened up complex polemics around the role of logic in philosophical enquiry, with claims that the Stoics insisted on logic as a part of philosophy on one hand, and the later Peripatetic claims that it is simply a tool employed by philosophy.[324] Of course, the title '*Organon'* was not given by Aristotle himself. However, Aristotle does speak of the dialectical method in particular as "no small

[322] For Aristotle, *technē* does seem to involve knowledge, per the *Eth. Nic.* VI. 4. 1140a1–24. But see *Metaph.* A. 1. 981a24–981b5, where a type of subordinate worker, the handicraftsmen *(cheirotechnai*), is compared with inanimate things that do not know the causes of what they do and distinguished from the master-craftsman (*architektonas*) who does, through a discussion of the superior knowledge produced by *technē* over mere experience (*empeirias*).

[323] Frank, "Citizens, Slaves, and Foreigners: Aristotle on Human Nature", 2004, 94.

[324] For more on this debate and its nuances see Hadot, "Appendices", 1989, 183–188; Ierodiakonou, "Aristotle's Logic", 1998, 33–53; Sorabji, *The Philosophy of the Commentators*, 2005, 30–36; Griffin, *Aristotle's Categories in the Early Roman Empire*, 2015, 32–35. Curiously, Francis Bacon suggests that Aristotle "made his natural philosophy completely subservient to his logic, and thus rendered it little more than useless disputations". See Bacon, *Novum Organum*, 29 (LIV).

organon" in the *Topica*.[325] Notwithstanding this, it is clear that Aristotle's counterfactual in the *Politics* does not contemplate dialectic or logic as the *organa* in question. But we cannot deny that later Peripatetics and even modern thinkers have contributed to the idea that logic can be a tool, or that reason itself can hold out an *organon*.[326] While this is acutely relevant to aspects of contemporary automation, computer science, and machine learning processes, it moves beyond that which is strictly contemplated by Aristotle per se.

To sum up then, *organa* are a building block of sense-making in Aristotle's world. They have a task, function, or work that they complete. They can be a general class of means to an end, or a specific class of things like working tools. They can natural or artificial, animate or inanimate, and evaluatively productive and/or active. Aristotle evaluates subordinates in particular as animate, natural tools of action, and the slave moreover as an *organon* and possession that is a separated part of their master. *Organa* are always directed to their tasks by something that is cognitively superior – the idea that tools can be smarter than their users is not Aristotle's. It may well happen that masters and master-craftsmen lose their cognitive edge over their subordinate living tools. When that happens, however, a distinction between them ceases to exist: the subordinate is no longer a tool, and/or the master users have become tools as well.[327]

Moreover, we do not find in Aristotle the idea that *organa* can directly refer to immaterial, cognitive and psychological faculties. A qualification to this is that *organa* can

---

[325] *Top.* VIII. 14. 163b9–11; Ueberweg, "History of Philosophy, From Thales to the Present Time", 1874, 144–145; see also footnote 5 per Sorabji, *Ancient Commentators on Aristotle*, 1991, 41–42.

[326] For example, in Kant's first Critique, where he plans to outline pure reason architechtonically (*architektonisch*) and provide a propaedeutic, he refers to an "*Organon*" of pure reason, "*ein Inbegriff derjenigen Prinzipien sein, nach denen alle reinen Erkenntnisse apriori können erworben und wirklich zustande gebracht warden*". See Kant, *Kritik der reinen Vernunft*, 1956 [1781], 57* (A14/B27); 55, (A11/B24).

[327] *Pol.* I. 7. 1255b19–38, and 3. 1277a33–1277b7. See also Frank, "Citizens, Slaves, and Foreigners", 2004, 94–95.

comprise natural, living subordinates having these faculties coincidentally, however impaired they might be. Moreover, there is some support to suggest that method – in particular dialectics, can be a kind of general *organon*. But this is not what Aristotle's counterfactual contemplates in the *Politics.* His reference to weaving shuttles and plectra used for musical instruments suggests to us that he is concerned with how artificial tools might have substituted for the living tools and the subordinates he discusses throughout the *Politics*.

IV. Aristotle's Two Types of Automation

We must now ask *how* it is that artificial *organa* like the weaving shuttle or plectra for musical instruments could possibly complete their work such that they might have substituted for living tools. This tells us as well about the work requirements that Aristotle expects slaves and subordinate craft workers to perform. From Aristotle's mytho-poetic references to the statues of Daedalus and Hephaestus' *automatous* golden tripods in Homer's *Iliad*, we uncovered a motile principle of reflexive repetition that Aristotle explains and attributes to circular motion. These beings must act 'of their own accord' somehow. The reflexive loop appears through the verbal construction attributed to the weaving shuttle (*kerkides*) that wove (*ekerkizon*) itself (*autai*). And while we do not find the same reflexive linguistic construction with the plectra that played the lyre (*ekitharizen*), both examples are said to refer similarly in this way (*houtōs*) to the principle that precedes their mention.[328]

But the principle of circular motion and reflexive repetition contained in *automatos* cannot be the only relevant component of Aristotle's theory of automation. If that were the

[328] *Pol.* I. 4. 1253b37–38.

case, tools would loop on ceaselessly in their tasks without any measure of order, guidance, or control. But Aristotle does not propose wholly autonomous artificial tools. These tools are not really free to act of their own accord, since that conflicts with the work (*ergon*) for which they are teleologically purposed and fashioned. Put more concretely, the inherent tension between *automatos* and *organon* therefore remains to be solved. And Aristotle has indeed specified two disjunctive conditions for which this might have been resolved: these tools must complete their work a) when commanded (*keleusthen*) *or* b) by perceiving in advance (*proaisthenomenon*). These conditions result in two different types of automation entirely. It is the difference between asking a voice-activated tool to perform a task, and that tool anticipating what needs to be done without being told to do it.

Keleusthen

Aristotle seems to imagine a tool acting on mere human command. The use of the command, in the expression of an imperative, tells something what to do. It serves as the input that sets the self-weaving shuttle or the lyre-playing plectrum into its circular, repetitive motion. The command is what might distinguish the activity of the apparent ruling elements from ruled elements in a set of relations that contains both. For Aristotle, elements such as the intellective faculty (*nous*), reason (*logos*), the law (*nomos*), are said to command (*keleueīn*). *Nous* commands (*keleuei*) us to resist with a view to the future (*to mellon*) while passion *(epithumia*) aims towards the present (*to ēdē*) .[329] Reason (*logos*) and knowledge (*epistēmē*) command (*keleuei*) the best mean (*to meson*) in relation to us, regarding action

[329] *De an.* III. 10. 433b7–10.

(*praxis*).[330] And the law commands, for example, that specific officials shall fix the weights of goods in trade,[331] or commands us not to commit suicide (and most notoriously that "what the law does not command (*mē keleuei*), it forbids (*apagoreuei*)"). [332]

But commands issued by ruling elements are not absolute, nor are they exhausted by the law or purely intellective capacities and activities. Moreover, *keleuein* can refer to command in a strong sense, but also a weaker form of urging or exhortation. *Nous* can fail to command or urge (*keleui*) avoidance (*pheugein*) or pursuit (*diōkein*), and even when an order is issued (*epitattontos*) by *nous*, movement can fail to occur as with the case of a lack of self-mastery or *akrasia*.[333] As Giulia Sissa puts it, "thought is not imperious: it often fails to issue any command (*keleuein*) to move in a certain direction or to feel a certain emotion". [334] In fact, the passion (*epithumia*) also commands – it just does so with a view to the present.[335] This conflict of interest, so to speak, points to the problem of human fallibility in judgment and action, which Aristotle moreover stresses in the *Politics*:

> Therefore, the one exhorting (*keleuōn*) the law (*nomon*) to rule (*archein*) seems to exhort (*keleuein*) that god (*theon*) and the intellective faculty (*noun*) alone to rule, but the one exhorting (*keleuōn*) man (*anthropon*) to rule adds a beast (*thērion*) also; for passion (*epithumia*) is like a beast (*thērion*), and also spiritedness (*thumos*) warps rulers (*archontas*) and the best men (*aristous andras*). So the law

[330] *Eth. Eud.* II. 1220b27–1220b29.

[331] [*Ath. Pol*.]. LI. 3.

[332] *Eth. Nic.* V. 11. 1138a7–8. On the difficulties raised here, as well as proposed solutions, see Johnson, "Aristotle on Nomos", 1938, 351–356; Sparshott, *Taking Life Seriously*, 1994, 401; see footnote 53 in Kraut, *Aristotle: Political Philosophy*, 2002, 162; Murphy, *The Philosophy of Customary Law*, 2014, 12, on the problem as well of *nomos* as custom *or* law.

[333] *De an.* III. 10. 432b30–433a7; cf *Resp*. IV. 439c–439d.

[334] Sissa, "Bulls and Deer, Women and Warriors: Aristotle's Physics of Morals", 2018, 168.

[335] *De an.* III. 10. 433a7–9. *Keleuein* is the operative verb applying to both clauses – the clause containing the action of *nous* and the clause containing the action of *epithumia*.

(*nomos*) is the intellective faculty (*nous*) without desire (*aneu orexeōs*).[336]

Aristotle's normative preferences are clear, but he also knows that commands and exhortations can both be issued by our desiderative side, and also disobeyed by agents. This is a general problem in politics moreover as different groups in society are more or less inclined to obey the authority (*peitharchein*) of, or follow (*akolouthein*) reason (*toi logoi*).[337]

It is therefore unsurprising that cognitively impaired living *organa* like slaves, who Aristotle already treats as closely substitutable for animals, are problematized in their ability to follow commands. But in the case of slaves, Aristotle is acutely aware that they are not *only* animals per se[338] and, as we have seen, he explicitly recognizes that they are still humans (*anthrōpos*) – the basis of which might form bonds of affection between themselves and masters qua humans. Whereas Plato's Athenian Stranger had claimed that slaves should not be admonished (*nouthetountas*) as freemen but rather that their address should be an order (*epitaxin*),[339] Aristotle refutes this position. The order (*epitaxei*) is not the only thing (*monon*) to be used with slaves, as admonishment (*nouthetēteon*) is in fact more appropriate to them than it is with children. This is because slaves are not fully robbed (*aposterountes*) of reason (*logos*), but rather share in it to the extent that they are able to perceive it within the master – slave association. This does not mean commands or orders are not to be used with slaves, rather that their humanity and desiderative side requires someone also to admonish,

[336] *Pol.* III. 16. 1287a29–32.

[337] *Pol.* IV. 11. 1295b1–9; IV. 8. 1294a4–9. 1294a9 on how laws (*nomos*) must be both good *and* obeyed (*peithesthai*).

[338] A human (*anthrōpos*) is of course still an animal, and moreover a political animal (*politikon zōon*).

[339] *Leg*. VI. 777e–778a.

or more literally 'to put mind in' them regarding what is required.[340] The master's responsibilities are to cultivate the appropriate virtue in the slave, and not simply to instruct the slave in tasks as someone having some technic of mastery –the slave is by nature and therefore unlike lowly technical laborers like shoemakers (*skutotomos*). These technicians often (*pollakis*) fail (*elleipousi*) in their works (*ergōn*) because of intemperance (*di'akolasian*), and they share in the same virtue of the slave only to the extent that they are also under a form of slavery (*douleian*) themselves.[341]

While living subordinates like slaves or lowly technicians are complicated by their desiderative side and the fact that they sometimes disobey their superiors, the counterfactual artificial tool substitute might simply get on with the job when commanded to do so. Aristotle's use of *keleusthen* cannot be an exhortation in a weaker sense – those requiring tasks to be done could hardly be urging tools to complete their work rather than commanding them to do so.[342] His counterfactual task manager is therefore one who orders these tools to their tasks as if they were boatswains (*keleustai*) of an Athenian trireme ordering the rowers to their beats – although without the same exhortative morale management.[343] The perfect tool has no need for encouragement. It simply does what is required, on command. For Aristotle the desiderative side in slaves and lowly craft workers can therefore

[340] On this see Speliotis, "Women and Slaves in Aristotle's *Politics* I", 2000, 78.

[341] *Pol.* I. 13. 1260a37–1260b7; cf Fortenbaugh, "Aristotle on Slaves and Women", 1977, 137: "Slaves cannot put together reasoned arguments and cannot offer their masters reasoned advice. But they can perceive their masters' reasons and can decide to follow them".

[342] If Aristotle had in mind tool substitutes that were moreover equipped with an enhanced sense of agency, he might instead have referenced Hephaestus' living golden maiden assistants who are said to have intelligence (*noos*), speech (*audē*), strength (*sthenos*), and know the work (*erga*) of the gods in *Il.* 18. 417–421.

[343] These *keleustai* were responsible for more than just commanding on beats and rhythm, but also morale and encouragement. For more on trireme arrangements see Morrison, Coates, and Rankov, *The Athenian Trireme*, 2000, 231–275, who call the boatswain (*keleustēs*) 'literally, the exhorter' at 249; Jordan, "The Crews of Ancient Triremes", 2000, 88 and 96 in particular.

be superfluous to the work to be performed – automated tools need only be able to respond to command and do what needs to be done. To put it bluntly, workers with errant passions are not required, and the passions can lead these workers away from what they are supposed to do.

Finally, it is true that Aristotle does not specify the form of the command. Naval *keleustai* issued commands verbally and through physical gestures, but this is clearly not how cognitive or psychological faculties do so. Moreover, the laws, which we know also command or exhort, can be written (*kata grammata*) or not.[344] Aristotle seems to be insisting here on a discrete relation between the one who actively commands, and the tool being passively commanded. It is unlikely therefore that he contemplates a tool that gives itself commands or that need only rely on written commands to complete its work. Automation here is direct and quite involved since action wholly depends on the presence or absence of the command and commander. Whether as speech, reason, or argument, man's ability to give this command to the tool requires *logos*. Man stands superior among earthly beings because he can use *logos* to command others, and even himself. [345] But could a command be 'programmed' into the counterfactual tools? To see how this might be, we can turn to another type of automation that Aristotle theorizes through his use of perceiving in advance or *proaisthanomenon*.

Proaisthanomenon

Aristotle could have stopped at the command. However, he offers a disjunctive alternative

[344] *Pol.* III. 16. 1287a32–1287b8.

[345] Man alone amongst the animals has *logos*. *Pol.* I. 2. 1253a9–10.

in his counterfactual. Artificial tools might also complete their work by perceiving in advance what to do (*proaisthanomenon*). *Proaisthanesthai* is a verb that is a middle construction and refers literally to a 'feeling or sensing in advance'. It has thus far remained underexplored in Aristotle's political theory, certainly with respect to the role it plays in this counterfactual. Winner, for example, refers to it as "intelligent anticipation".[346] But this can mislead us about the involvement of Aristotle's conception of the intellective or noetic faculties. If the weaving shuttle could sense when it needed to weave, without being commanded, it knows that if X occurs, Y must happen, but it does not necessarily know why. The weaving shuttle can sense what it needs to do without any noetic understanding or knowledge of causality. It simply goes through the motions by responding to the presence of X by doing Y. To sense or feel in advance regarding what to do requires further examination of *proaisthanesthai* in Aristotle's broader corpus.

But before turning to Aristotle's conception of *proaisthanesthai* in his work, however, it is instructive to see it in action within a familiar political context. In Thucydides' Mytilenean Debate, Cleon chastises the Athenian assembly for its susceptibility to rhetoric:

> You are excellent men for one to deceive with a speech of a new strain but backward to follow any tried advice, slaves (*douloi*) to strange things (*atopōn*), contemners of things usual. You would everyone chiefly give the best advice; but if you cannot, then you will contradict those that do. You would not be thought to come after with your opinion but rather, if anything be acutely spoken, to applaud it first and to appear ready (*prothumoi*) apprehenders (*proaisthesthai*) of what is spoken even before it be out, but slow to think ahead (*pronoēsai*) regarding the sequel of the same. You would hear, as one may say,

[346] Winner, *Autonomous Technology*, 1978, 20–21; Armstrong, *The Logic of Slavery*, 2012, 10–11, uses the Sinclair translation of the *Politics* that translates this verb as "itself perceiving the need"; Marx, *Das* Kapital, 398, relies on Biese's edition of the *Politics* and captures this phrase as *vorausahnend*. However, the 1887 Moore and Aveling translation renders this exactly the same as *automatos* – as "of its own accord" and appears in the work, for example, of Boesche, *Theories of Tyranny*, 1996, 63–54; Simpson, "Aristotle's Defensible Defence of Slavery", 2006, 106, misses the disjunctive formulation altogether and focuses instead on the command: "Recall, then, that a living tool is supposed to act by perceiving and obeying the master's command (like the machines of Daedalus and Hephaestus)".

> somewhat else than what our life is conversant in; and yet you sufficiently understand not that that is before your eyes. And to speak plainly, overcome with the delight of the ear, you are rather like unto spectators sitting to hear the contentions of sophisters than to men that deliberate (*bouleuomenois*) of the state of a commonwealth.[347]

This reconstructed speech is quite telling for our purposes. Instead of deliberating (*bouleuomenois*) or being able to think ahead (*pronoēsai*) regarding causes and consequences, Cleon charges the Athenians assemblymen with being like slaves to absurd things and being eager to have advance perception (*proaisthesthai*) rather than truly being in the know. The thrust of this is that instead of doing the hard work of foreseeing consequences, the Athenians are eager to anticipate what is said so that they can feign that they understood all along. They simply feel their way through what they are supposed to understand – what the argument means before it is even spoken. *Pronoēsai* is therefore treated here as cognitively and normatively superior to *proaisthanesthai*.

Turning now to Aristotle, *proaisthanesthai* is theorized as a perceptual activity that, as Henry Richardson puts it, gives animals an "advance awareness" of things that threaten or sustain it: "If an animal moves from place to place, it must be able to foresee where it will be – or where its prey will be when it leaps".[348] For Aristotle, senses like smell (*osphrēsis*), hearing (*akoē*), and sight (*opsis*) are distinguished from touch (*haphē*) and taste (*geusis*) as the former occur through an external medium (*dia tōn exōthen*) and belong to locomotive animals (*tois poreutikois*). They allow these animals to be in a state of perceptual anticipation

[347] Thuc. III. 36–40 (174–180); III. 38. 4–7 (177). Lattimore, 1998, 147, translates the relevant point as, "to be ready with instant approval when a point is made, and to be as keen in anticipating what is said as you are slow in foreseeing the consequences".

[348] Richardson, "Desire and the Good in *De Anima*", 1992), 385.

(*proaisthanomena*) as regards what to avoid or pursue. Moreover, in higher animals capable of practical judgement (*phronēseōs*), these senses happen to be for the sake of well-being as well.[349] What Aristotle therefore seems to emphasize here is that *proaisthanesthai* belongs to perception, occurs in higher animals that are able to move and interact with their external environment, and allows animals to recognize things that they should avoid or pursue. Importantly, it is not restricted to humans, and it forms the basis of reaction to environmental stimuli.

It is also more than simply sense-perception (*aithesis*) by the addition of the prefix *pro-*. Time (*chronos*) is involved here too, which makes it an important component of memory formation. Memory (*mnēmē*) is not exclusive to man, though not every animal has it.[350] As Richard Sorabji says, "Aristotle is careful here to say that one perceives, rather than that one judges, or thinks, one saw such-and-such." Why? Sorabji suggests that "[this] is necessary for his theory that memory can belong to animals incapable of judgment, and that memory is a function of the perceptual faculty, not of thought.[351] Because, as Aristotle continues, "always whenever one is actively engaged in memory (*mnēmē*)…he has an advance perception (*proaisthanetai*) that he saw this or heard that or learnt that before. And before and later are in time (*en chronōi*)."[352] *Proaisthanesthai* is therefore extremely important in allowing certain animals a sense of recognition over what they should pursue or avoid,

[349] *Sens.* 436b11–437a4.

[350] *Mem.* 450a15–19.

[351] Sorabji*, Aristotle on Memory*, 2006 [1972]), 79.

[352] *Mem.* 450a19–22, following Sorabji, *Aristotle on Memory*, 2006 [1972]), 9–10; 79, on the emendation to *proteron proaisthanetai* but departing in that both Hett and Sorabji translate *proaisthanetai* as an "additional" perception (Sorabji) or consciousness (Hett). Instead, I argue it is the temporality in *pro-* that makes this verb distinctive.

allowing them to mark the passage of time,[353] and in contributing to the formation of a perceptual memory.

An animal capable of *proaisthesis* does not need noetic intellection to get things done. Recall once more Aristotle's comparison between handicraftsmen *(cheirotechnai*) and inanimate things that produce (*poieī*) things without a knowledge of the causes involved. We said that they simply go through the motions. In the case of the handicraftsmen, it is their habit or disposition (*ethos*) that facilitates their work.[354] Animals in general are said to have many aspects of their disposition (*kata to ēthos*) and sensory perception (*kata tēn aisthēsin*) determined by the [different] nature of their blood.[355] In order to perform the tasks before them, handicraftsmen need to be habituated and disposed correctly to do so. While they do not belong to their trade by nature, nevertheless they must be constituted such that they can perform it, and disposed towards it via habit. This conditioning goes for the artificial tool that Aristotle suggests might have replaced them.

An artificial tool working through advance perception simply does what needs to be done when it needs to be done. Its ability to complete its work is purely perceptual, and it contains a perceptual memory that allows it to react to stimuli such that it has an advance awareness of, and habituated disposition regarding what to do and when to do it. A command is therefore no longer necessary. Automation by command is direct and involved in the sense that the presence or absence of the command determined action. But

[353] Sorabji, *Aristotle on Memory*, 2006 [1972]), 70. But see Bowin, "Aristotle on Perception and Cognition", 2018, 183, who makes the point that "Sorabji speculates that Aristotle is using a broader sense of "perceive", here, to emphasize that memory is a perceptual and not an intellectual activity. But I think that Aristotle calls this perceiving time because he does not distinguish between remembering time and perceiving time as it is passing". Bowin turns to inter alia Aristotle's comments in the *Physics* to support this claim.

[354] *Metaph.* A 1. 981a29–981b5.

[355] *Part. an.* II. 4. 651a12–14. See also Fortenbaugh, "Aristotle: Animals, Emotion, and Moral Virtue", 1971, 155; 165.

automation by advance perception is indirect and more remotely controlled. A task manager need only set the tool up and constitute it correctly – programme it in a sense – for its work. The manager does not need to continue to issue verbal commands to keep it performing the work as required. If this is the way the perfect substitute tool should act, it illustrates that the work to be performed – even performed *well* – does not require use of the deliberative faculty. For Aristotle, a good natural slave or craft worker can simply be perceptually conditioned to know what to do.[356]

Finally, it is important to note again the limits of Aristotle's theory. These tools are not Hephaestus's golden maidens who are said to have *noos*.[357] An intellective faculty is not involved here. Instead what Aristotle seems to have in mind is a tool with a kind of sense-perception feedback that allows it to complete its work. For example, a thermostat that 'senses' temperature deviations and corrects for this through a feedback mechanism would, at first blush, appear to fulfil Aristotle's criteria. They could indeed substitute for the temperature control in heated Athenian baths that was otherwise manually maintained by living subordinates.[358] But thermostats on their own, while they can certainly sense deviations, do not have the *dynamis* to replace the muscular effort required in actually correcting the change of temperature. This situation applies as well to tools that operate when commanded. Aristotle's counterfactual tools must be able to complete the work such that they can replace living subordinates. To do so, a thermostat or a commanded tool still

[356] On the employment of *proaisthanomenon* to argue that a good or useful slave tends to be less and less like a natural slave see Nichols, *Citizens and Statesmen*, 1991, 20, who therefore overstates *proaisthanomenon* as "something of the foresight that characterizes the master"; similarly Trott, *Aristotle on the Nature of the Community*, 2013, 185–186, who reads this term as "anticipating instructions" in a way that makes slaves more useful than tools, moreover claiming that "the activity of the good slave approaches deliberation".

[357] *Il.* 18. 417–421.

[358] See Trümper, "Baths and Bathing Culture, Greek", 2014, 784–799; Lucore, "Greek Baths", 2016, 330 in particular. See also *Nub*. 1046; 1053–1054, on the warm water of the baths.

needs more than advance perception or the appropriate reaction to the command.

V. Without Need for Subordinates or Slaves - Assembling Like the Gods

In the unreal world Aristotle presents to us, masters have no need of slaves and master-craftsmen have no need of subordinates. Trivially, but still important to note, Aristotle does not contemplate a world without work. *Ergon* is not eliminated but is instead distributed differently. For Aristotle this still sits within the realm of the necessity – what is necessary (*anangkaion*) in the household and the defined arts. Arendt, summarizing the view of Greek philosophers, notes that for them, "necessity is primarily a prepolitical phenomenon, characteristic of the private household organization". Moreover, "force and violence are justified in this sphere because they are the only means to master necessity—for instance, by ruling over slaves—and to become free."[359]

And yet we have already seen that this cannot be a strict, unconditioned necessity. Slaves, for example, are not strictly necessary as they can be substituted by inter alia animals, wives, and children. [360] And we certainly could imagine a master-craftsman who is capable of performing the work of any subordinate. But given the prevailing erga of Greek society in Aristotle's theory, slaves and subordinates are for him, in fact, specialized necessary tools to be used. And while this determination sits within Aristotle's prepolitical realm, the economic distribution involved becomes, by Marx's pen, *the* defining political problem. For Marx, that Aristotle supposedly dreamed (*träumte*) of a world of automated tools is related to the idea that the Greeks thought that slavery of one was necessary for the

[359] Arendt, *The Human Condition*, 1998 [1958], 31.

[360] *Pol.* I. 2. 1252b11–12; VI. 8. 1323a5–6.

development of another.[361]

Moreover, let us recall the critical scene from *Prometheus Bound* where we saw how Hephaestus's crafts are directed as a form of necessary corrective justice to the Promethean frustration of Zeus' plans. Alongside him stand Force (*Bia*) and Power (*Kratos*). Hephaestus laments that he must use his handiwork (*cheirōnaxia*) to bind his kinsman. Power, accompanied by silent Force, reminds him that no one is really free (*eleutheros*) but Zeus. Hephaestus's crafts (*technē*) is not to blame (*aitia*) here. And yet it is quite directly accompanied by power and the silent threat of force.[362] In presenting his counterfactual through the comparison with Hephaestus, Aristotle sees automation as a replication of the divine master-craftsman's deeds – emancipation from his pointless (*matēn*) labour conditioned on the necessary binding of another being. *Technē* merely carries out what needs to be done to effect this. And so while we might go along with Aristotle and see this issue as somehow 'prepolitical', its status in configuring the *Politics* as a text, the distributive issues raised, and deeper involvement of force and power imply sharply political issues. Fittingly then, we turn first to the consequences for master-craftsmen.

Master-craftsmen with no need for subordinates

Aristotle does not contemplate a world without human work – the master-craftsman (*architektōn)* persists. Nor can it be said that the subordinate (*hupēretēs*) necessarily disappears from the unreal world he specifies in the *Politics*. They simply become unnecessary.

[361] Marx, *Das Kapital,* 1867, 398–399 (532–533). Marx makes this comment,*"Sie entschuldigten etwa die Sklaverei des Einen als Mittel zur vollen menslichen Entwicklung des Andern*", relative to the mass slavery (*'Sklaverei der Massen"*) onwards from Christianity. But, as we have seen, that this counterfactual can be read as Aristotle 'dreaming' is complicated by a deeper textual analysis.

[362] *PV.* 15–17; 40–41; 50.

Substitutability means that master-craftsmen would have another acceptable choice in terms of labour and would presumably choose their mix of automation and human labour according to the situation at hand. Whether automated tools are *better* than subordinates in the same economically stratified sense that a household slave (*oiketēs*) is better than an ox, with the latter serving instead for the poor (*tois penēsin*), is not strictly specified.[363] Of course the fact that Homer's Hephaestus has automated tools yields a normative, divine ideal[364] for Aristotle's counterfactual, and given the desiderative problems of human agency that can obstruct workers' abilities to do as required, it is quite likely that Aristotle contemplates automated tools as a 'step up' in a sense for the master-craftsman.

But who are these master-craftsmen? David Charles summarizes three types of craftsmen in Aristotle, along epistemic lines, as follows: 1) "low-level artisans" who go through the motions, as we have said, without understanding why; 2) "empirical doctors: people with experience" who can reason in a limited way based on prior experience with success or failure; and 3) "master-craftsmen" who understand the nature of things before them "in terms independent of what [they] can do with it, which explains why [they] should act in one way or another". [365] Put simply, master-craftsmen know their work and the principles that underlie it. In explaining different technics or arts and sciences like medicine (*iatrikēs*), shipbuilding (*naupēgikēs*), winning generalship (*stratēgikēs de nikē*), household management (*oikonomikēs*), horsemanship (*tēn hippikēn*), Aristotle notes that those that are more encompassing – the master-crafts (*architektonikōn*) are to be preferred (*airetōtera*). And

[363] *Pol.* I. 2. 1252b11–12.

[364] *Pol.* I. 2. 1252b26–27, on how humans assimilate the lives of the gods.

[365] Charles, "Wittgenstein's Builders and Aristotle's Craftsmen", 2001, 59–63. Recall that in the *Politics* Aristotle likens *logos* to a master-craftsman at I. 13. 1260a18–19.

most notoriously for theorists like David Keyt, Aristotle continues on to say that politics (*politikē*) is most decisively, and in particular, a master-craft (*architektonikēs*).[366]

For Aristotle, master-craftsmen are moreover said to exist in virtue of production (*poiētikēs*), but in a way also use (*chrōmenē*), since the former also knows the form (*eidous*) while the latter knows the matter (*hylēs*). Thus,

> While the ship's pilot (*kubernētes*) knows what sort of form (*eidos*) the rudder should have and prescribes its production, whereas the other knows from what sort of wood and by what movements it will be made.[367]

Both use and production therefore are within the preserve of master-craftsmen, though of different types. This passage from the *Physics* maps well with Aristotle's reference to the primacy of the ship pilot (*kubernētēi*) in the *Politics*, and moreover the discussion of *organa* of action (*praxis*) and production (*poeisis*) wherein the former contains use alone (*chrēsis monon*).[368]

The scope of Aristotle's reference to master-craftsmen is therefore very broad upon further inspection. Different types of master-craftsmen exist within different epistemic

[366] *Eth. Nic.* I. 1. 1094a7–28; see David Keyt's argument that "according to Aristotle's own principles the political community is an artifact of the practical reason, not a product of nature, and that, consequently, there is a blunder at the very root of Aristotle's political philosophy" in "Three Fundamental Theorems in Aristotle's *Politics*", 54 in particular; cf also *Pol.* VII. 4.1325b40–1326a5 on how the statesman (*politikōi*) and lawgiver (*nomothetēi*) are comparable to workmen (*dēmiourgois*) like the weaver (*huphantēi*) or shipbuilder (*naupēgōi*).

[367] *Ph*. II. 2. 194b2–8.

[368] *Pol.* I. 4. 1253b28–1254a9.

situations, [369] and include inter alia doctors, [370] builders, [371] , rhetoricians, [372] and politicians.[373] Each area contains master-craftsmen, though not every type within it will be a master-craftsman since they are qualified by the specific kind of knowledge they have relative to low-level artisans, those with mere experience, or even those who simply understand a subject from a theoretical or scientific point of view. If all of these master-craftsmen are collectively relieved of the necessity of subordinate labour, the range of Aristotle's counterfactual extends far beyond what we might assume at first glance. His unreal world could apply to the area of politicians and their subordinate administrators[374] just as well as the master builder and his subordinate handymen.

Aristotle does, however, single out two particular areas of craft in his counterfactual: weaving and music. By focusing on self-weaving shuttles and plectra that strike lyres by themselves, he gives us an indication as to where he thinks automation might be most relevant. The act of weaving and the act of striking lyres with plectra, within the crafts of weaving and music more generally, are closely associated through process and repetitive

[369] This is precisely the substance of the critique against David Charles made by Katayama, "David Charles and Aristotle's Master Craftsmen", 2011, 145: to "cast doubt on Charles's interpretation that *all* master craftsmen have the ability to latch onto objective kinds" since "there are different kinds of craftsmen with their own unique standpoint from which they encounter natural kinds"; See also Landrum, "Before Architecture: *Archai*, Architects and Architectonics in Plato and Aristotle", 2015, 19 on the "plasticity, inclusivity, and mobility of Aristotle's architectonic qualification. Its scope and capabilities are general and loose enough so as to be adapted—like a malleable rule—to diverse arenas of action, without losing sight of any architectonic art's fundamental target: obligations to the common good."

[370] *Pol.* III. 11. 1282a2–5; cf the contrast here with those who have studied medicine as part of their educational program (*pepaideumenos*)

[371] *Ph.* II. 2. 194a25 –27, implicit as the builder (*oikodomou*) is said to know the form (*eidos*) and the matter (*hylnē*) in their craft.

[372] *Poet.* 1456b10–11, implicit as the art of the diction (*lexin*) belongs to rhetoric.

[373] *Eth. Nic.* I. 1. 1094a26–28.

[374] For a thorough treatment of this subordinate administration and the role of public slaves, for example, see Ismard, *La Démocratie contre les experts*, 2015, *passim*.

rhythm.[375] Moreover both fall in areas that Aristotle finds normatively inferior in some or other way, relative to the standard and proper preserve of the free, adult Greek man. His reference to weaving takes on a strongly gendered implication given its association with the work of women. As Kathryn Sullivan Kruger so aptly puts it, "Traditionally, the history of weaving is a history of women's work".[376] Greek society during Aristotle's time was no exception.[377] Similarly and as regards music-making, Aristotle is clear that while some musical education will benefit the citizen,[378] making music for others risks the threat of unmanly vulgarization:

> For Zeus himself does not sing or play the lyre (*kitharzei*) for the poets, but we call the ones of this sort vulgar (*banausous*) and the actions [are] not manly (*ouk andros*) except when drunk or playing like a child.[379]

Both of these crafts then, music-making and weaving, risk the emasculation and vulgarization of the ideal Greek male citizen. They should not be performed by proper Greek men, according to Aristotle. This language not only identifies the inherently

[375] On this point and more specifically the linguistic connection between acts of weaving and making music, see Fanfani, "Weaving a Song. Convergences in Greek Poetic Imagery between Textile and Musical Terminology", 2017, 421–436.

[376] Kruger, *Weaving the Word: The Metaphorics of Weaving and Female Textual Production*, 2001, 22.

[377] See Brock, "The Labour of Women in Classical Athens", 1994, 336–346; Barber, *Women's Work*, 1994, *passim*; Lee, "Dress and Adornment in Archaic and Classical Greece", 2012, 180: "The proper Greek woman produced textiles, just as she produced children, for the benefit of her husband's *oikos*; Karanika, *Voices at Work*, 2014, *passim*; Tsakirgis, "Whole Cloth", 2016, 83–184 in particular, noting that "female agency in weaving should not be discounted" and that weaving was not only the preserve of women in lower classes.

[378] *Pol.* VIII. 5. 1340b12–15. For a discussion of Aristotle and music – including the issue of *mousikē* taken in a narrow or broad sense where the latter is akin to culture and includes poetry – see Lord, *Education and Culture in the Political Thought of Aristotle*, 1982, 93; Kraut, *Aristotle – Politics*, 1997, 141; 178–179; 193; 204; Ford, "Catharsis, 2004, 309–336.

[379] *Pol.* VIII. 5. 1339b9–10. On a further association between playing the lyre and developing a feminine and submissive qualities, see Hdt. I. 155.

prejudiced and gendered assumptions of work in Aristotle's theory, but also his imagination of the release from labour through automated tools. Tasks considered vulgar or effeminate might no longer accrue to humans and so no longer burden women and subordinate craft workers in particular. But Aristotle proceeds under the assumption that this kind of automation is not possible in his time.

Masters with no need for slaves

Whereas a world where master-craftsmen do not need subordinates tells us a bit about the scope of, and normative implications for the defined arts involved, a world without the additional need for slaves is qualitatively different. Master-craftsmen are more knowledgeable and competent in their arts than their subordinates. But slaves, for Aristotle, are *by nature* different to masters. Moreover, whereas a master-craftsman can exist independently from subordinates, masters and slaves form a dyadic relationship of dependence. The partnership between master and slave is one of those instantiated relations of necessity (*anangkē*) where partners cannot exist without each other.[380] At first glance, a master with no need for a slave would no longer qualify as a master since the necessity that underpins this relationship has been dissolved. A world where masters have no need of slaves then is a world in which the very role of mastery would seem to be obsolete.

But does Aristotle really mean that the master-slave relation ceases to exist in the unreal automated world? To assess this, we must first examine the type of necessary slavery Aristotle has in mind in his counterfactual. We know Aristotle admits that slaves are not

[380] *Pol.* I. 2. 1252a25–1252b1.

strictly necessary in the first place. They are certainly an instantiation in the household of the necessary relationship between natural ruler (*archon*) and ruled (*archomenon*) for the sake of preservation (*dia tēn sōtērian*).[381] But as we have seen, slaves can be substituted by other natural ruled elements like animals, wives, and children. [382] Such substitutions are, for Aristotle, impoverished ones. It is non-Greek speaking societies (*barbaroi*) who maintain no difference between female (*thēlu*) and slavish (*doulon*), and who have no class of natural ruler (*archon*) in the household. Aristotle therefore approves Euripides' saying that Greeks should rule over these peoples, as the latter are the same as slaves.[383] Greeks should aim at making dignified, natural distinctions in their households and avoid confusing the position of women and children with slaves.

Per the Delphic knife principle, slaves have a distinct function for preservation (*dia tēn sōtērian*) and collective self-sufficiency (*autarkeias*).[384] Only once these goods are properly obtained by the appropriate tool – namely natural slaves – can masters turn to living well (*tou eu zēn*) and indeed *eudaimonia*, as no *eudaimonia* can exist without preservation and self-sufficiency. As Malcolm Heath has already argued, it is "hypothetically necessary…that natural slaves exist" because without slaves, "masters' natural capacity for *eudaimonia* would be frustrated".[385] For Aristotle, natural slaves are a step up to the undignified and/or impoverished misuse of animals, wives, and children, allowing humans to move beyond preservation and into flourishing. While they might not be strictly necessary, they are

[381] *Pol.* I. 2. 1252a30–31.

[382] *Pol.* I. 2.1252b11–b12; VI. 8. 1323a5–6.

[383] *Pol.* I. 2. 1252b5–9; *IA.* 1400–1401.

[384] *Pol.* I. 2. 1252b29.

[385] Heath, "Aristotle on Natural Slavery", 2008, 264; cf. *Pol.* I. 9. 1256b20–22.

nevertheless necessary for flourishing. Nature is not a miser who makes things poorly. For Aristotle, natural slaves are thus supplied as fit for purpose in the course human perfectibility. This attitude, as we saw, is precisely what also disturbs Marx in his reference to this passage.

We should therefore read Aristotle as saying that in the unreal world of his counterfactual it is the master's hypothetical necessity for *eudaimonia* that is implicated, not that slavery is necessary in general. Masters would no longer need slaves *for flourishing* if they could rely on automated, artificial tools. Indeed, this would appear to relieve man of the need to engage in mastery itself, which Aristotle considers as neither being great (*mega echousa*) or dignified (*semnon*), suited to stewards (*epitropos*) so that time can be spent in politics or philosophy, and ultimately distinct from political rule more generally.[386] As Aristotle says, "There is nothing dignified (*semnon*) in using a slave as a slave (*doulos*): [giving] commands (*epitaxis*) regarding necessities (*peri tōn anangkaiōn*) has no share of fine things (*tōn kalōn*)". [387] But there are a few good reasons to suppose that mastery persists in the unreal automated world.

So how then can the master-slave relation persist in the unreal automated world? We may assume that masters would no longer need natural slaves for flourishing if they could rely on automated, artificial tools. But perhaps other kinds of slaves might still exist. In the *Nicomachean Ethics*, we saw that Aristotle specifies a critical relation: "the slave (*doulos*) is an animate tool (*organon*), and the tool (*organon*) is an inanimate slave (*doulos*)."[388] Usually

[386] *Pol.* I. 7. 1255b16–19; 1255b30–38; III. 4. 1277a27–37; VII. 2. 1324b32–40; on this point see Schofield, "Ideology and Philosophy in Aristotle's Theory of Slavery", 1999, 113–115; also Frank, *A Democracy of Distinction*, 2005, 28, who refers to mastery per Aristotle as a "servile" science.

[387] *Pol.* VII. 3. 1325a25–27.

[388] *Eth. Nic.* VIII. 11. 1161b3–4.

we are interested in the position of the slave as a tool, but the fact that Aristotle goes on to say that a tool is a type of slave too is striking. It means that his concept of *doulos* is also wider than we might assume at first blush. In the unreal automated world therefore, masters persist because *slaves* might still nominally exist artificially as automated tools.

But can artificial slavery of living persons also persist? Peter Garnsey, who has described Aristotle's theory of natural slavery as a "battered shipwreck of a theory", notes that the inconsistencies between Aristotle's discussion of slaves in certain passages of the *Nicomachean Ethics* and *Politics* suggests that what he has in mind in these former passages is *legal slaves* rather than natural slaves.[389] Legal slaves are those enslaved by law (*kata nomon*) and force (*biastheīsi*) and such a slavery can be therefore be termed an artificial product itself.[390] Just because masters no longer need natural slaves for *eudaimonia*, does not mean that legal slavery and the practices surrounding it are in any way abolished. Automated tools do not herald a necessary end to slavery, simply put.

Why, then, automate tools in the first place? On one hand and per Aristotle's Delphic knife principle, nature provides sufficiently for purpose. Moreover, there exists the empirical impossibility of automated tools *during Aristotle's time*. As such, natural slaves are fit for the purpose of allowing masters to realize *eudaimonia*. Aristotle is not offering a radical criticism of slavery as practised at the time, and even his best *politeia* will perhaps (*isōs*) of necessity (*anangkaion*) contain the presence of a [large] number of slaves".[391] As Richard Kraut puts it, for Aristotle "most of those who serve as slaves in Greece are justly

[389] Garnsey, *Ideas of Slavery from Aristotle to Augustine*, 1996, 107; 115–119 in particular, and regarding the treatment of slavery as a comparison for a political relation of tyranny.

[390] *Pol.* I. 6. 1255b14–15.

[391] *Pol.* VII. 4. 1326a19–20. See also the need (*anangkaion*) for the actual tillers of the soil (*georgous*) to be slaves (*doulous*), or non-Greek speaking (*barbarous*) subjects (*perioikous*) at VII. 10. 1329a24–25; also 10. 1330a25–30.

enslaved".[392] And yet on the other hand the theoretical possibility of automated tools offers a way for man to rely on dispassionate tools that cannot disobey what is required of them in terms of the work that needs to be completed. Man could assimilate the lives of the gods as a divine ideal, and we might imagine that the scope of political possibilities widens as well. With the burdens of mastery eased, we might expect that more time can be devoted to politics or philosophy, as Aristotle mentions.[393] This holds out the possibility of a more politically engaged class of citizens. But it also bears on the nature of that politics itself. Non-Greek speaking societies (*barbaroi*), per Aristotle, are composed – from their household levels – of slave associations.[394] For Aristotle, this is unlike the Greek societies of his own time. It is the *barbaroi* that are more slavish (*doulikōteroi*) by nature than Greeks. Consequently, the forms of *politeia* they exhibit are of a more despotic (*despotikēn*) nature.[395] Such rule as monarchy and tyranny suit these societies. The Greeks however are able to aim higher, remain free, govern themselves politically in the best manner, and have the capacity to rule all.[396] More liberal forms of *politeia*, like democracy, and the capacity to be ruled and rule in turn, are open to them. If we assume therefore that the possibility of more liberal forms of *politeia* arises when societies are composed less of naturally slavish groups of people, then the unreal world of automated tools would tend to favour these *politeia* and further liberal developments to, and from them. In short, we might reasonably assume that in Aristotle's theory, automation is associated with freer political regimes. It holds out an

[392] Kraut, *Aristotle: Political Philosophy*, 2002, 285.

[393] *Pol.* I. 7. 1255b30–38; cf the leisure (*scholēs*) needed for political action at VII. 9. 1329a1–2.

[394] *Pol.* I. 2. 1252b7–8.

[395] *Pol.* III. 14. 1285a18–23.

[396] *Pol.* VII. 7. 1327b30–34.

imaginary of how the Greeks might conduct their affairs like Homer's gods who gather together in their assemblies (*agōnes*). Aristotle is therefore caught between a compelling, wondrous impossibility during his time, and a relatively inferior natural reality.

Chapter Three: The Medieval Christian Organ(on)

I. The Medieval Moment

The rediscovery of Aristotle's *Politics* in Western thought provides the next moment for our analysis. But to understand why we should next turn to the medieval period and its Aristotelian scholars for the reception of Aristotle's passage on automation, it is illuminating to first detour a bit to consult what Marx has to say here. Marx understood quite well that Aristotle's passage on automation defended the assumption that, in the absence of automated artificial tools, slavery of one was required for the development of another. But he also makes a point of identifying a radical extension of this principle – slavery of the masses – with the development of Christianity itself. In his footnote on Aristotle's passage he notes the following:

> But they lacked the specifically Christian qualities (*das specifisch christliche Organ*) which would have enabled them to preach (*predigen*) the slavery of the masses (*Sklaverei der Massen*), in order that a few crude and half-educated parvenus might become "eminent spinners", "extensive sausage-makers" and "influential shoe-black dealers".[397]

To Marx, Christianity's success allowed for the possibility that masses of people could be thrown into servitude, and that social strata could be broken open for economic exploitation. The so-called *christliche Organ* goes beyond enslaving someone for personal development, but in fact acts as a great leveller. Peter Garnsey, drawing on various literary sources that include the words of Paul regarding the *doulos*, puts it thusly, "in Christian

[397] Marx, *Das Kapital,* 1867, 398–399 (533).

theology it can be a good thing to be a slave – a slave of God, that is, as opposed to a slave of sin".[398]

To examine the medieval Christian commentators on Aristotle's text therefore allows us to understand some key inflections of the *christliche Organ* as regards the issue of slavery and political thought. Aristotle's comments about the artificial automated tool substitute sheds light on his expectations of slaves and subordinate craft workers, as well as his attitudes towards work and the cognitive requirements thereof. The commentaries on Aristotle's text by thinkers like Albertus Magnus, Thomas Aquinas, Nicole Oresme, and Leonardo Bruni show the transformation of these expectations and attitudes within the bath of Christian thinking. Slavery was by no means an anathema in the medieval period, although it was increasingly geographically and regionally distinguished and appeared alongside other forms of unfreedom like captivity and serfdom. This is reinforced by recent scholarship countering abolitionist narratives on the period. Orlando Patterson notes quite explicitly that "Christianity was to provide institutional support and religious authority for the advanced slave systems of medieval Europe and of the modern Americas". [399]

But slavery is not the only transformation of interest to us that emerges out of Aristotle's passage on automation in this period. The possibility of automata, and of the

[398] Garnsey, *Ideas of Slavery from Aristotle to Augustine*, 1996, 18. At 7 per footnote 16 Garnsey notes and warns against an early tradition seeing "the generally benign and ameliorating effect of Christianity" or even outright opposition to it. On this he points to Wallon, *Histoire de l'esclavage dans l'antiquité,* 1847, and Allard, Paul, *Les esclaves chrétiens*, 1876. See also Wiedemann, *Greek and Roman Slavery*, 1981, 13, that "Stoic philosophy, and later Christianity, cannot be considered to have had any noticeable effect on improving the conditions of slaves, let alone leading to its 'abolition'". For more on Paul's references to slavery, *doulos* and slaves of sin/God, see Goodrich, "From Slaves of Sin to Slaves of God", 2013, 509–530.

[399] Patterson, *Slavery and Social Death*, 1982, 72; see also McCormick, "Slavery from Rome to Medieval Europe and Beyond, 2017, 249–264; Irvin, *The History of White People*, 2010, 34–72; Fynn-Paul, "Empire, Monotheism and Slavery in the Greater Mediterranean Region from Antiquity to the Early Modern Era", 2009, 3–40; Davis, *The Problem of Slavery in Western Culture*, 1988, 29–91; Phillips, *Slavery from Roman Times to the Early Transatlantic Trade*, 1985; and seminally, two volumes by Verlinden, *L'Esclavage dans l'Europe médiévale*, 1955–1977.

types of automated tools contemplated in the *Politics*, finds itself situated between magic, the occult, and the development of modern mechanism. The wondrous *automata* of the Greek imaginary that we saw in previous chapters spans the medieval period through concrete things that, as Elly Truitt puts it, evoke in the Latins "amazement, suspicion, desire, and fear". These objects were seen to have a kind of "alien [origin]" requiring writers and scholars "to place them in a Latin Christian context and to understand them according to a scientific framework that did not privilege mechanical knowledge".[400] We find this transformation occurring as well within the reception of Aristotle's *Politics* through William of Moerbeke's Latin translation of the Greek text. As we shall see, this text shaped the commentaries of some of the key medieval thinkers and later translators who engaged with Aristotle's work. In this engagement we find connections between *spontaneos* automata and natural or demonic/dark magic, mechanism, and affect.

From historical texts, these automata were translated into literary contexts and then "reinscribed into historical legend and biography". While in the 12th and 13th century, automata were "most often represented as the products of astonishing erudition in the liberal arts and natural philosophy", by the mid-14th century BCE "artists and engineers began to create richly ornamented self-moving machines that incorporated human and animal figures as centerpieces for courtly pageantry or for the glory of the Church". These later automata were elaborately constructed using "gears, levers, and counterweights" which "permitted the fabrication of increasingly complex mimetic machines". According to Truitt, men who made these automata in the earlier periods were "philosophers as well as sorcerers, while medieval philosophers with particular interests in

[400] Truitt, *Medieval Robots*, 2015, 8.

the *quadrivium* in later periods were characterized as sorcerers for having created automata."[401]

This chapter will therefore seek to recover the reception of Aristotle's passage on automation in the Latin West. It aims to highlight the transformations and interpretations that bear on issues of slavery, magic, and mechanism in the development of what we might, following Marx, call the *christliche Organ*. To do so, we will first examine the rediscovery and reception of Aristotle's *Politics* into medieval circles through the Moerbeke translations. Christoph Flüeler's two volumes on the *Rezeption und Interpretation der Aristotelischen Politica im späten Mittelalter* remain authoritative here.[402] Second, we turn briefly to literary and material culture automata present during this period. As Truitt notes, a kind of wondrous magic and occult sense suffuse the former kind, associated with sorcerers and philosophers. The kind of automata that were actually built, however, speak to the increasing turn towards mechanism and the work of artisans in providing pageantry and display. After this contextual review, we will then turn to the commentaries on Aristotle by, and political thought of Albertus Magnus, Thomas Aquinas, Nicole Oresme, and Leonardo Bruni respectively.[403]

We will see how Magnus, who attained a reputation for the occult and making "either through demonic or astral magic, oracular heads or statues that would reveal to

[401] Truitt, *Medieval Robots*, 2015, 8.

[402] Flüeler, *Rezeption und Interpretation der Aristotelischen Politica im späten Mittelalter*, 1992–1993, two volumes.

[403] Aside from the German and Italian friars, and the French bishop, another significant commentary on the *Politics* was written by Walter Burley. The relevant manuscripts have not been transcribed from their original formats: the Vatican's MSS Borgh. 129, and Balliol College's MSS 95. For an overview of scholarship on Burley's texts see Lambertini, "Burley's Commentary on the Politics", 2013, 347–352. Peter of Auvergne also commented on the *Politics'* Books III – VIII, completing Aquinas' unfinished work – this set is sometimes referred to as the Aquinas-Auvergne commentary. Other scholars include Guido Verani, Nicolas de Waldemonte (ps. John Buridan), and later 15th century scholars – see Flüeler, "Political Aristotelianism", 2011, 1038–1040.

[him] both future events and further occult knowledge, offers his own interpretation of Moerbeke's version of the text in the 13th century CE. He characterises slaves and subordinate craft workers as *motore animato* or external, animated sources of movement required to make use of inanimate tools for the purposes of the work to be performed. Automated tools make an exterior source of movement redundant, transforming it into an internal source. For these tools to replace workers they must be able to have estimative knowledge (*vis aestimativa*) and preconceive (*praeconcipere*) what needs to be done.

Aquinas, later in the same century, tells us how the arts used to fabricate Daedalus' statues in the *Politics* required quicksilver – deriving this from Aristotle's comments in *De Anima*. The Homeric tripods *seemed* to act almost (*quasi*) spontaneously (*spontanei*) by themselves as creations of either human handiwork or black magic (*artem nigromanticum*). For an automated tool to replace workers it must recognize (*agnoscens*) the master's command and what it means. Aquinas' automated tools would need to be able to form linguistic conceptions of the command and are therefore not purely perceptual beings, but have some form of cognition too.

Turning to Oresme in the 14th century, we see how Moerbeke's Latin is translated into a vernacular, French, for the first time. Oresme ignores *proaisthanomenon* in his commentary on Aristotle's passage on automation and focuses only on the command. The counterfactual automated tool might share perception (*apparcevance*) with dumb beasts but the work it is required to perform does require *some* level of perception (*sens)* of reason that allows for the command to be fully understood. Other animals appear not to have this, and only obey their passions. Finally, Leonardo Bruni offers a new way of translating Aristotle's *Politics* in the 15th century that absorbs it into the Latin mind, outdating Moerbeke's version and introducing the disjunctive condition through the use of *vel* instead of *et*. Moreover, he

translates *proaisthanomenon* as *ad nutum*, which offers a rich way of thinking about the master's gestural authority over the worker and counterfactual tool.

What emerges from this analysis is an ongoing conversation with Aristotle's political thought and theory of automation nearly 1500 years later. It highlights the extent to which Aristotle continued to shape political ideas around the nature and distribution of labour and work, and the conditions for emancipation from it. The medieval Christian moment sets a dramatic stage for the proliferation of automata and mechanism in the Renaissance and early modern period. More importantly, it situates these *spontaneos* marvels within the purview of political thought and imagination. As the following chapter shows, thinkers like Hobbes will further transform and extend these ideas into the heart of politics – the creation of Leviathan or the modern state itself.

II. The Rediscovery of the *Politics*

Aristotle's *Politics* had, by no means, an unbroken presence in intellectual circles since antiquity. It is only from the late 13th century CE onwards that the text emerges alongside other Aristotelian works in curricula and commentaries in the Latin West. This makes the *Politics* a late child to the study of Aristotle. The earliest works available were predominantly those on Aristotle's logic. Boethius' Latin translations of parts of the *Organon* were available from the late 5th century CE, including the *Sophistical Refutations, De Interpretatione, Topica, Prior Analytics,* and the *Categories*. In summarizing this development in the Latin West, Grace Allen notes that in "the mid-twelfth century James of Venice produced Latin versions (translated from the Greek) of the *Physics*, *De anima*, *Metaphysics* and *Parva naturalia*, and made new versions of some of the works translated by Boethius, as well as composing and translating commentaries on Aristotelian logic." After another century or so, "Michael Scot

(1175–c.1232) made a version of *De animalibus* and also, more significantly, translated the Arabic commentaries of Averroes (1126–1198) on the *Physics*, *De caelo*, *De anima*, and *Metaphysics* into Latin in the 1220s and 1230s." Allen notes further that for "the treatise closest in content to the *Politics*, the *Nicomachean Ethics*, two twelfth-century fragmentary translations, the *Ethica nova* and the *Ethica vetus*, possibly by Burgundion of Pisa (c. 1110–1193), preceded a thirteenth-century complete version made in Oxford around 1246-7 by Robert Grosseteste (c. 1175–1253)." It is only in the late 13th century that William of Moerbeke turns his attention to this text, "as part of his revision of the entire Aristotelian corpus". Additionally around this time, "a Latin translation of an Arabic epitome of the *Ethics* was made by Hermannus Alemannus."[404] The role of translation, and particularly the transmission of Aristotle across Byzantine, Arab, and Jewish scholarship into the Latin West cannot therefore be understated.[405] But while there is an indication that there was *some* knowledge about the existence of the *Politics* in these circles, there was no knowledge of, and engagement with the text itself.[406]

This, however, does not mean that any idea of 'political Aristotelianism' was entirely absent before the rediscovery of the *Politics*. As Flüeler notes, political Aristotelianism "is not limited to the reception of Aristotle's *Politics*, but involves a more complex understanding of the entire body of Aristotelian works."[407] Aristotelian ideas on ethics and practical philosophy, for example, were certainly transmitted through texts like

[404] Allen, *Vernacular Encounters with Aristotle's Politics in Italy*, 2015, 17–18.

[405] See for example Burnett, "Arabic into Latin", 2005, 370–404; Hasse, "The Social Conditions of the Arabic-(Hebrew) Latin Translation Movements in Medieval Spain and in the Renaissance", 2006, 68–86; Marenbon, "Aristotelianism in the Greek, Latin, Syriac, Arabic, and Hebrew Traditions", 2011, 99–105.

[406] Flüeler, *Rezeption und Interpretation der Aristotelischen Politica im späten Mittelalter*, 1992–1993, 10.

[407] See Flüeler, "Political Aristotelianism", 2011, 1039.

the *Nicomachean Ethics* and *Metaphysics* and through Arabic thinkers like Ibn-Sīnā, (Avicenna), Ibn-Rushd (Averroes), and Al-Farabi.[408] And as Cary Nederman has shown, there are various fragments of Aristotle's moral and political thought in the works of Cicero and Boethius, on which some 11-12th century CE thinkers like John of Salisbury relied.[409] Augustine's political ideas on man as the most social of all animals also created a prior point of continuity with Aristotle's practical political philosophy.[410] There was therefore, as Allen notes, no "vacuum in medieval Europe before the reintroduction of Aristotelianism".[411] Moreover, Aristotelian political ideas were certainly present before the rediscovery of the *Politics* itself.

Somewhere around or just after 1260 CE the Flemish Dominican, William of Moerbeke, completed his first attempt at translating Aristotle's *Politics*. Moerbeke, named archbishop of Corinth at one point later in his life, had found the Greek text of Aristotle's *Politics* in Greece and had begun to translate it into Latin for the first time. He was a magisterial and voluminous translator not just of Aristotle's works, but also others like Proclus, Galen, and Archimedes. His first attempt to translate the *Politics* is dated between 1255 and 1261 CE and is usually referred to as the *Translatio prior* or *imperfecta*, as it covers only Books I to II. 11. By around 1265 CE, Moerbeke had produced another, more complete translation of the *Politics* known as the *Translatio integra* or *completea*. While Moerbeke was committed to an extremely literal translation style, word-for-word (*verbum de*

[408] Flüeler, *Rezeption und Interpretation der Aristotelischen Politica im späten Mittelalter*, 1992–1993, 8–15.

[409] Nederman, "Aristotelianism and the Origins of "Political Science", 1991, 183–189. See also Schütrumpf, *The Earliest Translations of Aristotle's Politics and the Creation of Political Terminology*, 2014, 9–12 and footnote 7 in particular.

[410] But note the differences with Aristotle as R. W. Dyson points out – Augustine does not consider man to be naturally political. See Augustine, *The City of God Against the Pagans*, translated edition, 1998, xvii.

[411] Allen, *Vernacular Encounters with Aristotle's Politics in Italy*, 2015, 20.

verbo), and fidelity to the original Greek, his second translation has been deemed "remarkably superior over the first one" owing to the availability of better Greek texts and manuscript familiarity.[412]

In 1872, Franz Susemihl's published a critical and revised edition of Moerbeke's translations of the *Politics*, repairing earlier work and based on a collation of several earlier manuscripts belonging to two distinct families of transmission. From this authoritative text we can glean how Moerbeke translated Aristotle from his Greek source for our relevant passage on automation in Book I:

> *Si enim posset unumquodque organorum iussum et praesentiens perficere suum opus, quemamodmum quae Daedali aiunt aut Vulcani tripodas, quos ait poeta spontaneos divinum subinduere agonem, sic si pectines pectinarent per se et plectra citharizarent, nihil utique opus esset architectonibus ministrorum neque dominis servorum.*[413]

We see here that command (*keleusthen*) is taken as *iussum*, and advance perception (*proaisthanomenon*) as *praesentiens*. *Automatous* is taken as *spontaneos*. Our master-craftsmen are referred to as *architectonibus*, while craft subordinates are *ministrorum*. Masters are *dominis*, while slaves are *sevorum* in grammatical context.

Firstly, we note an important transformation here with the association of *automata*, through its form *automatous*, with the Latin of language of *spontaneous*, *sua sponte* more generally, and the reflexive *per se* movement of the shuttles. The scene is clearly set for an

[412] Schütrumpf, *The Earliest Translations of Aristotle's Politics and the Creation of Political Terminology*, 2014, 14–15. The comparison of these two versions was made by Verbeke, "Moerbeke, traducteur et interprète; un texte et une pensée", 1989, 1–21.

[413] Text drawn from *Aristoteles Politicorum Libri Octo Cum Vetusta Translatione Guilelmi De Moerbeka*, Franz Susemihl's edition, 1872. For an overview of the distinct families and manuscripts at work in collation efforts, see Newman, *Politics of Aristotle with an Introduction*, 1887, xli–lxvii.

understanding of Homer's tripods as things that act spontaneously in the medieval period. *Spontaneos*, however, takes on a more deliberate inflection than *automata* had in the Greek. It involves a concrete sense of willing – what is voluntary. As Augustine famously declares in Book I of *De Civitate Dei*, suicide, or voluntary death, is expressly forbidden:

> This we say, this we declare, this we by all means endorse: that no man ought to inflict on himself a voluntary death (*spontaneam mortem*), thinking to escape temporary ills, lest he find himself among ills that are unending; [414]

This notion of "*mors spontanea*" forms the basis of the next Chapter XXVII, treating the case where suicide is committed in order to avoid sinning.[415] The idea of a willed action is inescapable here, and also repeats in later 11-12th century CE thinkers like Peter Abelard:

> Otherwise they would have more merit with God, who have carried the heavy yoke of the law rather than served under the liberty of the gospel, because fear (*timor*) has to do with punishment and perfect love (*perfecta caritas*) casts out fear and whoever acts by fear, labours more in work than those in whom charity makes willing (*spontaneos*).[416]

For Abelard, the perfect love that finds itself in believers of the gospel allows a kind of obedience not based out of fear of punishment. Making this transition from fear to love turns one from a coercive kind of obedience to an inner voluntary kind. As Ineke van 't

[414] Augustine, *De Civitate Dei Contra Paganos*, I. XXVI.

[415] Augustine, *De Civitate Dei Contra Paganos*, I. XXVII.

[416] Abelard, *Scito te Ipsum,* I. 47, 8–48, 4, 1235–1240. I make use of the translation offered by Van 't Spijker, "Conflict and Correspondence, 2014, 93.

Spijker puts it, this is a transition "from external obedience to inner love". This allows obedience to become *spontaneous*, or fully voluntary/willing.

Secondly, we also note that the Moerbeke edition, "largely used in the middle ages notwithstanding the censure passed by Roger Bacon on the class of translations to which it belongs and its occasional almost complete unintelligibility", collapses the disjunctive space between command (*iussum*) and advance perception (*praesentiens*) through *et* (or *kai* in the Greek) instead of *vel* (or *ē* in the Greek). [417] The Moerbeke edition could simply be using *et* to imply that *praesentiens* is an additional condition that satisfies (i.e. both satisfy as *vel* would also suggest in the weak disjunctive sense), or alternatively that automation might occur in tools that that act reflexively to complete their work by *first* being commanded and then perceiving in advance what to do once they are so commanded. For the latter case, the command must be present as the relevant input stimulus each time. This ambiguity, as we shall see, holds implications for some of our commentators, who tend to emphasize the command over the conditioned advance perception.

III. Medieval Automata

To date, the seminal work on medieval automata remains Elly Truitt's study on *Medieval Robots*. Unlike the title might suggest, Truitt's focus on automata is much broader than our contemporary understanding of robots. The automata Truitt examines share two things in common: "they were apparently self-moving or self-sustaining manufactured objects, and

[417] Newman, *Politics of Aristotle*, 1887, xliv–xlv. On the manuscripts that retain the disjunction (MSS Γ) versus the conjunction see Susemihl's *Aristoteles Politicorum Libri*, 1872, 14. Modern translators including Bekker seem to have favoured the disjunctive version, which makes better sense contextually as well. Homer's tripods, for example, are not said to be commanded in order that they move in the *Iliad*, a fact that Aristotle must have known from his reference to this text.

they mimicked natural forms". Moreover, as we saw with *automata* in the Greek world, "the medieval category was not limited to mechanical causality, and so "it allowed for more variation in terms of structure and operation", including magic.[418] These automata appeared in both literary culture, as well as material objects. By examining both types we are able to give context to the rediscovery of Aristotle's *Politics* and the commentaries on his critical passage regarding automation.

Literary Automata

There are two important aspects of medieval literary automata relevant for our purposes. The first concerns the powerful affective dimension these automata held out for those who remarked on them. The second concerns their fabrication methods – whether attributed to (black or natural) magic, astral science, or the occult. What emerges from this review is a picture of automata that is far from marginal in the medieval imaginary, and which paradoxically served to entrench political power as much as it created a suspicion against those who engaged with it.

Turning first to affect, we note that the earliest description of automata in the Latin West is from the start of the 9th century CE and refers to a water clock (clepsydra) sent from the Abbasid Caliph, Harun Al-Rashid, to the Frankish king, Charlemagne. As Truitt notes, "Throughout much of the medieval period, Latin Christians associated automata with Arab, Greek, and Mongol courts and saw them…as products of foreign knowledge and exotic materials not easily available to themselves".[419] As such, automata held the status of

[418] Truitt, *Medieval Robots*, 2015, 2–3. On automata in medieval Europe see also Ambrosetti, *Cultural Roots of Technology*, 2010, 124–165.

[419] Truitt, *Medieval Robots*, 2015, 19.

exotic marvels and wonders and so featured as diplomatic gifts. The Abbasid water clock is described as follows:

> marvellously (*mirifice*) contrived by mechanical art (*arte mechanica*), on which the course of the twelve hours was marked by a clepsydra, with the right number of little bronze balls, which would fall into a basin when the hour was complete and make it sound. [This clock] also had the same number of horsemen, and they would, through twelve windows, come forth at the end of the hours. With the force of their exit they would close the proper number of windows, which had before been open.[420]

Clearly *mirifice* automata had not lost much of their wondrous shine since the 4th century BCE kinds we encountered in Greece in Chapter One.

We see this exoticism also in Frankish poetic comparisons between Charlemagne and the fictional Byzantine Emperor Hugo of Greece. In the *Pèlerinage de Charlemagne*, Hugo's court is said to contain automata that move in a lifelike manner.[421] They established Hugo as a "thaumaturgical ruler, able to perform miracles". Charles, in contrast, is "amazed and floored by the wonders of Hugo's court", reacting with curiosity, concern, envy, and wonder."[422]This, however, is not the end of the story. The Latins were, in the first place, eager to emphasize their *spiritual* superiority over their Eastern and foreign counterparts more generally. Hugo might avail himself to a quite natural ability to create marvels, but Charlemagne still triumphs eventually because he has God on his side, "The

[420] Translation from Truitt, *Medieval Robots*, 2015, 21. Taken from *Annales regni Francorum*, ed. F. Kurze, 1895), 123–124.

[421] *Pèlerinage de Charlemagne*, 1925 edition, 364; 374. *Que ço vus fust viarie que tut fussent vivant*, and *Que ceo vus fust viarie que il fussent tuz vis*, respectively.

[422] Truitt, *Medieval Robots*, 2015, 29–30.

might of God and his favor for the Latin Church allows a technologically backward and poorer empire to prevail over a more scientifically advanced, schismatic one."[423]

The exoticism and religious suspicion towards these foreign technological marvels transform in the *romans antiques* of the 12-13th century CE. Romantic medieval retellings of ancient epics, for example *Le Roman de Thèbes* (based on the Thebaid) and *Le Roman d'Éneas* (based on the Aeneid), absorb automata into Latin West history as a *legitimating* device for power. In Benoît de Sainte-Maure's 12th century CE *Roman de Troie,* the author describes an Alabaster Chamber filled with moving statue automata created by necromancy (*nigromance*). The fourth automaton, in particular, was in charge of directing the Trojan nobility's behavior and decorum:

> The fourth statue had a very important function: it observed those in the Chamber and signalled to them how they should act and what they most needed. It gave them the information without anyone else noticing it. If there were seven hundred people in the Chamber, each of them would truly know what the statue revealed regarding what they needed most. What it revealed was completely private, for no one else would know anything that it communicated, neither I nor anyone else, other than that one individual. This was truly an ingenious invention. It was a wonder how it could be possible, or how anyone could contrive such a thing. No one was to remain in the Chamber longer than he or she should be there. The statue could indicate when it was time to leave, as well as when it would be too soon or too late; it was constantly on the watch for this. It kept those who came into the Chamber from becoming annoying, boorish or importunate, whether they were entering or leaving it. No one could inadvertently be foolish, boorish or improper, for the statue with great skill kept them all from any baseness."[424]

[423] Truitt, *Medieval Robots*, 2015, 30.

[424] *Roman de Troie*, 14863–14936, 2017 translation, 224. For an overview of this passage see also Sullivan, "Medieval Automata, 1985, 1–20.

These Trojan nobles, however, figured into a projected history that became dominant amongst French and Anglo-Norman courts. As Truitt argues, "ancient legends of Thebes, Troy, and Rome were ideally suited to origin myths of nobility and empire." As a result there existed a "medieval tendency to claim noble descent from Trojan nobility [going] back as early as the seventh-century legend that the Franks were descended from Francio, a survivor of the Trojan War." Truitt therefore suggests that these automata of myth and legend functioned to legitimate medieval nobility, while in turn being legitimated by them: "[by] inserting automata into these stories of nation-building, which had been reinvented to reflect the territorial and political aspirations of the French and Anglo-Norman elites, the authors claimed these marvels as culturally legitimate". This alleviated concerns about how "impious knowledge" could have played a role in their fabrication. Automata, exotic and suspicious marvels, would thus "become part of the classical heritage of the ruling dynasties of Latin Christendom".[425]

The creation of the automata in the Alabaster Chamber above also raises questions about how they were fabricated. One way that these automata were speculated to have been created was through occult or hidden properties of natural substances. Much as Aristotle had related Philippus' attribution of quicksilver to Daedalus' statues in *De Anima*, certain properties were believed to produce the effects that imitated living beings in non-living artifices. Aside from quicksilver, other substances with hidden, wondrous properties included often included lodestones and gems.[426] In the Alabaster Chamber we have many allusions to various exotic gemstones that seem to infuse the space with its wondrous

[425] Truitt, *Medieval Robots*, 2015, 63–65.

[426] Truitt, *Medieval Robots*, 2015, 54.

qualities.[427] We also find a description of the second maiden automaton doing the following:

> On a large, broad table of refined gold in front of her she produced wonders (*merveilles*), the likes of which no one could have imagined – a fight between a bear and a wild boar or a griffin, a tiger or a lion; or the flight of a goshawk, a falcon, a sparrow-hawk or some other bird; games played by ladies or young men; assemblies or ambushes, battles, betrayals or assaults; a boat sailing on high seas; various fish from the sea; single combats; horned men or grotesque figures; flying serpents, small in size and hideous; goblins and dangerous monsters – all these she made appear every day to reveal their natural properties (*lor natures demostrer*). She showed clearly how each of them functioned and what its use was. When one witnessed all these things, they seemed to be marvels (*merveille*). No one could figure out what became of them after their performance. The man who crafted and prepared these statues had a profound knowledge of the arts (*des arz*), as well as of the mysteries of the heavens (*des segreiz des cieus*).[428]

The automaton acts as a manifest expression of her creator's skill in both crafts and natural knowledge of the heavens. It reveals the natural properties of their workings to astound onlookers, indicating that these wondrous automata are associated with a deep knowledge of the natural world. This deep knowledge pushed the boundaries of science or natural philosophy, to manipulation and magic.

Medieval automata in literature were, therefore, often speculated to have been created by some kind of magic – whether black or natural. *Nigromance* or the Latin *necromantia* refer to magic or sorcery generally, and sometimes specifically divining through animals or with the dead. In the *Roman de Thèbes*, the Argive king Adrastus has an ally named

[427] See e.g., *Roman de Troie*, 14631–14656, 2017 translation, 21.

[428] *Roman de Troie*, 14711–14758, 2017 translation, 22.

Amphiras, who is said to be a powerful sorcerer. Amphiras can revive the dead (*revivre fait homes morz*) and knows the secrets of the heavens (*le secrei del ciel*). The author tells us there is no better sorcerer under the heavens, in fact (*soz ciel n'aveit meillor devin*).[429] In his possession he has a powerful chariot which contains musical automata (*images*) created by Vulcan (Hephaestus).[430] Vulcan creates this chariot through craft and through enchantment (*par art et par enchantement*).

Naturally, this association with magic and enchantment came to be viewed as suspicious and even heretical in the Christian Latin West. In Chrétien de Troyes' *Perceval* prose, Perceval encounters a diabolical automaton in a cursed castle, taking the form of a copper bull with an evil spirit (*mauveis esperiz*) inside of it. The castle itself is guarded by copper men automata created by necromancy (*l'art de nigromence*). Only the 13 souls who convert to Christianity are saved from death after Perceval forces those in the castle to run between the copper men. Once this happens, the evil spirit in the bull escapes and leaves.[431] Such black magic often appeared in connection with automata and the sorcerers who were suspected of creating them.

Magic therefore pushed the boundary of what was permissible in the Latin Christian world. Using astral science (as a form of astrology), a subject within the astronomy component of the liberal arts *quadrivum* (along with arithmetic, music, geometry) could blur the boundaries between using the circular motions of the heavens and their interactions with the sublunary world to predict future events, and changing them altogether – between a *scientia divinationis* and an *ars magica*. Using one's natural knowledge of heavenly motions

[429] *Roman de Thèbes*, 2025–2036, 1890 translation, I. 130.

[430] *Roman de Thèbes*, 4715–4778, 1890 translation, I. 230–233.

[431] *Perceval le Gallois, ou le conte du Graal*, 1977 [1866-1871) edition, I. 202–204.

and properties to manipulate nature in an *ars magica* could easily turn into an involvement with demons. Augustine had warned against astral science and superstitious divination in *De Doctrina Christiana*,

> …there are two kinds of learning pursued even in pagan society. One comprises things which have been instituted by humans, the other things already developed, or divinely instituted, which have been observed by them. Of those instituted by humans, some are superstitious (*superstitiosum*), some not. Something instituted by humans is superstitious if it concerns the making and worshipping of idols (*idola*), or the worshipping of the created order or part of it as if it were God, or if it involves certain kinds of consultations or contracts about meaning arranged and ratified with demons (*daemonibus*), such as the enterprises involved in the art of magic (*magicarum artium*), which poets tend to mention rather than to teach. From this category—only their vanity is even more reckless—come the books of haruspices and augurs (*haruspicum et augurum*)… We must not omit from this category of deadly superstition the people called *genethliaci* because of their study of natal days, or now in common parlance *mathematici* [astrologers]. Although they investigate the true position of the stars at a person's birth and sometimes actually succeed in working it out, the fact that they use it to try to predict our activities and the consequences of these activities is a grave error and amounts to selling uneducated people into a wretched form of slavery (*servitutem*).[432]

Thus, while astral science could appropriate heavenly circular motions and was "understood to be a way to gain foreknowledge and create automata", it was also true that, "The range of possibilities, from studying the *quadrivium* to trafficking with demons, runs the gamut from intellectually legitimate to maximally transgressive."[433] Consequently automaton-makers in this earlier medieval period were considered to be those – like

[432] Augustine, *De Doctrina Christiana*, II. 74–78 (90–93).

[433] Truitt, *Medieval Robots*, 2015, 69, 48.

characters in poetic myth, theologians and philosophers – who commanded highly specialized esoteric knowledge and art.

Automata in Material Culture

The kinds of fictional automata mythologized in medieval literature were complemented by kinds that were actually built by artisans. These latter automata gradually began to lose their exotic status in the Latin West by the middle of the 13th century CE. From this period onwards, mechanical automata "became increasingly complex and more commonly fabricated". Truitt notes that as automata "changed from textual to material objects, the methods and materials of their fabrication became more pedestrian: instead of being rare objects that were created or operated with magical, power they constructed with wood, ropes, pipes, and screws." As a result, "the creators of automata changed from the philosophers and magicians (in twelfth- and thirteenth-century romances) to artisans skilled in craft knowledge.[434]These automata included various kinds of fountains, clocks, human and animal figures, and church objects. Artisans relied on mechanical, hydraulic, and pneumatic principles for their operation.

Some of the earliest *designs* for mechanical automata in the Latin West are taken from Villard de Honnecourt's mid-13th century CE notebooks. They include things like a siphon-based Tantalus cup that would give the appearance of drinking to a moving bird figure attached to it, a mechanical pointing angel, a hydraulic-powered saw, a mechanical

[434] Truitt, *Medieval Robots*, 2015, 116–117.

eagle that could turn its head, a hand-warmer, and a perpetual motion machine.[435] Some of the earliest automata actually fabricated, however, appeared at the Hesdin chateau, in Artois: "the automata at Hesdin included trick fountains, a time-keeping device, artificial monkeys and birds, and android automata."[436] Extensive feats of artisanal engineering were undertaken to create this early courtly pleasure garden.

Another type of common automaton amongst the elite included wine and water fountains. Ambrosetti describes their function as follows:

> These devices, known as wine or water fountains, were placed at the center of the table and pumped the liquid automatically (to the top of the fountain) from a large cup that served as base; then the liquid went down from one floor of the fountain to another through animal (or gargoyle) shaped mouths. The guests had just to put their glass under one of these mouths and this would be filled.[437]

These devices have largely not been preserved as they were made of valuable materials and repurposed for other ends. However, one mostly complete and surviving example includes the French 14th century CE gilt-silver fountain in the Cleveland Museum of Art collection.[438]

---

[435] Bechmann, *Villard de Honnecourt*, 1991; Truitt, *Medieval Robots*, 2015, 118; Ambrosetti, *Cultural Roots of Technology*, 2010, 155.

[436] Truitt, *Medieval Robots*, 2015, 122–123. See also Riskin, *The Restless Clock*, 2016, 27–28.

[437] Ambrosetti, *Cultural Roots of Technology*, 2010, 161.

[438] Table fountain, France, Paris, c. 1320–1340, gilt-silver and translucent enamel, 31.1 x 24.1 cm. The Cleveland Museum of Art, J. H. Wade Fund 1924. 859; for an overview of other smaller incomplete finds as well as literary allusions that extend into English and Italian milieus see Fliegel, "The Cleveland Table Fountain and Gothic Automata", 2002, 6–49.

Ecclesiastical objects – figures of Jesus, Mary, devils and all the like – became increasingly complex and more popular towards the late medieval period. But already in the early period, automata of this type were being used to demonstrate Church authority and power through ingenious contrivances – especially as part of musical organs and clockwork. One example, as Jessica Riskin notes, serves to illustrate this pageantry in full display – the Strasbourg Cathedral Rooster. It "cocked its head, flapped its wings, and crowed on the hour atop the Clock of the Three Kinds", sitting above a turning astrolabe with a Magi scene sequence.[439]When the clock was refurbished in the 16th century CE, various other automata were added that included a day date-keeping rotation of the Roman gods, an angel who raised a wand on the hour, an angel that turned an hourglass on a quarter hour, and various others. Writing on his design and part fabrication effort for the clock, Conrad Dasypodius tells us:

> And on this clock we exhibit eternity, the century, the orbits of the planets, the yearly and monthly revolutions of the sun and moon, the divisions of the week, days, hours, parts of hors, minutes; all these I say, we exhibit to be seen. We have added also, for the sake of adornment, splendor, admiration, various contrivances, pneumatic, sphaeropoetic, and automatic (*automatopoetica*), everything from history and the tales of the poets, and also from sacred and profane writings in which there is or can be some delineation of time.[440]

[439] Riskin, *The Restless Clock*, 2016, 17.

[440] Dasypodius, *Heron Mechanicus*, 2008 [1580]), 129.

As Truitt puts it, the clock "celebrates divine creation and memorializes Jesus's sacrifice for mankind, exposes the links between the macrocosm and microcosm, and rests on mechanical principle and skilled labor".[441]

Clockwork automata in general were often attached to ostentatious demonstrations of the power of the Church, but also served to remind people of their working responsibilities. Before the Strasbourg Rooster's construction, a bronze automaton 'overseer' (*dottiere*) was added to the Duomo in Orvieto around 1348. Acting as a striking system, it ensured that workers were aware of working hours so that any tardiness could be easily identified.[442] These automata therefore simultaneously reminded people of their Christian responsibilities, and their secular duties towards work, within the monumental grandeur and power of the Church.

IV. Albertus Magnus

One of the Church's most celebrated saints, Albertus Magnus is credited with both a revival of a new Aristotelianism in the Latin West,[443] and a mythological status as an automaton-maker. On the latter status, Magnus' interest in astral science – for example his defense of astral prediction as a Christian science in the *Speculum Astronomiae* – lent some support to a legend that continued well into the encyclopaedias of the 18th century CE. In the first *Supplement* to Ephraim Chamber's *Cyclopaedia*, notable for one of the earliest uses of the term 'android', compilers have the following written:

[441] Truitt, *Medieval Robots*, 2015, 151.

[442] Ambrosetti, *Cultural Roots of Technology*, 2010, 163.

[443] See Weisheipl, "The Life and Works of St. Albert the Great", 1980, 13–51; Tkacz, "Albertus Magnus and the Recovery of Aristotelian Form", 2011, 735–762.

> Authors sometimes speak of brazen heads made under certain constellations, capable not only of speaking, but of prophesying, and rendering oracles…Albertus Magnus, it is pretended, went further. He made a compleat man, or *Androides*, after this manner; in a course of thirty years continual operation, by taking the benefit of a number of infinite constellations, and aspects, which presented themselves in that time: for instance, the eyes were made, when the sun was in the sign of the zodiac, which bore analogy to that part; and the like of the rest. It is generally said to have been composed of a mixture of divers metals; though some will have it to have been made of flesh and bones. It was burnt by Thomas Aquinas.[444]

The 'androide" in question references an established tradition of attributing to Magnus – without any real substantiation - the creation of a kind of statue automaton or oracular 'talking head'.

In the enigmatic Matteo Corsini's 14th century CE *Rosaio della Vita*, Magnus' automaton and skills had been referenced as follows:

> I could give you infinite examples of how wisdom must be revered and honored, but in order not to be too prolix, I will briefly tell you only one notable one. We find that one Albert the Great, a member of the Preaching Friars, so perfected his reason that by his sagacity (*grande sapienza*) he made a metal statue (*statua di metallo*) according to the courses of the planets, and gave it such reason that it spoke. And this was not by diabolical art (*arte diabiolica*) nor by necromancy (*negromanzia*), since great intellects take no pleasure in that, because it puts both your soul and body at risk, and since that art is forbidden by the Christian faith. Whence, when a friar called on Brother Albert in his cell when he wasn't there, the statue replied. Believing it to be an idol of an evil nature, [the other friar is Aquinas in later legend] broke it. When Brother Albert returned he said many bad things to him, and he said that it had taken him thirty years of work to make it, and "You won't learn that science in the order of the Friars". The friar said, "Forgive me, I did wrong. What can't you make another one?". Brother Albert

[444] Chambers et al, *A Supplement to Mr. Chambers's Cyclopædia*, 1753.

> replied that he could not make another for thirty thousand years, because that planet has made its course and will not return for that length of time."[445]

Corsini is eager to dispel any notion that Magnus' alleged fabrication of his automaton resorted to diabolical or black magic arts contrary to Christian tenets. Instead, it is his perfectly acceptable knowledge of heavenly, orbital and circular motion that is credited with his knowledge of how to make a moving statue in the sublunar world. For this feat, Magnus is considered as having great wisdom (*sapienza*).

It is within this context, therefore, that we should turn to Magnus' commentary on Aristotle's *Politics* and his passage on automation in particular. Flüeler notes that Magnus' commentary was one of the first, if not the first to appear on the Moerbeke version of Aristotle's text.[446] Conor Martin describes Magnus' commentary as one that is reflective, and slightly informal, "Albert is personal, self-revealing, even chatty; and although he gives the impression of writing in a hurry, he is ready to digress on any point suggested by the text, to tell us anything he knows".[447] In the short epilogue to his commentary, Magnus excoriates those anti-Aristotelian Scholastics who he claims be slothful and incurious in their philosophical inquiry, and for which purpose he seeks to offers his own commentary and opinion as a corrective:

> And I say this because some people are idle, who in seeking the comfort of their idleness, seek nothing in the writings but what they might find fault

[445] Corsini, *Rosaio della Vita*, 1845 edition, II. (B), 15–16. I used the translation offered by Katharine Park in Truitt's *Medieval Robots*, 2015, 9–93.

[446] Flüeler, "Political Aristotelianism", 2011, 1039.

[447] Martin, "Some Medieval Commentaries on Aristotle's "Politics"", 1951, 33.

> with: and since such people are torpid in their idleness, they do not [want to] appear alone in their torpidity, [so] they seek to taint the elected. Such people killed Socrates, exiled Plato from Athens in his Academy [there], and in their machinations forced Aristotle to leave, as he said, "To Athens pear trees upon pear trees is not lacking, that is to say, wickedness upon wickedness. I do not consent for the Athenians to sin twice against philosophy. [448]

Magnus is clearly reacting to what he perceives as a profound lack of enthusiasm for truth in the scholarship of his time.

He goes on to compare the idle scholars to the liver in the body, which can dry up and poison the body with its bile and bitterness. In this way these scholars taint others with their poison, stunting the growth of true philosophical discourse, not allowing them to seek the truth (*veritatem*) in the sweetness of society (*in dulcedine societatis*). [449] Such a powerful invective closes his commentary on the *Politics*, and therefore must colour our appreciation of his enthusiasm for both the text and the revival of (political) Aristotelianism more generally.

Magnus takes Aristotle to be describing the necessary despotic nature of rule in the household towards subordinate workers like slaves. A subordinate of this nature is an *organum animatum*, and is needed because inanimate tools, *organa inanimata*, cannot move themselves. Insofar as they cannot move themselves, they are effectively useless:

---

[448] Magnus, "Commentarii in Octo Libros Politicorum Aristotelis, 1891 edition, 803–804: *Et hoc dico propter quosdam inertes, qui solatium suae inertiae quaerentes, nihil quaerunt in scriptis, nisi quod reprehendant: et cum tales sint torpentes in inertia, ne soli torpentes videantur, quaerunt ponere maculum in electis. Tales Socratem occiderunt, Platonem de Athenis in Academiam fugaverunt, in Aristotelem machinantes etiam eum exire compulerunt, sicut ipse dixit, "Athenis numquam defuit pyrus super pyrum id est, malum super malum. Non consentio Atheniensibus bis peccare in philosophiam.*

[449] Magnus, "Commentarii in Octo Libros Politicorum Aristotelis, 803–804.

> However, it is the inanimate tool that comes neither for operation nor use unless through the animated [tool]: because no fields are tilled, nor vineyards cultivated, nor is the ax moved, unless through the animated tool.[450]

Subordinates therefore serve as a kind of *motore animato*. They are external, animated sources of movement that are required to make use of inanimate tools for the purposes of the work to be performed.

As Magnus therefore relates it, automated tools make an exterior source of movement redundant, transforming it into an internal source. The tripods of Vulcan and Daedalus' things do just this, as the poems relate. Similarly:

> For also if weavers' combs wove themselves and would complete their work, and the shuttle freely underlaid the thread by itself , and lyres' plectra would touch and move the chords for the music by themselves without the (external) mover, then having the external mover would not be necessary.[451]

Subordinates, including slaves (*servus*), as animate tools, are needed because they supply the movement needed to use and operate inanimate tools. If there was a way to internalize this movement in the inanimate tool, then they would no longer be necessary. Magnus takes imparting motion quite explicitly here as the source of the usefulness of subordinate workers.

---

[450] Magnus, "Commentarii in Octo Libros Politicorum Aristotelis", 21 (II. f): *Est autem organum inanimatum, quod nec ad operationem nec usum venit, nisi per animatum: quia nec aratur ager, nec colitur vinea, nec movetur securis, nisi per organum animatum.*

[451] Magnus, "Commentarii in Octo Libros Politicorum Aristotelis", 21 (II. f): *Sic etiam si pectines textorum per se pecterent et perficerent opus suum, et navicula per se subtegumen supponeret ultro, et plectra citharaedorum per se sine motore ad symphoniam tangerent et moverent chordas, tunc non esset necesse quod exteriorem motorem haberent.*

Unlike Aristotle, however, Magnus seems to suggest that immaterial, psychological faculties can in fact be *organa* or tools as well. In his commentary on *De Memoria*, for example, he discusses the views of Ibn-Rushd (Averroes) and Ibn-Sīnā, (Avicenna) before challenging the idea that memory and common sense (*sensus communis*) are the same *organum*. This idea is false, he claims, not because these faculties are not *organa*, but because animals like worms (*vermes*) and mollusks (*conchae*) clearly have the *sensus communis* to unite their sensations for perceptual processing, but do not have memory.[452] Although *organa* is used here in reference to allegedly perceptual faculties (much as Aristotle would consider the hand a sensory organ), we see here already, therefore, the presence of an extension to Aristotle's idea of the *organon* into immaterial faculties.

But how, then, does he treat the disjunctive formulation of the conditions for automation? Magnus is working from Moerbeke's edition where the disjunctive space is collapsed by the use of '*et*' instead of '*vel*'. This makes interpretation tricky because being commanded what to do would seem to negate the need for any advance perception on doing it. Put another way, what role is there for advance perception if we are being told exactly what to do? Magnus approaches this by focussing on the command as a signal for what must be done. Giving the command is therefore treated as a different moment to receipt in the subordinate worker or slave of the complete action that needs to be done, as *signalled* by that command. These two moments are unified in the conjunctive specification of Aristotle's passage, which therefore takes the command alone as the central impetus. As Magnus says:

[452] Magnus, "De Memoria et Reminiscentia", 99 (I). For more on the *sensus communis* see Gregoric, *Aristotle on the Common Sense*, 2007.

> …because if each of the inanimate tools were able such that it were anticipatory and preconceived the master's command, and so would complete the master's command and his work for what is [needed], then it could be said that slaves and subordinates would not be needed and despotic rule would not be part of the household.[453]

Praesentiens, according to Magnus, is sensory and tells us something about the future. However, it needs a signal, which is the command (*jussum* or *iussum*) in this case. In his commentary on *De Memoria*, Magnus makes this clearer when discussing how animals mark the passage of time in determined ways like the past and future:

> …like sheep and goats who return to the pens, knowing the pens where they lived in the past, and [how] ants collect in their homes anticipating the rains in the future. For they sense the past through images of the past which are in themselves, but they do not anticipate the future unless some sign is present, like water vapour, or heat, or something of this [kind].[454]

To complete the work required by the master's command, the automated tool must be able to anticipate what actions that command implies. This requisite faculty is not unique to humans – animals have these too, as Magnus's examples illustrate.

But through *praeconciperet*, or preconception, Magnus seems to be implying the use of an intellective or noetic faculty. As Jennifer Marie Sanders has explained, "Conceptualizing (*concipere*) is the terminal activity to being intelligent" and is that "which

[453] Magnus, "Commentarii in Octo Libros Politicorum Aristotelis", 21 (II. f): *…quia si posset unumquodque organorum inanimatorum, ita quod esset praesentiens et praeconciperet jussum domini, et sic perficeret jussum domini et opus sum ad quod est, tunc posset dici quod servus et minister non essent necessarii, et despotica non esset oeconomiae pars.*

[454] Magnus, "De Memoria et Reminiscentia", 100–101 (I): *...sicut oves et caprae revertuntur ad caulas, cognoscentes caulas ubi habitaverunt in praeterito, et formicae colliguntur in domibus suis praesentientes pluvias in future. Sentiunt enim praeteritum per picturam praeteritorum quae sunt in ipsis: futura autem non praesentiunt nisi signo aliquo praesenti, sicut vapore, vel calore, vel aliquo hujus.*

receives the *verbum*" or inner word.[455] *Prae-concipere* therefore seems also to involve something beyond this – time as well. Discussing whether knowledge of God is possible naturally, Duns Scotus tell us for example, "before there can be any question of the truth of a proposition wherein existence is predicated of a subject, it is necessary to preconceive (*praeconcipere*) the terms of this proposition."[456] Has Magnus therefore added an intellective means for grasping the content of the command on the nature of the work to be performed? Relatedly, does this mean that in order to perform this work, slaves and craft subordinates must be capable of a higher cognitive function than perception?

Magnus casts doubt on the extent of *praeconcipere* when commenting on the extent of reason attributable to the natural slave. These slaves have reason to a limited extent only and for a specific function:

> [the natural slave] does not share in reason, except as much as is [necessary] to receive meaning and estimative knowledge of orders and [to receive] the disposition for other orderings in respect of life, and alone not having such direction or disposition.[457]

A natural slave merely needs what is sensorily necessary to receive meaning so that they know what to do. Estimative knowledge too, related to the *vis aestimativa*, is sensory and

[455] Sanders, *The Trinitarian Telos of the Summa Theologiae*, 2017, 173, 176.

[456] For this selection of Scotus's work see Duns Scotus, "On the Nature of Man's Knowledge of God", 1947 translation, 10–13. *Nec oportet distinguere de si est, ut est quaestio de veritate propositionis, vel ut est quaestio de esse Dei, quia si potest esse quaestio de veritate propositionis, in qua esse tamquam praedica tum quaeritur de subiecto, ad concipiendum veritatem illius quaestionis oportet praeconcipere terminos illius quaestionis; et de conceptu simplici illius subiecti, si est possibilis naturaliter, nunc est quaestio.*

[457] Magnus, "Commentarii in Octo Libros Politicorum Aristotelis", 28 (III. h): *et non est communicans ratione, nisi tantum quantum est recipere sensum et cognitionem aestimativam praecepti et dispositionem alterius ordinantis vitam, et ex se non habentis tale regimen vel dispositionem.*

shared with animals.[458] *Praeconcipere* here, then, should be taken as *prior* to intellective conception.

Similar to the case of the natural slave, Magnus uses the passive in his commentary on the *Metaphysics* to describe the way handicraftsmen are different from, and cognitively inferior to master-craftsmen. These handicraftsmen act from habit (*consuetudinali*) which is acquired through use (*usu acquiritur*).[459] In short therefore, the living *organa* Aristotle mentions in his counterfactual passage are, for Magnus, still very much doing cognitively inferior work to that required by independent reason or unimpaired deliberation. What Magnus adds is how the command, as a signal, can come to be sensorily internalized and so pre-conceived such that automated tools anticipate what must be done. This delimits the cognitive requirements of the work to be performed, which must otherwise be performed by slaves and craft subordinates.

V. Thomas Aquinas

We saw in Ephraim Chamber's *Cyclopedia* and Corsini's tale that Magnus had allegedly created an automaton. This automaton was so life-like that it disturbed a friar who stumbled across it. As the legend goes, it was Thomas Aquinas who found Magnus's automaton and destroyed it out of concern for its diabolical nature. Whereas Magnus had a penchant for the occult, including astral sciences and minerology (and therefore allegedly alchemy), Thomas paints a far more sober picture towards automata and automation in general. Citing Alexander Birkenmajer's work, Ambrosetti notes that Moerbecke "would

[458] On this point see Oelze, *Animal Rationality*, 2018, 151 in particular; also Steneck, "Albert the Great on the Classification and Localization of the Internal Senses", 1974, 193–211.

[459] Magnus, "Metaphysicorum Lib. XIII", 18 (IX).

have translated, among many other works, Heron's *Pneumatics* into Latin; his proof is based on the presence of a treatise entitled *De aquarum conductibus et ingeniis erigendis* in a list of works, owned by St. Thomas, actually translated by the Flemish scholar". Ambrosetti finds this evidence "not completely convincing", but nevertheless finds it "remarkable that the Aquinas, minor character in a legend about Albertus Magnus' automaton, is also quoted as a possible reader of one of Heron's texts."[460]Notwithstanding whether Aquinas in fact did absorb Heron's mechanical texts, his possession of *De aquarium* speaks to his knowledge of the principles of hydraulics or at least texts thereon: "he was afterwards able to speak to students of the University of Paris upon the construction of aqueducts and machinery for raising and conducting water". [461] Aquinas, therefore, was no fool to the emerging mechanical arts at the time. But as Lynn Thorndike puts it, while "Aquinas was a perfecter according the standards of his own age; Albert sometimes was a pioneer in the spirit of the new age of science".[462]

Like Magnus, Aquinas based his commentary on Aristotle's *Politics* from Moerbeke's translation. However, Aquinas's commentary is incomplete, and covers Books I, II and III up to the end of chapter VI. As a result, it is often grouped together with Peter of Auvergne's commentary covering books III to VIII. The combined Aquinas–Auvergne commentary "enjoyed the position of a 'standard' commentary" for much of the medieval period.[463] While it is likely that Aquinas' commentary was written after Magnus', this

[460] Ambrosetti, *Cultural Roots of Technology*, 2010, 132.

[461] Mullany (Brother Azarias), *Essays Educational*, 1905, 84.

[462] Thorndike, Lynn, *A History of Magic and Experimental Science*, 1923, 602.

[463] Lambertini, "Burley's Commentary on the Politics", 2013, 372.

cannot be proven as the two texts cannot be definitively disentangled from each other.[464] On the style of Aquinas' commentary itself, Conor Martin has noted that is "stream-lined" and "ruthlessly and austerely to the point." Martin describes how Aquinas moves his analysis "first between distant texts, then in arcs of steadily decreasing breadth, till at last the pendulum of his attention has ceased moving and hangs concentrated over the part which is earmarked for immediate consideration." On translation quality, Richard Regan critiques Aquinas for a "good, if occasionally faulty, understanding of the Greek world". Regan suggests however that "he understands the basic arguments of Aristotle very well… [clarifying] and [systematizing] the thought of Aristotle", although "perhaps more than the elliptical text justifies." He notes that "Aquinas sticks to explanation of the text but occasionally expands on it (e.g., on moneymaking) or qualifies it (e.g., on slavery)."[465] Regan's translation is itself the first English translation of Aquinas's commentary on the *Politics.*

In his *Prologue* to the commentary, Aquinas distinguishes mechanical skills from moral science through the use of reason as follows:

> Moreover, reason does some things by making them, by action that extends to external matter, and this belongs strictly to skills called mechanical (e.g., those of craftsmen, shipbuilders, and the like). And reason does other things by action that remains in the one acting (e.g., deliberating, choosing, willing, and the like, and such things belong to moral science. Therefore, it is evident that political science, which considers the direction of human beings, is

[464] Cheneval, "Considérations presque philosophiques sur les commentaires de la "Politique" d'Albert le Grand et de Thomas d'Aquin'", 1998, 64.

[465] Aquinas, *Commentary on Aristotle's Politics*, 2007 translation, viii.

> included in the sciences about human action (i.e., moral sciences) and not in the sciences about making things (i.e., mechanical skills).[466]

Aquinas moreover considers politics to be superior and architectonic to all other practical sciences (*principaliorem et architectonicam omnium aliarum*).[467] It is not mechanical, though it is architechtonic.

Distinguishing nature and skills (or arts), Aquinas tells us the following:

> But nature does not complete the things that belong to skills; it only prepares particular sources and offers craftsmen a model for acting in a certain way. And skills can indeed examine things of nature and use them to accomplish the skill's proper action but cannot accomplish things of nature. And so it is clear that human reason regarding things of nature is only cognitive, but human reason regarding artifacts is both cognitive and causative. And so human sciences, which concern natural things, are necessarily theoretical, while human sciences about things produced by human beings are necessarily practical, or active, by imitating nature.[468]

This re-emphasizes Aristotle's distinction as well between slaves and their actions – as belonging to slavery by *nature* – and craft subordinates and their work. The latter belong to their crafts not by nature but through craft specialization.

---

[466] Aquinas, "Sententia libri Politicorum", pr. 6. English translations, unless otherwise specified, are taken from Regan's text: *Rursumque cum ratio quaedam operetur per modum factionis operatione in exteriorem materiam transeunte, quod proprie ad artes pertinet, quae mechanicae vocantur, utpote fabrilis et navifactiva et similes: quaedam vero operetur per modum actionis operatione manente in eo qui operatur, sicut est consiliari, eligere, velle et hujusmodi quae ad moralem scientiam pertinent: manifestum est politicam scientiam, quae de hominum considerat ordinatione, non contineri sub factivis scientiis, quae sunt artes mechanicae, sed sub activis quae sunt scientiae morales.*

[467] Aquinas, "Sententia libri Politicorum", pr. 7.

[468] Aquinas, "Sententia libri Politicorum", pr. 2: *Sed natura quidem non perficit ea quae sunt artis, sed solum quaedam principia praeparat, et exemplar operandi quodam modo artificibus praebet. Ars vero inspicere quidem potest ea quae sunt naturae, et eis uti ad opus proprium perficiendum; perficere vero ea non potest. Ex quo patet quod ratio humana eorum quae sunt secundum naturam est cognoscitiva tantum: eorum vero quae sunt secundum artem, est et cognoscitiva et factiva: unde oportet quod scientiae humanae, quae sunt de rebus naturalibus, sint speculativae; quae vero sunt de rebus ab homine factis, sint practicae, sive operativae secundum imitationem naturae.*

What is also interesting to note from the foregoing is that at first blush Aquinas seems to afford a level of intellection to the activities of craftsmen in their work. Reason is said to operate here, and not only at the level of the master-craftsman. Similarly, Aquinas allows that natural slaves are able to be taught how to *receive* the meaning of reason and so be more useful than animals.

> And he says that the former who are natural slaves share in reason only insofar as they receive the meaning of reason, as when taught by others, but not so far as to have the meaning of reason by themselves…And so as much as the way of serving is different, [it is] insofar as the natural slave serves reason, while brute animals serve their passions….For the natural slave is not able, because of a deficiency in reason, to help in deliberation or any work of reason. Nevertheless, a slave, because of [receiving the meaning of] reason, can serve in physical tasks in more ways than an irrational animal can.[469]

However, natural slaves are still said to be deficient in reason on their own. They can learn how to be directed by the dictates of reason, but this might mean nothing more than understanding exactly what to do when commanded.

This kind of conditioning or habituation is also mentioned for handicraftsmen in Aquinas's commentary on the *Metaphysics*:

> It is evident, then, that the master-craftsman know the causes of the things which are done. In fact we judge and speak about the others, i.e., the handicraftsmen, as we do about certain inanimate things. This is not because they do not perform artful operations, but because the things which

[469] Aquinas, "Sententia libri Politicorum", I. 3. 14. I have amended Regan's translation here: *et dicit quod ille qui est servus naturaliter, communicat ratione solum quantum ad hoc, quod recipit sensum rationis, sicut edoctus ab alio; sed non quantum ad hoc, quod habeat sensum rationis per seipsum... Et sic quantum ad modum serviendi est differentia, inquantum naturaliter servus servit ratione, brutum autem animal passione…Non enim naturaliter servus, cum deficiat ratione, potest auxiliari ad consilium, vel ad aliquod opus rationis: in corporalibus autem pluribus modis potest servire servus quam animal brutum, propter rationem.*

> they do they do without knowing the cause; for they know that something is to be done but not why it is, just as fire burns without knowing why. Hence there is a likeness between inanimate things and manual laborers from this point of view, that, just as inanimate things act without knowing the causes, inasmuch as they are directed to their proper end by a superior intellect, so also do handicraftsmen. But they differ in this respect, that inanimate things perform each of their operations as a result of their nature, whereas handicraftsmen perform theirs through habit. And while habit is practically the same as nature inasmuch as it is inclined to one definite effect, still habit differs from nature inasmuch as it is open to opposites by reason of human knowledge. For we do not habituate natural bodies, as is stated in Book II of the *Ethics*; nor, indeed, is it possible to cause habits in things that lack knowledge. Now the statements that have been made, as is evident from the statements themselves, must be interpreted as meaning that some men are wiser, not insofar as they are "practical," i.e., men of action, as befits men of experience, but insofar as they have a plan for things to be done and know their causes, which are the basis of such a plan; and this befits master-craftsmen."[470]

Handicraftsman are said to be ignorant of causes yet able to be habituated because they have some kind of knowledge (*cognitione*). Recall however that for Magnus, this meant a perceptual estimative knowledge of orders (*cognitionem aestimativam praecepti*). Thus, we should not be too hasty to think that for Aquinas, subordinate workers like slaves and craft subordinates operate through an independent productive reason. Rather, what appears to be the case is that Aquinas' mention of reason in artifice and production pertains to consolidated action that extends to external matter, and includes masters and master-

[470] Aquinas, *Commentary on the Metaphysics of Aristotle*, I. 1. 28: *Et sic manifestum est, quod architectores factorum causas sciunt. Illos vero, scilicet manu artifices, iudicamus vel denominamus, sicut quaedam inanimatorum. Et hoc non ideo quia faciunt operationes artificiales, sed quia quae faciunt, incognita faciunt. Sciunt enim quia, sed causas non cognoscunt; sicut etiam ignis exurit absque aliqua cognitione. Est igitur quantum ad hoc similitudo inter inanimata et manu artifices, quod sicut absque causae cognitione inanimata operantur ut ordinata ab aliquo superiori intellectu in proprium finem, ita et manu artifices. Sed in hoc est differentia: quia inanimata faciunt unumquodque suorum operum per naturam, sed manu artifices per consuetudinem: quae licet vim naturae habeat inquantum ad unum inclinat determinate, tamen a natura differt in hoc, quod est circa ea quae sunt ad utrumlibet secundum humanam cognitionem. Naturalia enim non consuescimus, sicut dicitur in secundo Ethicorum. Nec etiam cognitione carentium est consuescere. Haec autem quae dicta sunt, sic sunt consideranda tamquam ex eis appareat, quod aliqui non sunt sapientiores secundum quod est practicos, id est operatores esse, quod convenit expertis; sed secundum quod aliqui habent rationem de agendis, et cognoscunt causas agendorum, ex quibus rationes sumuntur: quod convenit architectoribus.*

craftsmen with their slaves and subordinate craft workers as tools respectively. When he discusses mechanical skills in the *Prologue* like that of craftsmen and shipbuilders, he means the consolidated dyadic production and not simply a master-craftsman or craft subordinate alone. Nevertheless, it appears he considers their work to require a certain level of cognition.

In defining craft subordinates and natural slaves as *organa*, Aquinas moreover considers Aristotle's natural slaves to be living, separate instruments useful for activity. Craft subordinates are further distinct because they are living instruments of production not action:

> a slave is a living, separate instrument useful for activity, a human being belonging to another. And in this definition, we posit instrument as the genus and add five specific differences. By the fact that we call the instrument living, we distinguish it from inanimate instruments. By the fact that we call the instrument useful for activity, we distinguish it from a craftsman's assistant [craft subordinate], who is a living instrument of production.[471]

What Aquinas doesn't explain however, is how Aristotle's look-out can be considered a tool for production as a craft subordinate despite not really *making* anything, for example.

Turning now to Aquinas's discussion of Aristotle's passage on automation, we see a number of important differences in the way he treats the text relative to Magnus:

> For chief craftsmen, whom we call master-craftsmen, would not need craft subordinates, nor the masters of household slaves, if each inanimate

[471] Aquinas, "Sententia libri Politicorum", I. 2. 14: *servus est organum animatum activum separatum alterius homo existens. In qua quidem definitione, organum ponitur tamquam genus, et adduntur quinque differentiae. Per hoc enim quod dicitur animatum, distinguitur ab instrumentis inanimatis: per hoc autem quod dicitur activum distinguitur a ministro artificis, qui est organum animatum factivum.*

> instrument were able, at the master's command, by recognizing [the command] itself, to perform his work. For example, looms would operate by themselves, and lyres play by themselves, as they say the statue made by Daedalus moved itself by the natural disposition of its mercury. And likewise, a certain poet says that human handicraft or the art of black magic equipped tripods in a temple of Vulcan, whom the pagans called the god of fire, so that they seemed by themselves to engage almost spontaneously in a divine contest, as if fighting to serve in the ministry of the temple.[472]

Aquinas treats this passage with more expansive commentary than Magnus. Firstly, he references Aristotle's discussion in *De Anima* suggesting mercury as the possible motile force in Daedalus' statues. Secondly, the reference to Homer's tripods is distorted and somewhat deflationary – whereas the actual reference in the *Iliad* has the tripods coming and going to the assembly of the gods as a wonder to behold, Aquinas's interpretation situates them fighting with each other in a temple dedicated to Vulcan (Hephaestus) as if to become ministers. Moreover, instead of moving simply spontaneously, they only seem (*videbantur*) to do so almost spontaneously (*quasi spontanei*). Curiously, he denies them true spontaneity even though in "Aquinas's corpus, we find references to spontaneous reflex actions, passions, and movements of the will." [473] Spontaneity, as with Aristotle, is not *ex nihilo* for Aquinas,

---

[472] Aquinas, "Sententia libri Politicorum", I. 2. 11. I have amended Regan's translation here: *Principales enim artifices, qui architectores dicuntur, non indigerent ministris, neque domini domorum indigerent servis, si unumquodque instrumentum inanimatum posset ad imperium domini, agnoscens ipsum, perficere opus suum; puta, quod pectines per se pectinarent, et plectra per se cytharizarent, sicut dicitur de statua quam fecit Daedalus, quod per ingenium argenti vivi, movebat seipsam. Et similiter quidam poeta dicit, quod in quodam templo Vulcani, qui dicebatur Deus ignis, tripodes quidam erant sic praeparati, quod per artificium humanum, vel per artem nigromanticam, quod per seipsos, quasi spontanei videbantur subinduere divinum agonem quasi concertando ad serviendum in ministerio templi.*

[473] Titus, "Passions in Christ: Spontaneity, Development, and Virtue", 2009, 57, at footnote 8; cf also 57–58, footnote 10: "sensate spontaneity concerns specific natural (instinctual) or connatural (acquired) movements in relation to the receptivity of the primary and secondary cognitive senses…Voluntary spontaneity, in contrast, concerns particular natural (unforced) and acquired movements of intellectual appetite. Volition or the will, whose first act is love of the good, concerns two types of internal principle of movement. One is intuitive (a foundational attraction to a good end), the other discursive (the wishing, intending, consenting, choosing, applying, and completing needed to attain this end). The particularly volitional spontaneity flows from the deepest part of the person and his spiritual inclinations (toward what is good, true, and perfective of one's wellbeing, family, and the common good), which, as [Servais] Pinckaers affirms, are shaped by a natural and "spontaneous desire that can only be fulfilled by the vision of God".

but Aquinas nevertheless refuses spontaneity to inanimate (but self-moving) beings. In blunt terms, it appears that an automated tool will never have a soul and be spontaneous, for Aquinas.

In fact, Aquinas ventures further to suggest that the tripods are created either by human artifice *or* through black magic. The suggested association with the *artem nigromaticum* suggests that Aquinas views automated tools with suspicion. Necromancy, for Aquinas, is a species of divination that directly invokes the aid of demons.[474] It is sinful for him, indeed more so than doing anything that deserves a demon's intervention.[475] It is also linked to foreknowledge and, in particular, unacceptable forms of astrological astral science. There is little wonder, therefore, why it is Aquinas who came to play the role of the friar who destroyed Magnus's automaton in the legends. Aquinas shows skepticism about the permissibility of automated tools given the arts that might be invoked to create them.

Finally, we are correct to note that Aquinas requires a certain level of cognition for the work to be performed by slaves and craft subordinates. While he focuses solely on the command of the master (including master-craftsman) as the operative condition, avoiding *praesentiens* altogether, he requires that an automated tool recognize the command itself. The verb choice *agnoscere* is one that has a history of cognitive intellection. Augustine, for example, tells us:

> As we ascend, then, by certain steps of thought within, along the succession of the parts of the mind, there where something first meets us which is not

[474] Aquinas, *Summa Theologiae*, II[a]-IIae, q. 95, a. 3 co.

[475] Aquinas, *Summa Theologiae*, II[a]-IIae, q. 95, a. 3 ad 1.

> common to ourselves with the beasts reason begins, so that here the inner man can now be recognized.[476]

In this context, Augustine is discussing how man comes to know God through the familiar image after which he or she was created, according to the rational mind (*rationalem mentem*).[477] Aquinas, in turn, for which the idea of recognition suffers "historiographical neglect",[478] quotes a gloss of Augustine favorably: "when recognition of the truth (*agnitio veritatis*) is missing, virtue is false, even in good conduct."[479] To recognize the master's command therefore is a cognition of something familiar and common with the master, which we can reasonably assume is meaningful language. Aquinas's automated tools would need to be able to form linguistic conceptions of the command and the work needing to be done, and actually be able to perform it. They are not purely perceptual beings. But they are also likely beings created through less than Christian ways.

VI. Nicole Oresme

Like Magnus and Aquinas, Nicole Oresme also worked from Moerbeke's Latin edition of Aristotle's *Politics*. Unlike either of them, however, he successfully translated the Moerbeke edition from medieval Latin into a vernacular language for the very first time: French. An attempt had been made at the start of the 14th century by Master Pierre de Paris, but it

---

[476] Augustine, *De Trinitate*, XII. 8. 13: *Ascendentibus itaque introrsus quibusdam gradibus considerationis per animae partes unde incipit aliquid occurrere quod non sit nobis commune cum bestiis, inde incipit ratio ubi iam homo interior possit agnosci.*

[477] Augustine, *De Trinitate*, XII. 8. 12.

[478] Robiglio, "Aquinas on Recognition", 2019, 168.

[479] Aquinas, *Summa Theologiae*, Iª-IIae q. 65 a. 2 co. *Unde Rom. XIV super illud, omne quod non est ex fide, peccatum est, dicit Glossa Augustini, ubi deest agnitio veritatis, falsa est virtus etiam in bonis moribus*.

would only be until sometime between 1370 and 1374 before Oresme's consolidated and surviving translation would appear.[480] The decision to do this was political. As Schütrumpf notes, Oresme produced this translation at King Charles V's request. Charles "was aware that he could not reach the leading nobility, who would benefit from the study of the Aristotelian *Politics*, in the Latin language." This, Schütrumpf claims, is because the "topics and theoretical concepts Nicole Oresme found in Aristotle's *Politics* had never been dealt with before in the French language". As such "it has been said that Nicole Oresme had to invent the target language." [481] Oresme therefore had to introduce new words into French in order to overcome translation challenges. In general, he is credited with introducing over 1000 new words into French through his translation and commentary efforts. [482]

Oresme followed in part the literalist mode of translating from Latin to French as Moerbeke had from Greek to Latin. However, as Schütrumpf shows, Oresme also created a number of neologisms which remain important, such as '*politique*'.[483] On his relation to previous commentators, Susan Babbit notes that he "mentioned Albertus Magnus over forty times, apparently preferring his commentary to that of Thomas Aquinas/Peter of Auvergne, even for the earlier section of the *Politics* where the explication was that of Aquinas." Curiously, he also "sometimes followed Albertus into errors which his own knowledge should have prevented. At the same time, however, he very often introduced an

[480] Oresme, "Livre De Politiques D'Aristote, 11; 19–20; Babbit, "Oresme's Livre de Politiques and the France of Charles V", 1985, 9.

[481] Schütrumpf, *The Earliest Translations of Aristotle's Politics*, 2014, 25; see also Babbit, "Oresme's Livre de Politiques and the France of Charles V", 1985, 7–10.

[482] Schütrumpf, *The Earliest Translations of Aristotle's Politics*, 2014, 26.

[483] Schütrumpf, *The Earliest Translations of Aristotle's Politics*, 2014, 27.

interpretation of Albertus merely to contradict it."[484] Oresme's work on the *Politics* therefore encompasses this engagement through both a rendering into French vernacular and his own commentary thereon.

Translated from Oresme's French, Aristotle's critical passage on automation reads as follows:

> Because if each of the other instruments, when commanded, have perception and can complete its work in the way it is said of the automata that Daedalus made or made like the trivets or tripods of Vulcan about which the poet said he [Vulcan] made them to contend voluntarily in their divine contest, and similarly if shuttles wove wool by themselves and if fiddles sounded and played the vielles by themselves and so with other instruments, for sure masters of some of the arts would have no need of subordinates or young boy servants nor masters have need of slaves."[485]

We note immediately that Oresme collapses the disjunctive conditions for automation such that automated tools need only be commanded to do what is required. However, these tools are said to have sensible perception (*apparcevance*). Such perception is something common to dumb beasts (*les bestes mues*) who have sense and perception (*sens et apparcevance*) of pain and pleasure (*de tristece et de delectacion*).[486]

Oresme gives us an example to illustrate his emphasis on the command:

---

[484] Babbit, "Oresme's Livre de Politiques and the France of Charles V", 1985, 20–21.

[485] Oresme, *Livre De Politiques D'Aristote*, 51: *Car se chascun des autres instrumens, quant 1'en lui commande, eust apparcevance et peust parfaire son oeuvre en la maniere que 1'en dit d'un ymage lequel fist Dedalus ou comme faisoient les treves ou trepiéz de Vulcan desquelz dit le poëte que il faisoient de leur bon gré contention divine et semblablement se les pignes a laine pignassent par eulz meisme et se les archéz les vielles sonnassent ou jouassent par eulz meisme et ainsi dez autres instrumens, pour certain il ne fust nul mestier as maistres de telz ars de avoir ministres ou vallés ne as seigneurs de avoir serfs*.

[486] Oresme, *Livre De Politiques D'Aristote*, 49.

> Because if the master-builder commanded a [masonry] hammer and said to it, 'Cut this stone", and the [masonry] hammer did it, another mason-worker would not be needed. And if the master of the manor commanded his carriage and said to it, 'Go find some wood,' and the carriage accomplished the command, he [the master] would not have any need of a footman."[487]

No mention at all is made of anticipating in advance or *praesentiens*, and Oresme uses the imperative tense to show that what he thinks Aristotle is referring to is the ability of an otherwise inanimate object to understand commands.

Again, we may look at this ability to understand commands in the way Oresme interprets the natural slave's possession of reason, according to Aristotle. Oresme renders this passage as follows:

> And such a slave shares in reason only inasmuch as he has a sense of receiving of something close by instruction, but he does not have reason by himself. And the other beasts have no sense for reason, but they serve and obey through cause of any passions.[488]

In commenting on this more generally, Oresme quotes *Ecclesiastes* 33: 25 in Latin and translates it into French to emphasize the difference: *Cibaria et virga et onus asino, panis et disciplina et opus servo* ("gruel and the rod and burden are for an ass, bread, discipline, and

---

[487] Oresme, *Livre De Politiques D'Aristote*, 51: *Car se le maistre de faire un edifice commandoit au marteau et luy disoit, 'Taille ceste pierre,' et le marteau le faist, il ne convendroit autre machon. Et se le seigneur de l'ostel commandoit a sa charete et luy disoit, 'Va querir du boiz,' et elle acomplissoit le commandement, il ne convendroit avoir nul charetier.*

[488] Oresme, *Livre De Politiques D'Aristote*, 54: *Et tel serf communique en raison seulement en tant comme il a sens de la recevoir d'autre par enseignement, mes non pas qu'il ait raison de soy meisme. Et les autres bestes ne ont nul sentement de raison, mes il servent et obeissent par causes d'aucunes passions.*

work are for the slave").[489] Thus, for Oresme, the automated tool might share perception with dumb beasts but the work it is required to perform does require *some* level of perception (*sens)* of reason that allows for the command to be fully understood. Other animals appear not to have this, and only obey their passions.

In terms of the liveliness of the automated tool, Oresme offers his own interpretative commentary on the comparisons with Daedalus' statues and Hephaestus' tripods. Like Aquinas, Oresme refers to quicksilver (*vif argent*) and the speculative theory in *De Anima* regarding the fabrication of Daedalus' automata. But he adds lodestones (*aymant*) as well as other things. Daedalus' automata seemed like they were alive and moved themselves when he wanted them to do so because of they were the products of very skilled fabrication techniques:

> He [Daedalus] was a very intricate worker, and made an automaton which would move itself when Daedalus wanted, through quicksilver and lodestones and others things, and would seem that it was alive.

Similarly, Vulcan's temple contained trivets or tripods that were created from such intricate artifice (*par subtil artifice telement*) that they seemed to move by themselves when someone would offer a sacrifice.[490] Like Aquinas, Oresme sees the tripods as actual things in a pagan temple, instead of those in Olympus mentioned in Homer's *Iliad*. He adds a pagan sacrifice for the semblance of motion, however.

---

[489] Oresme, *Livre De Politiques D'Aristote*, 54: *Ce fu un tres subtil ouvrier, et fist un ymage lequel par vif argent et par aymant et autres choses se mouvoit quant Dedalus vouloit, et sembloit que il fust vif.*

[490] Oresme, *Livre De Politiques D'Aristote*, 51.

VII. Leonardo Bruni

While Moerbeke's version of Aristotle's *Politics* was undoubtedly the standard on which medieval commentaries were based, this unrivalled position was challenged in the 15th century CE. Leonardo Bruni, a humanist scholar, launched a scathing attack against previous translations of Aristotle's works. As Christopher Celenza notes, for example, Bruni thought that previous literalist translations were somewhat barbarous. Bruni had come across standard translations of texts like the *Nicomachean Ethics*, done by Robert Grosseteste, the thirteenth century bishop of Lincoln. "Without naming Grosseteste, Bruni strongly criticised this received translation, saying that the *Nicomachean Ethics* 'seemed to have been made more barbarian' [*ut barbari magis quam Latini effecti viderentur*]. He also complained about the many incorporations into Latin of Greek terminology, transliterations that in Bruni's view were unnecessary."[491] Bruni's own translation of the *Nicomachean Ethics* was completed somewhere around 1416. In order to respond to the criticism he received for challenging the standard editions of the text, he wrote *De Interpretatione Recta* in 1425, which set out the methods appropriate to the act of translating, according to him.

On the *Politics*, Bruni felt that Moerbeke's style had failed to capture the lively and rhetorical prose of the text:

> The subject is political and therefore admits of rhetorical treatment. There is almost no passage without its rhetorical glitter and flourish, which from time to time results in an oratorical liveliness.[492]

[491] Celenza, *Renaissance Humanism and the Papal Curia*, 1999, 47.

[492] Bruni, *Sulla perfetta traduzione*, 100–101; J. Hankin's translation, 223: *Materia est civilis et eloquentie capax, nullus fere locus ab eo tractatur sine rhetorico pigmento atque colore, ut interdum etiam festivitatem in verbis oratoriam persequatur*.

As Schütrumpf notes, Moerbeke's translation, suffering from transliterations that Bruni detested and felt were unnecessary given the accommodating nature of Latin prose, therefore found itself side-lined by the late 15th century CE: "Bruni's translation of Aristotle's *Politics* was the most popular translation of that text until well into the sixteenth century, and was used as a basis of commentaries by Donato Acciaiuoli, Lefèvre d'Étaples, Octavianus Ferrarius, Melanchthon and probably others." [493] The supersession of Moerbeke's version of the *Politics* is therefore an important moment in the reception of this text into the Latin West. Commentaries, like Aquinas's, that had been based on Moerbeke's version were still considered important to the interpretative tradition but now appeared alongside Bruni's translation of the *Politics*. As we shall see, Bruni's version also marks out key differences between texts in the treatment of Aristotle's passage on automation.

Bruni's version of Aristotle's passage reads as follows,

> For if instruments were able to complete, at the command or will of the master, his work, in the way of Daedalus' things or Vulcan's tripods (which the Poet says spontaneously of themselves went of themselves in the divine contest), if [thusly] shuttles wove and plectra struck, neither then do master-craftsmen need subordinates, nor masters slaves.[494]

[493] Schütrumpf, *The Earliest Translations of Aristotle's Politics*, 2014, 64.

[494] Bruni, "In hoc libro contenta. Politicorum libri octo...", fol. 5r: *Si enim possent instrumenta ad iussum vel nutum domini opus suum conficere, quemamodum Daedali, aut Vulcani tripodes (quos inquit Poeta sponte sua divinum prodisse in certamen), sic et pectines texterent, et plectra pulsarent, nec architecti sane ministris, neque domini indigerent servis.*

This version looks a lot more like the standard editions of the passage we see today. At least two important differences stand out from Bruni's version relative to Moerbeke's. Firstly, Bruni has translated the conditions for automation disjunctively using *vel* instead of *et*. This remains the preferred way of interpreting this passage. *Vel* gives the sense of an inclusive disjunctive condition – which may in fact also be signalled by *et* – namely that either the command or the master's will can fulfil the outcome. These conditions are not exclusive nor combined and collapsed into each other.

Secondly, and perhaps of more interest, is the choice to render *praesentiens* and *proaisthanomenon* as [*ad*] *nutum*. *Nutus* is a complex concept in medieval theology that has gestural connotations. In *De Trinitate*, Augustine says the following:

> For of necessity, when we speak what is true, i.e. speak what we know, there is born from the knowledge itself which the memory retains, a word that is altogether of the same kind with that knowledge from which it is born. For the thought that is formed by the thing which we know, is the word which we speak in the heart: which word is neither Greek nor Latin, nor of any other tongue. But when it is needful to convey this to the knowledge of those to whom we speak, then some sign is assumed whereby to signify it. And generally a sound, sometimes a nod [*nutus*], is exhibited, the former to the ears, the latter to the eyes, that the word which we bear in our mind may become known also by bodily signs to the bodily senses.[495]

[495] Augustine, *De Trinitate Dei*, XV. 10. 19: *Necesse est enim cum verum loquimur, id est quod scimus loquimur, ex ipsa scientia quam memoria tenemus nascatur verbum quod eiusmodi sit omnino cuiusmodi est illa scientia de qua nascitur. Formata quippe cogitatio ab ea re quam scimus verbum est quod in corde dicimus, quod nec graecum est nec latinum nec linguae alicuius alterius, sed cum id opus est in eorum quibus loquimur perferre notitiam aliquod signum quo significetur assumitur. Et plerumque sonus, aliquando etiam nutus, ille auribus, ille oculis exhibetur ut per signa corporalia etiam corporis sensibus verbum quod mente gerimus innotescat.*

Nutus is therefore a kind of manifested sign. But to heed something, like God or angels, [496] *ad nutum* is broadly defined for any matter of visible things (*visibilium rerum materiam*).[497] Therefore it cannot simply be exclusive to man alone. Instead, what is stressed is the obedience to the *gravitas* of a more authoritative being through gesture – hence why it can commonly be translated as 'will'. Augustine himself talks about the will of the lord (*ad nutum domini*), for example.[498]

Indeed, in their interpretation of Tacitus's *Annals* and the speech of Thrasea Paetus, Mathew Owen and Ingo Gildenhard note the following:

> Thrasea sketches out a complete reversal of republican realities in imperial times: we are moving from one random Roman lording it over every provincial to one random provincial lording it over every Roman. At the centre of the design Thrasea places the antithesis *de cuiusque obsequio – ad nutum alicuius. obsequium* indicates '(slavish) obedience', nutus ('nod', but here in the technical sense of 'a person's nod as the symbol of absolute power') refers to someone's virtually unlimited power to get things done by a mere jerk of the head.[499]

Not inconsequential to an interpretation of *ad nutum*, therefore, is Kenneth Schellhase's observation that it was Bruni "who first came to see the importance of Tacitus as a source of political and historical ideas".[500] The sense in which Bruni is using *ad nutum* here is to emphasize the dominance of the master at such an extremity that a mere gesture is enough

[496] For more on a treatment of *nutus* as it appears in thinkers like Augustine, Magnus, Aquinas, et al on the topic of angelic (non-material) communication see Goris, "The Angelic Doctor and Angelic Speech", 2003, 87–105.

[497] Augustine, *De Trinitate Dei*, III. 8. 13.

[498] Augustine, *De Trinitate Dei*, III. 5. 11.

[499] Owen and Gildenhard, *Tacitus, Annals,* 2013, 100.

[500] Schellhase, *Tacitus in Renaissance Political Thought*, 1976, 20.

to set the automated tool to the relevant work to be performed. It is a complete authority over the tool itself, and places less emphasis on the 'advance' perception we saw with *praesentiens* and *proaisthanomenon*.

VIII. Medieval Complications and Transformations of Aristotle's Theory

Moerbeke's translation of Aristotle's *Politics* provided Christian thinkers with an opportunity to express their thinking on Aristotle's conception of work and automation, as well as the associated cognitive requirements. Because Moerbeke's version of Aristotle's text collapsed the disjunctive conditions of automation between command and advance perception, commentators tended to focus on the former and so a more direct form of authority over work and workers. In this context, different thinkers viewed Aristotle's requirements quite differently. For Magnus, automated tools replacing workers would needs only be perceptual – having an estimative knowledge (*vis aestimativa*) and a sensory preconception of what commands symbolized (*praeconcipere*). To Aquinas, the arts used to fabricate automata were most probably going to be suspect and involve black magic. Nevertheless, the work required of them implied a linguistic recognition (*agnoscens*) of commands – and so these tools cannot be said to be wholly perceptual. They have some level of cognition to them. However, Aquinas seems to refuse spontaneity to self-moving automated tools on the basis that they will never have souls.

Nicole Oresme becomes the first to offer Aristotle's *Politics* into a vernacular language through his French translation. Still working off Moerbeke's edition, he focuses his commentary on the command in Aristotle's passage on automation. While the automated tool needs only perception (*apparcevance*) to substitute for the work of living

subordinates, this is not the same level of perception as with dumb animals. Work requires a higher level of perception (*sens)* of reason so that a linguistic understanding of the command can take place. And finally, we see Moerbeke's standard edition of the *Politics* replaced with the advent of Leonardo Bruni's ornate Latin edition in the 15th century CE. Bruni's edition does away with the conjunctive condition for automation, separating it into the two disjunctive ones with which we are still familiar. Bruni also translates *proaisthanomenon* as *ad nutum*, which tells us how a master's simple gesture is authoritative enough that it could be used to set an automated tool in motion to complete its work.

Through these thinkers, Aristotle's idea of automation is given new life and transformed during the medieval period. The medieval period saw the rediscovery of Aristotle's *Politics* into the Latin West, and alongside it there was a burgeoning of both literary and material culture automata. Like the automata of classical antiquity, these automata were wonders to behold. For the same reason, they found themselves at the site of magic and diabolism, under suspicion of arts forbidden to Christianity. We see again a connection between the circular motion of the heavens and the wondrous movement of automata, through the controversial astral science. And while automata increasingly became absorbed into structures of power – including those of the Church – and moved from speculative fiction to the hands of artisans, the idea that they could truly replace and/or emancipate slaves and workers was equally fantastic to thinkers at the time as it was to Aristotle. Instead, Christian workers found themselves in the Pauline context where it 'can be a good thing to be a slave'. Marx's comment about a *christliche Organ* in connection with Aristotle's passage on automation, therefore, takes on a new inflection when we consider the ways in which Christianity and Christian thinkers shaped the idea of man as a worker within the context of the Greek tool or *organon*.

Chapter Four: Early Modern Receptions – Hobbes and the Automated State

I. "For seeing life is but a motion of Limbs"

A major development in the history of political thought and the idea of automation occurs in the work of Thomas Hobbes. *Leviathan* sets forth the idea of the state as an artifice in opposition to Aristotle's political naturalism. But, more importantly, Hobbes does so while drawing on a concept of automata. Annabel Brett has argued that a "striking difference with the Aristotelians here is in the dynamic rather than static conception of the commonwealth as an automaton, something that moves itself", while moreover suggesting that Hobbes had an acute awareness of the Aristotelian interpretive tradition surrounding the *Politics* during the Renaissance.

Examining Hobbesian resonances with Renaissance interpreters like Pier Vettori, Louis le Roy, Antonio Montecatini, and Juan de Salas – the latter making only a brief but somewhat uniquely resonant allusion to the *Politics*, Brett concludes that "one [answer as to why Hobbes was employing Renaissance Aristotelian ideas in the service of an intentionally anti-Aristotelian political theory] is that Hobbes was simply ignorant of the sophistication of late-Aristotelian political discourse, and constructed his anti-Aristotelian enterprise around a very crude picture of what Aristotelianism involves". This means, for Brett, Hobbes might have been "deliberately ignoring what he knew to be a more sophisticated and up-to-date version of Aristotle in the interests of trumpeting himself as the founder of a completely new political science." However, another "more intriguing possibility is that what Hobbes was rejecting was precisely the attempt of Renaissance Aristotelians to read Aristotle in such a way as to generate a workable theory of contemporary political

reality."[501]

And yet, Brett does not examine the "dynamic conception of the commonwealth as an automaton" further or by considering it through the Aristotelian interpretive tradition. One reason for this is that automata are perhaps relatively unimportant in Hobbes's political thought when compared with other concepts and categories. After all, *Leviathan* only mentions automata once. But it is also true that Hobbes chose to introduce his greatest and most complete work of political philosophy by inviting us to question why we cannot say that automata have life too:

> For seeing life is but a motion of Limbs, the beginning whereof is in some principall part within; why may we not say, that all *Automata* (Engines that move themselves by springs and wheeles as doth a watch) have an artificiall life?[502]

Hobbes makes this reference to artificial automata when introducing the commonwealth as an "Artificiall Man". This reference has raised a number of interpretive difficulties.

Firstly, Hobbes's bracketed definition of automata might appear to be overly narrow. It is, however, specific. In the generic category of "engines", Hobbes argues, there are those in particular "that move themselves" thanks to something like a "principall part within".[503] It is through this internal principle that self-movement occurs. The crucial difference between this kind of engine and others is that in the former, motion persists and

[501] Brett, "'The Matter, Forme, and Power of a Common-wealth'", 2010, 96; 99–100.

[502] Hobbes, *Leviathan*, 16 (I: Introduction. 1). Page numbers for *Leviathan* refer to Malcolm's editions.

[503] On this point see Frost, *Lessons of a Materialist Thinker*, 2008, 21–22, who excludes the application of "some principall part within" to automata on the basis of the latter's artificiality. But this seems textually unsupported, especially since Hobbes makes a point here to stress similarity. The Latin text also contradicts such an exclusion.

continues through an internal principle. In the latter, an external cause alone is operative. It is the difference between winding up a watch so that it continues to move by itself, and needing to apply oneself contiguously to a vacuum pump "engine" that "produceth the same effects that a strong wind would in a narrow room".[504] The key word here is "within".

Now, Hobbes's specificity of "Engines that move themselves" appears to contradict his own denial of self-movement.[505] Motion in one body occurs because of a contiguous, moved body.[506] The Latin version of *Leviathan*, published later in 1668, improves the classification. Automata are to be considered inclusively similar to, but nevertheless disjunctively distinct (*sive*) from all engines (*machinas omnes*) which have movement through specific parts that are disposed within (*intus dispositus*).[507] Here, in fact, we see a Hobbesian resonance with a thinker from the medieval Aristotelian tradition that we encountered in Chapter Three: Thomas Aquinas. Closer inspection of the idea of *intus dispositus* reveals three striking connections with Aquinas's *Summa Theologiae* I. q. 91, a. 3, where he i) discusses artifice and the aptitude of the disposition (*dispositus*) in the creation of man's body, ii) describes man as *nobilissimum animalium* – just as Hobbes does, and iii) references Aristotle's *Physics* II. 7 directly, where Aristotle where talks about local self-movers as those that contain a principle or beginning of movement *(ekhonta arkhēn kinēseōs)*.[508]

---

[504] Hobbes, *Seven Philosophical Problems*, 19 (III).

[505] It cannot be excluded here that Hobbes's English presentation was also designed to impress those who were acquainted with the apparently self-moving automata at the time. On this patronage see Sarasohn, "Was "Leviathan" a Patronage Artifact?"", 2000), 606-631.

[506] Hobbes, *De Corpore*, 115 (II: 8. 19); 124 (II. 9. 7); 347 (III: 22. 17); Hobbes, *Decameron Physiologicum*, 19-20 (II), "For, since nothing can move itself, the movent must be external".

[507] Hobbes, *Leviathan*, 17 (I: Introduction. 1), *Automata omnia, sive machinas omnes quae ab Elastris Rotulisque intus dispositis motum habent.* Malcolm translates this movement on p. 16 as "arranged within".

[508] Aquinas, *Summa Theologiae*, I, q. 91, a. 3. *Nobilissimum animalium* was a derived medieval and Renaissance imputation into Aristotle's *History of Animals* – see Beullens, "A 13th-Century Florilegium From Aristotle's Book on

As "Artificial Animals", Hobbesian artificial automata are similarly disposed for continued motion that "tends towards its own perpetuation", acting "to persist".[509] They can therefore take on as many forms as man's ingenuity might permit, but "move themselves" only in the sense that they are *internally* disposed to continue this motion. Hobbes credits this "difference between *Continuum* and *Contiguum*" with his own geometric doctrine of "compounded motion" – a kind of habitual motion composed of circular and rectilinear motions.[510]

Secondly, Brett is not alone in suggesting, for Hobbes, man, the commonwealth, or both are analogous – or even identical – to an automaton.[511] Tom Sorell, for example, argues that "the introduction strongly emphasizes the status of the commonwealth as an artefact, and more than that, as an automaton analogous to man in respect of its working parts."[512] Horst Bredekamp has taken this "confusing notion of the state as a living machine" further towards a revitalization of Hermeticism – in particular the *Asclepian*

Animals", 1999, 75; Hamesse, *Les Auctoritates Aristotelis*, 1974, 209. See also *Ph.* II. 7. 198a29; 198b1–2. On Hobbes's familiarity with Aquinas see Arp, "'The 'Quinque Viae' of Thomas Hobbes", 1999, 368–369. Also, see Hobbes's mention of Aquinas in "Of Liberty and Necessity", 36 (§24).

[509] Frost, *Lessons of a Materialist Thinker,* 2008, 23.

[510] Hobbes, *Decameron Physiologicum*, 46 (V); see also 61 (VI) for how "*compounded Motion*" is responsible for the "Natural heat of a man or other living Creature", resulting from both circulation of the blood and the nutritive movements in digestion; Hobbes, *De Corpore*, 348–349 (III: 22. 20) on the discussion of habit as a "generation of motion, not of motion simply", of "perpetual endeavour, or by iterated endeavours" for "conducting of the moved body in a certain and designed way", and no less applicable to "living creatures…but also in bodies inanimate".

[511] Malcolm, *Aspects of Hobbes*, 2002, 150–151, "Hobbes's famous comparison between the state and an 'automaton or artificial man'"; Terrel, *Hobbes, matérialisme et politique*, 1994, 278, *L'homme et la cité sont des automates qui…contiennent en eaux-mêmes le principe permettant au movement de se perpétuer*, also 195; 269-285; Kang, *Sublime Dreams of Living Machines*, 2011, 133, on how Hobbes's state is "like a great automaton made up of many small automata"; Gillioz, *Dieu et Leviathan*, 1990, 61-93, on a cybernetic reading, 71: *c'est bien l'Etat-homme artificiel (l'Etat automate ou machine) qui est la métaphore centrale*; Peychaux, "*El Leviathan Como Automata*, 2013, 413–430; Bates, *States of War*, 2012, 79, who suggests that the "human automaton making up the machine precludes its full integration into the unity that the will of the sovereign represents".

[512] Sorell, "Hobbes's Moral Philosophy", 2007, 136-137.

"massive humanoid machine as a living statue".[513]

And yet automata remain relatively underexplored in Hobbes's thought and broader corpus. They appear nowhere in Sharon Lloyd's impressive, edited volume, *Interpreting Hobbes's Political Philosophy*, which promises a state-of-the-art interpretation of Hobbes's political thought.[514] But if we claim that Hobbes compared man or the commonwealth to an automaton, we should attempt to examine the full richness of this concept. In doing so we may therefore recover pieces of what Michael Oakeshott has described as Hobbes's scattered "philosophy of artifice".[515]

This chapter aims to address these challenges to provide a picture of how Hobbes incorporates both ancient and modern ideas about automata into the conception of an automated state. Automata are marginal *in* – but not *to* – Hobbes's political thought. This is because automata stand at the margin between nature and artifice, between animate and inanimate, and pre-industry and industry. Far from seeing passive machines, or what Jessica Riskin has termed "brute mechanism",[516] Hobbes develops a much livelier concept of automata throughout his works that draws on their ability to persist in motion. Like Cerberus, the three-headed hound at the precipice between two worlds, this Hobbesian

[513] Bredekamp, *Der Leviathan*, 2020, 63–66: *Der Automat als sterblicher Gott*; also Bredekamp, "Thomas Hobbes's Visual Strategies", 2007, 33–34.

[514] However, see the challenge to readings of Hobbes's psychology as "a sort of automatic and repetitive mechanism of stimulus and response" per Paganini, "Hobbes's Philosophical Method and the Passion of Curiosity", 2019, 64. On a careful treatment of an 'automatique' component of Hobbes's psychology, see Rudolph, "Hobbes et la psychologie morale", 1990, 255.

[515] Oakeshott, "Introduction to Leviathan", 1975, 28.

[516] Riskin, *The Restless Clock*, 2016, 72–74, who moreover claims that Hobbes extended the Cartesian idea that "animals were machines" to "human beings as well", and that "everything about a person [for Hobbes] was machinery in the brute sense".

concept emerges with three faces to behold.[517]

The first of these faces is quite ancient. Hobbes demonstrates the power of translation in political philosophy through his skillful engagement with archaic and classical Greek canon. Here he found the concepts of *automatos* and *automata*. Thucydides, Homer, and Aristotle present us with how Hobbes understood this concept generally to mean things "acting of their own accord", and a more specifically derived aleatory meaning that points to "chance". Hobbes's polemic with the bishop John Bramhall in *The Questions concerning Liberty, Necessity, and Chance* further demonstrates Hobbes's intervention into this concept.

The second face embraces the ingenuity of human art as a basis for political thought. It appears as the mechanical automata that surrounded Hobbes in his own time. From the affectively stimulating timepieces and hydraulic waterworks he saw or sought to investigate, to the appearance of automata in the works of his contemporaries like Descartes and Abraham Bosse, Hobbes found himself endeavouring to know how these things worked to keep themselves moving. The underlying field of mechanics shaped artificial automata to life's motions. Hobbes understood this field in a particularly mathematical way as he states in *De Mundo* and *Leviathan* – mediated again through Aristotelian influences.[518]

The final head is physiological and illustrates the need for political thinkers to pay

[517] Hobbes actually refers to Cerberus as one of the "spirituall Officers" of Hell according to the absurd opinions of "Gentilisme" in *Leviathan*, 172 (II: 12. 55).

[518] The field of mechanics is not the same as what has come to be understood as a 'mechanistic' philosophy, which is subject to terminological variance and confusion itself. For a detailed, critical discussion of this point as it relates to the seventeenth century see Berryman, *The Mechanical Hypothesis in Ancient Greek Natural Philosophy*, 2009, 1–22; 236–249. It is primarily mechanics that interests us here, though it should be noted that Cees Leijenhorst has already cautioned that "mechanistic philosophy" or "mechanism" were not terms Hobbes employed to describe his own thought. See Leijenhorst, *The Mechanisation of Aristotelianism*, 2002, 7. On a discussion of the Aristotelian influence and the broader early modern notion of geometry, with Hobbes's relation on this point and with mechanics, see Biener, "Hobbes on the Order of Sciences", 2016, 316–317. Frithiof Brandt also writes that Hobbes "wrote mechanics like a philosopher" to distinguish him from the scientific and mathematical mechanists of his day and also emphasize his Scholastic influences. See Brandt, *Hobbes's Mechanical Conception of Nature*, 1928, 340. See also Herbert, *Thomas Hobbes: The Unity of Scientific and Moral Wisdom*, 1989, 25–27.

attention to the natural world. Hobbes's ecological theorization of spontaneous generation is excavated from the *Decameron Physiologicum* in the service of his earth-generated mushroom men in *De Cive*. Indebted to his own store of natural history, to William Harvey's *Exercitationes De Generatione Animalium*, and ultimately Aristotle's concept of *genesis automatos*, natural creatures generated *automata* – of their own accord – offer a physiological way to think about man's dependency on the environment, and therefore the creation of *Leviathan* more generally.[519]

These heads, of course, are not purely separate from each other in either their development or final presentation. But they offer conjoined, though different routes into Hobbes's political thought. As Gabriella Slomp has so poignantly put it: the fragmentation in Hobbes studies and the "emergence of a multiplicity of 'Hobbeses' who have been [selectively] pieced and patched together" during the twentieth century can be compared with the fate of "Humpty Dumpty".[520] From disconnecting Hobbes's political thought from his natural philosophy,[521] to acknowledging significant interaction between the two,[522] Hobbes scholars continue to scour his depths for answers. This chapter takes seriously that

[519] On recent readings emphasizing physiology, see Frost, *Lessons of a Materialist Thinker*, 2008, 21–22 against a "Cartesian" tendency to view Hobbes as "describing people as machinelike automata"; 177 that Hobbes employs this metaphor to "propose that humans can create humanlike machines in imitation of God's creation", stressing the artificial nature of the state as a humanlike machine; 23, on physiological "vital motion" and cause-and-effect mechanism; Paganini, "Hobbes's 'Mortal God' and Renaissance Hermeticism", 2010, 9: "Leviathan, the 'artificial body' does not appear as a simple machine, containing in itself a mythical power that Hobbes's mechanistic approach only succeeds in exorcising with difficulty. Although the Introduction to Leviathan insists on the mechanical nature of the art with which man produces 'automatons' provided with 'artificial life', nevertheless the biological analogy maintains a highly evocative suggestion in that passage and in the rest of the work"; see also Terrel, *matérialsime et politique*, 1994, and Gillioz, *Dieu et Leviathan*, 1990 for physiological mechanist readings.

[520] Slomp, "The Politics of Motion and the Motion of Politics", 2010, 19–20.

[521] Strauss, *The Political Philosophy of Hobbes*, 1963 [1936], 169–170; Taylor, "The Ethical Doctrine of Hobbes", 1938, 408; Warrender, *The Political Philosophy of Hobbes*, 1957, 6.

[522] Watkins, *Hobbes's System of Ideas*, 1965, 6; 24; Spragens, *The Politics of Motion*, 1973, 36; Goldsmith, *Hobbes's Science of Politics*, 1966, 229; 242.

there are pieces of Hobbes's thought yet to be contributed, which form a part of a rich and lively Hobbesian world in which natural philosophy and politics had to interact for the political thinker. Hobbes attests to this interaction in his dedicatory letter to William Cavendish in *De Homine*.[523]

Despite his marked aversion to Aristotle's political thought, this chapter will moreover show how Hobbes nevertheless engages Aristotle and appropriates Aristotelian ideas about automata and automation through the interpretive tradition. It therefore follows thinkers from diverse positions who nonetheless agree on the debts Hobbes owes to Aristotle.[524] These debts, I argue, form the bedrock of a pre-industrial state of nature, which in turn spontaneously creates Leviathan as an automated artifice and inaugurates a place for mankind's industry. Moreover, the idea that an artificial sovereign expresses civil law through commands takes on a new resonance when viewed through the lens of Aristotle's despotic theory of automation, and Hobbes's idea of Leviathan an automated artifice.

II. *Automata* in Translation

In his work with archaic and classical literature, Hobbes directly translated the term *automatos*, with which we became familiar in Chapter One. In Hobbes's 1629 translation of Thucydides's *History of the Peloponnesian War*, he found a lively account of *automatos.* That Hobbes admired Thucydides is well known. In his autobiographical *Vita* he declares that

[523] Hobbes, *De Homine*, A2-3, *Ultima Physicae cum Principiis Politicae conjungendaerunt* in the Latin, and 35 in Bernard Gert's English edition: "the first principles of physics had to be conjoined with those of politics".

[524] For example, Strauss, *The Political Philosophy of Hobbes*, 1963 [1936], 30–43; Spragens, *The Politics of Motion*, 1973, 39–46; Skinner, *Reason and Rhetoric in the Philosophy of Hobbes*, 1996, 36–38; Leijenhorst, *The Mechanisation of Aristotelianism*, 2002, *passim*.

"it was Thucydides who pleased [him] above all the rest".[525] In Thucydides, he translated variants of *automatos* and *mēkhanē*. With *mēkhanē*, Hobbes's preference was to translate it as an engine. For example, Hobbes translates "*mēkhanas*" as the "engines of battery", used in the battle between the Peloponnesians and the Plataens.[526] And when Brasidas led the assault against Lecythus using a "*mēkhanēs*", out of which the Spartans intended to cast fire onto the Athenians' fences, Hobbes again translates this as a "great engine".[527] He refers to it again in the same place as simply an "engine"". In Thucydides therefore, Hobbes equates *mēkhanē* with the lifeless engines that were built for battle and moved by human agents. [528] These are emphatically not the species of apparently self-moving 'engines' he has in mind in *Leviathan's* Introduction.

In contrast, we saw in Chapter One that the appearance of *automatos* is much rarer in Thucydides. Where it does occur, however, Hobbes's translations are illuminating. Recall in the conflict between the Peloponnesians and the Plataens, the Peloponnesian 'engines of battery' do not manage to create an advantage. They then attempt to set fire to the city. Thucydides describes the fire as one greater than had ever been produced before "by the hand of man" ('*kheiropoiētos*'). Fires likes these *do* sometimes occur without man's helping hand. They occur "*apo tautomatou*" or "out of their own accord".[529]

We saw the articular form again when Athenagoras addresses the Syracusan

---

[525] Hobbes, *Thomae Hobbes Malmesburiensis Vita Carmine Expressa,* lxxxviii, *Sed mihi prae reliquis Thucydides placuit*.

[526] Grene (ed.), 1989, 133 (II. 76. 4).

[527] Grene (ed.), 1989, 294 (IV. 115. 2).

[528] For other examples, Grene (ed.), 1989, 121 (II. 58. 1): the engines brought to besiege Potidaea; 236 (IV. 13. 1): the Spartans sending galleys to Asine to make engines; 563 (VIII. 100. 5): Thrasyllus' plans to use engines and take Eressos by assault.

[529] Grene (ed.), 1989, 134 (II. 77. 4).

assembly against Hermocrates's warnings of Athenian invasion. Athenagoras dismisses the warning as emanating from those who would "shadow their own with the common fear". Such reports do not arise "*apo tautomatou*", or "raised by chance", but are instead "framed on purpose by such as always trouble the state".[530] Finally, another translation is given when Alcibiades is addressing the Spartan assembly. Alcibiades suggests that in fortifying Deceleia the Spartans will reap whatever is in the territory. Part of this will be taken, the other will be acquired from the territory "*automata*", or "of its own accord".[531]

Hobbes's early translations of the variants of *automatos* thus point to things acting of their own accord, and chance. These translations take place within contexts that include warfare and the political deliberations of the assembly. *Automatos* is also distinguished from man's own direct action. Fires not made by man can occur of their own accord, territory can produce wealth of its own accord, and fearmongering in the state occurs by bad actors and not by chance.

But we have another ancient source to examine Hobbes's conception of *automatos*. He translated Homer's epic poetry in 1675, four years before his death. It took him just over a year, and he was eighty-seven years old at the time. His rendering of the *Iliad* and *Odyssey* was undertaken, as he claims, "Because [he] had nothing else to do". Unlike his translation of Thucydides, Hobbes's Homeric translations are terse and truncated. But it succeeds the presentations of his political philosophy, including *Leviathan*. Moreover, Hobbes suggests that its publication was aimed at those against his "more serious writings"

[530] Grene (ed.), 1989, 399 (VI. 36. 2).

[531] Grene (ed.), 1989, 432 (VI. 91. 6–7).

in order to "set them on [his] verses to show their wisdom".[532] In light of this, examining *automatos* takes on a new importance, especially as Eric Nelson has also persuasively argued that Hobbes's Homeric (mis)translations are in fact deliberate and a continuation of his thinking from Leviathan.[533]

The first thing we notice in Hobbes's Homeric renderings is that there is no translation of *mēkhanē* as an engine. However, *automatos* still appears. In the *Iliad*, the gates of Olympus open "*automatai*", or "of itself" when Juno approaches the heavens in wrath.[534] But Hobbes adds additional information to the original Greek here. Bracketed after the gates' opening of itself, Hobbes adds that it is through Jove that this power is ultimately granted. He translates one other variant of *automatos* in the text. When Agamemnon calls his leaders together prior to the battle with the Trojans, Menelaus joins "*automatos*", or "unbid".[535] In *Behemoth*, Hobbes had talked about Uzza's divine slaying because of his 'ubidden' motion that was nonetheless needed to keep the Ark of the Covenant from falling over. He compares this to the punishment for those individuals short of a whole people who adventure to speak against Papal authority.[536]

But there is also a noticeable omission in Hobbes's translation. Vulcan's golden tripods are an ancient, mythological example of automata. Vulcan creates them himself so that they could enter and leave the gathering of the gods "*hoi automatoi*", or of themselves. As we have seen, Aristotle references them as acting *automatous* in the *Politics*, a text we know

[532] Hobbes, *To The Reader: Considering the Virtues of an Heroic Poem*, x.

[533] Nelson, *Thomas Hobbes: Translations of Homer*, 2008, xxvii-xxi.

[534] Hobbes, *Homer's Iliads*, 62 (V: 693), 92 (VIII: 353).

[535] Hobbes, *Homer's Iliads*, 20 (II: 376).

[536] Hobbes, *Behemoth*, 172 (I).

Hobbes had read.[537] Hobbes's *Iliad* omits this characteristic. Instead, all that is preserved is that they "go and come again at his [Vulcan's] command".[538]

Hobbes's *Iliad* also emphasizes that *automatos* ultimately occurs through divine or human causation. We may be tempted to think that this is simply a function of the contextual differences between *automatos* as it appears in *Iliad*, and the *Peloponnesian War*. But Hobbes's rendering of Homer is also far looser than his fidelity to the original Greek displayed in his rendering of Thucydides. Is Hobbes expressing more of his own thought on *automatos* in the *Iliad*? To answer this, we need to look at one more intervening source of *automatos* for which Hobbes provides not simply a translation, but also an extended explanation. This source was published between the time of Hobbes's renderings of Thucydides and Homer.

In 1656, Hobbes had discussed *automatos* in *The Questions concerning Liberty, Necessity, and Chance*. This text was a response to the bishop John Bramhall, drawing on the prior publication of a point-for-point polemic between the two men that had actually first occurred orally in 1645. The polemic dealt with the nature of human freedom, focusing particularly on (free) will, necessity, and liberty. It would only conclude in 1658 with the publication of Bramhall's *Castigations of Mr. Hobbes.* Hobbes chose not to respond at this point. But his determinism and compatibilism suggests much to us on how he had come to view the concept of *automatos* he had read in ancient texts.

Bramhall had first given an example that "children, fools, madmen, brute beasts" behave spontaneously.[539] This meant acting merely with "a conformity of the appetite,

[537] *Pol*. I. 4. 1253b35-40.

[538] Hobbes, *Homer's Iliads*, 223 (VIII: 346–347).
[539] "Bramhall's discourse of liberty and necessity", 2 (§6).

either intellectual or sensitive, to the object".[540] Hobbes had said that for a man to do something "of his own accord, which in Latin is *sponte*", was meant that the "action is spontaneous".[541] He implores his readers to see that spontaneous action is really one and the same as what is necessary and voluntary. The "Latins and the Greeks", he says, "did call all actions and motions whereof they did perceive no cause, spontaneous and αὐτοματα [*automata*]".[542] But for Hobbes this is a failure in causal perception, or rather a failure to understand the causes involved.

Hobbes then gives examples of this failure in the same place. In one example, he suggests that the ancients had incorrectly thought that heavy things falling downwards did so "of their own accord" if they were not otherwise hindered from doing so. Here he is evidently referencing Aristotelian natural motion. Aristotle himself gives various examples of an aleatory concept of *to automaton* in practice. He talks about a horse bolting and subsequently being saved.[543] For Aristotle the horse cannot deliberate (*prohairesis*) and so its subsequent saving is a chance event. In discussing spontaneity, Hobbes challenges Bramhall's views by referencing the real deliberation of a "horse retiring from some strange figure".[544]

It is clear therefore that both Hobbes and Bramhall are ultimately referring to *to automaton* as it is conceptually formulated in Aristotle's *Physics* Book II. Indeed, here we find

[540] "Selections from Bramhall, *A Defence of True Liberty*", 43 (§3).

[541] "Hobbes's treatise *Of Liberty and Necessity*", 16 (§8). The example in this passage is appropriated from Aristotle. See *Eth. Nic.* III. 1. 5. 1110a8-10.

[542] "Selections from Hobbes, *The Questions concerning Liberty, Necessity, and Chance*", 74 (§8(c)).

[543] *Ph.* II. 6. 197b15-30.

[544] "Hobbes's treatise *Of Liberty and Necessity*", 19 (§8).

precisely the derived meaning of *automatos* formulated by Aristotle and interpreted in that tradition as chance or spontaneity. Thomas Spragens refers to this connection with the "Aristotelian conception of spontaneity or chance" as follows: "The Aristotelian term for spontaneity is *to automaton* – things that move for no reason. Hobbesian movement is all 'automatic,' and life itself for Hobbes consists in automaticity…Natural movements are automatic for Hobbes."[545]

Clearly both Hobbes's translation of *automatos* as "chance" in Thucydides and his references to it as "spontaneity" with Bramhall are mediated by the Aristotelian tradition in which he was educated. The aleatory conception of *automatos* in *to automaton* thus forms one of the heads in the faceted concept of automata found in Hobbes's thought. For Hobbes these *automata* had come to mean things acting of their own accord, sometimes inflected more specifically with the Aristotelian derivative meaning chance or spontaneity. Hobbes's rendering of Homer's *Iliad* also therefore indicates his own commentary on this conception. If Eric Nelson is right about Hobbes's deliberate actions of (mis)translation in his version of the *Iliad*, Hobbes seems to be expressing a preference for the idea that automated tools find the root of their action in the command (*keleusthen* or *iussum*) stimulus rather than in some notion of *automatos* or spontaneity. Where *automatos* appears or is omitted, it is explained by human or divine causation. Denying *ex nihilo* spontaneity years before, Hobbes had also declared in the same place that "chance produces nothing".[546] Spragens was therefore on the right path in unearthing Hobbes's engagement with what he calls "automatic" motion,

[545] Spragens, *The Politics of Motion*, 1973, 67. But see, Dudley, *Aristotle's Concept of Chance*, 2012, 20; 25-6. Dudley is particularly averse to translations of *automatos* as 'automatic'. It is also not quite correct to follow Spragens and interpret *to automaton* in Aristotle as "things that move for no reason" – this is not supported by *Physics* II, as Dudley also shows.

[546] "Selections from Hobbes, *The Questions concerning Liberty, Necessity, and Chance*", 69.

but misses Hobbes's own direct intervention against any conception of *automatos* and its derivatives as *ex nihilo* spontaneity or chance.

Turning back to Thucydides's description of the Peloponnesians' fire against the Plataens, we see the triumph of Hobbes's own thinking exemplified. The great fires that previously occurred contingently in nature, "*apo tautomatou*" can now occur "*kheiropoiētos*". Man has learnt nature's ways. Just as we saw the growing philosophical disdain for spontaneity and *automatos* leading up to the 4th century BCE in Chapter One, so too does Hobbes place emphasis on human agency and effort. Human ingenuity, through artifice, serves as a vector for knowledge about the world. This is particularly important as we turn now to the next face of Hobbesian automata: mechanical.

III. Automata as Mechanical Artifice

Artificial automata were also developing in the literary and material culture during Hobbes's time. He certainly appreciated the arts and desired to understand their workings. In *De Homine*, Hobbes affirms this as he says both "the sciences and the arts are good" as nature has made man "an admirer of all new things, that is, avid to know the causes of everything". Every art applied to matter is "also of the greatest public utility, since it is to them that we owe nearly all the useful tools and trappings of mankind".[547]

In *Leviathan*, he tells the tale of the ancient city of Abdera where the people had come to see the tragedy of Perseus and Andromeda. The tragic imprint was so affectively powerful that a few spectators fell into fevers of madness.[548] In fact, Perseus and

[547] Hobbes, *De Homine*, 64 (XI: 9): *Nam finxit natura hominem omnis rei novae admiratorem, id est, avidum sciendi omnium rerum causas'*. Gert's English translation, 50.

[548] Hobbes, *Leviathan*, 116 (I: 8. 37).

Andromeda most likely played out their spectacle for Hobbes somewhere else. This time they would have done so as apparently self-moving fixtures in hydraulic pleasure gardens. To see this, we must first go back to the time when Hobbes was only ten years old.

In 1598, Henri IV had sought the craftsmanship of Tommaso and Alessandro Francini for the adornment of his palaces. Tommaso Francini was an artisan and mechanical engineer renowned for his exquisite garden waterworks. This had earned him the patronage of Ferdinando de' Medici, uncle to Henri IV's wife, Maria. The Francini brothers would design hydraulic systems to create figures and pieces that appeared to move by themselves in the grottoes and fountains of their noble benefactors. In 1587, Renaissance Platonist Franceso de' Vieri described their work. For Vieri, the automata at the Medici palace were affective at the extreme. In Pratolino they induced "ecstasy" (*estasi*) in those who looked upon them.[549]

At Henri IV's French palace at Saint-Germain-en-Laye, the Francini brothers set to work on new mechanical automata to delight their patrons. This included the young Louis XIII.[550] In his diary entry on the 27th February 1644, English gardener John Evelyn describes seeing the brothers' work at Saint-Germain-en-Laye. He notes artificial gods, men, and animals in various states of self-movement. Amongst others, he documents Orpheus, Neptune, and the poetic re-enactment of Perseus rescuing Andromeda from a fearsome beast.[551]

These hydraulic pleasure gardens, with their apparently self-moving automata, had

[549] De' Vieri, *Discorsi di M. Francesco de'Vieri*, 64.

[550] Accounts by the young royal's médecin, Jean Hérouard, suggest Louis XIII was highly enamored by the hydraulic automata as well as Tommaso Francini himself. See Mousset*, Les Francine*, 1930, 34.

[551] Evelyn, *The Diary of John Evelyn*, 1901 [1818], 44–45.

become increasingly desirable fixtures at the palaces of rich and titled.[552] In his *Voyage*, Montaigne had written both favourably and unfavourably about the waterworks he had encountered on his travels. He describes self-moving beasts, divinities, and human figures at the Fugger's palace, the Medici palace at Pratolino, and Villa d'Este in Tivoli. [553]

But these waterworks and hydraulic automata were expensive to maintain. When Louis XIII's court moved to the palace at Fontainebleau, they were abandoned. As Silvio Bedini writes, "No trace of it remains other than some engravings made by Abraham Bosse in 1625 from Francini's original drawings".[554] As it turns out, this Abraham Bosse is the same artist who is now credited with the frontispiece for Hobbes's *Leviathan*.[555] The connection between Bosse, Hobbes, and these hydraulic automata has thus far been overlooked.

Hobbes's frontispiece was not new work for Bosse. Bosse was a prolific engraver who developed a large acumen of frontispieces. Both men shared a love for geometry, so it is little surprise that Hobbes chose Bosse for the task while Hobbes was exiled in Paris from 1640 to 1652. [556] For a time, Hobbes lived a short walk away from Bosse's workshop in the rue Harlay. We do not know whether he saw the engravings Bosse had done for the Francini brothers. This collection appeared under the authorship of Alessandro Francini.[557] They were detailed schematics of the hydraulic systems, automata, and grottoes at Saint-

[552] For the relevant historical overview, see Riskin, *The Restless Clock*, 2016, 11–76.

[553] Montaigne, *Journal de voyage en Italie par la Suisse et L'Allemagne en 1580 et 1581*, 125; 187; 270.

[554] Bedini, "The Role of Automata in the History of Technology", 1964, 28.

[555] Bredekamp, *Thomas Hobbes visuelle Strategien*, 1999, 52ff; Bredekamp, *Der Leviathan*, 2020, 41–53; Skinner, *From Humanism to Hobbes: Studies in Rhetoric and Politics*, 2018, 272–274; 295.

[556] See for example Bosse, *Traité des pratiques géometrales et perspectives*, 1665.

[557] Alessandro Francini, Recueil, *Modèles de grottes et de fontaines. Dessins lavés,* in BNF Estampes et photograpgie, Réserve Hd-100(A)-Pet Fol; also in ANF, O^1 1598.

Germain-en-Laye.

But in fact we do know that Hobbes saw Saint-Germain-en-Laye for himself. Between 1646 and 1648 Charles II had fled to live with his mother at the palace. As Hobbes's letters to Samuel Sorbière show, Hobbes wrote from Saint-Germain-en-Laye in 1646. There he complained that he was only "teaching mathematics, not politics" to Charles II.[558] This was very likely not the first time he saw automata in the gardens of the rich and titled. Hobbes also undertook grand tours of the European continent. He accompanied his noble English patrons on at least three occasions, where he would have seen similar spectacles for himself.[559] Unlike Montaigne however, Hobbes did not keep such a detailed record of his travels.

Hobbes's other contemporaries also knew Saint-Germain-en-Laye. Perhaps the most well-known amongst these was René Descartes. Descartes almost certainly visited, if not lived in Saint-German-en-Laye for a while.[560] Although Descartes's *L'Homme* was only published posthumously, he had worked on it much earlier – around 1632-1633. There he described clocks, artificial fountains, mills, and other machines that had the power to move themselves.[561] These self-moving things would also inspire his *Discours de la Méthode*, a copy of which Hobbes received in 1637.[562] Here Hobbes would have read about self-moving machines or "*automates*", as Descartes described them.[563] Marin Mersenne would later ask

[558] Hobbes, *Letter 45, [24 September/] 4 October 1646, Hobbes to Samuel Sorbière*, 138–141.

[559] Martinich, *Hobbes: A Biography*, 1999, 29. These patrons included William Cavendish, his son, and the son of Gervase Clifton (who was also named Gervase).

[560] Per Gaukroger, *Descartes: An Intellectual Biography*, 1995, 62–64 where he proposes to support Adrien Baillet's uncorroborated claim that Descartes did indeed live there.

[561] René Descartes*, L'Homme*, 120. I will cite the Adam-Tannery shorthand for Descartes's works.

[562] Hobbes*, Correspondence*, *Letter 27, 4[/14] October 1637, Sir Kenelm Digby to Hobbes*, 51.

[563] AT VI, 55. See also Des Chene, *Spirits and Clocks*, 2001, 13–14.

Hobbes to respond to Descartes's *Meditationes*. In that text too Hobbes would most certainly have read Descartes's famous rumination on whether what he saw outside his own window were in fact really men or "*automata*".[564]

Like Descartes, Hobbes found himself inspired by these mechanical automata. In the Preface to *De Cive*, he outlines that the rights of states (*jus*), and duties of subjects (*officium*) "must be investigated" (*investigandis opus est*). He has in mind an analogous method of examining the constitutive causes of things like a watch, where we see another reference to automata in the Latin:

> Concerning my Method, I thought it not sufficient to use a plain and evident style in what I had to deliver, except I took my begining from the very matter of civill goverment, and thence proceeded to its generation, and form, and the first beginning of justice; for every thing is best understood by its constitutive causes; for as in a watch (*Horologio automato*), or some [other] (*aliave*) such small engine (*machina paulo implicatiore*), the matter, figure, and motion of the wheeles (*rotae*), cannot well be known, except it be taken in sunder, and viewed in parts; so to make a more curious search into the rights of States, and duties of Subjects, it is necessary, (I say not to take them in sunder, but yet that) they be so considered, as if they were dissolved, (i. e.) that wee rightly understand what the quality of humane nature is, in what matters it is, in what not fit to make up a civill government, and how men must be agreed among themselves, that intend to grow up into a well-grounded State. [565]

For the purpose of explaining his method, Hobbes tells us that a *Horologio automato* is substitutable for another (*aliave*) small engine that is similarly complex or involved (*machina paulo implicatiore*). His mention to the motion of parts like the wheels (*rotae*) echoes the

[564] AT VII, 32.

[565] Hobbes, *De Cive*, 32 (Preface: 9), with Latin footnotes; also Warrender's Latin edition, 79.

fascination with circular motion that we have seen throughout this history of automata. Just like Aristotle, Hobbes was clearly fascinated by the automata of his day.

Here, then, we should refer to his positioning of mechanics and the inspiration for the arts of automaton-making. Hobbes echoes a distinctly Peripatetic account of mechanics in *Leviathan* and *De Mundo* that places it demonstratively subordinate to mathematics. In *Leviathan*, for example, Hobbes discusses sources of power as follows:

> Arts of publique use, as Fortification, making of Engines, and other Instruments of War ; because they conferre to Defence, and Victory, are Power: And though the true Mother of them, be Scince, namely the Mathematiques; yet, because they are brought into the Light, by the hand of the Artificer, they be esteemed (the Midwife passing with the vulgar for the Mother,) as his issue.[566]

Aristotle's own positioning of '*mēkhanikai*' in the *Posterior Analytics* placed mechanics more specifically subordinate to geometry ('*geōmetrikai*') – in particular solid geometry ('*stereometria*').[567] As Sylvia Berryman puts it, "whatever 'mechanics' later came to mean, at the dawn of the seventeenth century it was still recognizably a discipline inherited from antiquity".[568]

We know also that the Peripatetic *Mechanical Problems* was known to both Mersenne, with whom Hobbes was intellectually intimate and had corresponded frequently. Mersenne also incorporated Hobbes's work in some of his own treatises, notably (but not exclusively)

---

[566] Hobbes, *Thomas White's De Mundo Examined*, 24, fol. 5v–fol.6, for Hobbes's comment that mechanics is one of the mathematical parts of philosophy; Hobbes, *Leviathan*, 134 (I: 10. 42); See also Hobbes, *De Cive*, 164–165 (XIII: 14), Latin, 202, where the '*Mathematicall sciences*' are specified as the 'fountains' of navigatory and mechanic arts.

[567] *An. post.* 76a21–26; 78b37–40.

[568] Berryman, *The Mechanical Hypothesis*, 2009, 239.

under the *Ballistica* section of his *Cogitata Physico Mathematica*.[569] In Mersenne's own *Ballistica et Acontismologia* he references principles from the *Mechanical Problems*, attributing them to Aristotle. Notably here, it is geometry again – the circle, and circular motion in particular – that according to this Peripatetic text, initiates the most wondrous nature of the mechanical arts.[570] It is from these arts that artificial automata derive. References to the *Mechanical Problems* are also found in Galileo's *Two New Sciences*. [571] We know too that Hobbes explicitly admired Galileo in his Epistle Dedicatory to *De Corpore*.[572]

Circling back to *De Cive* we see that Hobbes refers to "the *Mechanicks*" (*mechanica*) there as the arts of human ingenuity, "of the most excellent workmen" (*excellentium opificorum*).[573] In *Leviathan*, where architectonic metaphors of "edifice", "Architect", and "crasie building" occur in political elucidation,[574] Hobbes classifies the science of engineers, architects and navigation under "Mechaniques", or the "Consequences from the motion of special kinds, and Figures of Body". This grouping is categorically distinct from "Politiques, and Civill Philosophy".

Crucially, both categories are considered to flow ultimately from "Knowledge of Consequences" – i.e. science or philosophy.[575] As Derek Solla Price has argued, "some

---

[569] On this point see footnote 13 in Kassler, "On the Stretch: Hobbes, Mechanics and Shaking Palsy, 2000, 179; Malcolm, "The Title of Hobbes's Refutation of Thomas White's *De Mundo*", 2011, 184–185.

[570] Mersenne, *Ballistica et Acontismologia*, 456. *Circulus, quem Aristoteles, initio Mechanicae, quantitates ponderum, & potentiarum examinatricis, θαυμασιώτατον* (*thaumasiōtaton* – this corresponds with [*Mech.*]. 847b18–20), *in plurima complectitur, quae mirabilia esse videntur*.

[571] Galileo, *Two New Sciences Including Centres of Gravity and Force of Percussion*, 109–110; 123; 131–133; 257.

[572] Hobbes, *De Corpore*, xvi (viii: Epistle Dedicatory). On a science of motion derived from Hobbes's relationships with both Galileo and Mersenne, see Baldin, *Hobbes and Galileo*, 2020, 1–44; 115–133.

[573] Hobbes, *De Cive,* 164 (XIII: 14); Latin, 202.

[574] *Leviathan*, 498 (II: 29. 167).

[575] *Leviathan*, 124 (I: 9. 40).

strong innate urge toward mechanistic explanation led to the making of automata, and that from automata has evolved much of our technology, particularly the part embracing fine mechanism and scientific instrumentation." As such, "when the old interpretation has been thus reversed, the history of automata assumes an importance even greater than before."[576] Hobbes certainly demonstrates an urge towards this mechanistic explanation. And it is also true that he draws his examples of artificial automata in *De Cive* and *Leviathan* from the mechanical arts. Moreover, he would have been no stranger to the affective implications of the geometry of the circle and circular motion implied by accounts of Peripatetic mechanics – not least because of his own attempts to square the circle.[577]

It is clear therefore that Hobbes's own "love of the knowledge of causes" and "Desire, to know why, and how" as "CURIOSITY" drove him to investigate the artificial automata that surrounded him, and use them in political explanation.[578] Aristotle does something similar in the *Metaphysics* when treating the relationship between *thauma* and automata in the sublunary world, and when formulating his counterfactual passage on automata in the *Politics*. The former begins with Aristotle's desire to know by nature (*oregontai phusei tou eidenai*). Gianni Paganini has recognized this similarity, however missing the correct point of comparison with Aristotle for a Hobbesian passion of curiosity – it is not with a "disinterested and contemplative" admiration qua a desire to know. *Thauma*, and all humankind's natural *orexis* to know are distinct in Aristotle, as Seth Bernadete has

[576] De Solla Price, "Automata and the Origins of Mechanism and Mechanistic Philosophy", 1964, 10. Price looks as far back as prehistory. But see Berryman, *The Mechanical Hypothesis*, 2009, 21–22, who is skeptical of attempts to place philosophical 'mechanistic conceptions' prior to the systematic development of a field of mechanics.

[577] Hobbes, *De Corpore*, 287-317 (XX), on squaring the circle; Bird, "Squaring the Circle", 1996, 217–231; Jesseph, *Squaring the Circle*, 1999.

[578] Hobbes, *Leviathan*, 160 (I: 11. 51), 86 (I: 6. 26).

shown.[579] For Hobbes, artificial automata represented human ingenuity, and a novel source of an avid desire to know how things work to keep moving. *Leviathan's* Introduction affirms both of these in referencing man's ability to create an artifice so great that it resembles man, and by explicitly inviting readers to share in Hobbes's curiosity about automata, "why may we not say…?"[580] But since Hobbes grounds both man's artifice and curiosity in nature and the motions of life, we turn next to physiology.

IV. Of 'Mushromes' and Men: *Genesis Automatos*

Our final head remains – creatures generated *automata*. This requires us to *dig* a bit into the physiological dimension behind Hobbes's Introduction in *Leviathan*, and more generally in his thought. In fact, it is mechanical automata that are to be considered as an artificial species of animal. Hobbes begins his Introduction to *Leviathan* with nature as God's art, further echoing Aristotle in *Physics* II that man's art imitates nature,[581] and leaving no clear margin between the two. Since it is more difficult to imagine how animals generated from sexual reproduction might *really* be imitated in liveliness by automata unless through movement alone,[582] we may want to turn our attention to those neglected animals and things that seem to be generated from, *and* move out of the inanimate matter in which they

[579] *Metaph.* A. 1. 980a21–983a13. See Paganini, "Hobbes's Philosophical Method and the Passion of Curiosity", 67, that the "mechanistic label should be reassessed as it proves too simple and reductive", instead proposing an interpretation grounded on a "passion of curiosit"; also Paganini, "'Passionate Thought': Reason and the Passion of Curiosity in Thomas Hobbes", 2012, 250–254; Bernadete, "On Wisdom and Philosophy", 1978, 214.

[580] Hobbes, *Leviathan*, 17 (I: Introduction. 1).

[581] *Ph.* II. 2. 194a21–22, *ei de hē technē mimeitai tēn phusin…*

[582] Frost, *Lessons of a Materialist Thinker*, 2008, 21–22, noting here that in *Leviathan*'s Introduction Hobbes does not only emphasize [natural] life as a "motion of limbs", but *also* that the "begining whereof is in some principall part within".

are formed.[583] For this we should first turn to William Harvey, who Hobbes also admired.[584]

Harvey was a distinguished physician who engaged extensively with Aristotle's works. In his *De Generatione* we also find overlooked descriptions to automata that ring soundly with the disjunctive formulation we find in Hobbes: "as in the *Automata,* or *engines* that go of themselves where the foregoing wheel sets his follower upon motion too", and, "things that seem to move of themselves".[585] Harvey also mentions and uses Aristotle's comparisons to artificial *automata* throughout his own *De Generatione*. When discussing the mystery of how contagion can effect the generation of animals, despite a lack of contact between things, Harvey says the following:

> But since the case is plain, that *Contagion* (where the things touch not, nor have their extremities kissing one another) can destroy *living creatures,* what should hinder, but that it should be as powerful, to conduce to the *life* and *generation of animals.* The *Efficient* in an *Egge,* by a *plastical vertue* (because the *male* did but onely touch, though he now be far from touching, and have no extremity reached out towards it) doth frame and set up a *foetus* in its own species and resemblance. And this author of fecundity, this peircing power is translated through so many *mediums* or *instruments,* that one cannot pattern it, neither by that mutation procured by instruments (as in the productions of Art) nor by *Aristotles Automata,* nor our *Clocks* or *Watches;* nor by the instance of a *King* in his own dominions, where his command is every where a law;

[583] Hobbes, *Decameron Physiologiucm,* 130 (X), "For the smallest Creatures which we take notice of, do engender, though they do not all by conjunction".

[584] Hobbes, *De Corpore*, xvi (viii: Epistle Dedicatory). Hobbes directly mentions Harvey's work on "*Generation of Living Creatures*".

[585] Harvey, *Exercitationes De Generatione Animalium*, 331 (LVI), Latin, 181 (LV), *quemamodum in automatis, sive ultroneis machinis cernimus ubi rota rotam movet sequentem*; 37 (XLVII), Latin, 129 (XLVI), more vaguely: *quodammodo tamen movere dicitur*. The Latin version had been printed earlier in 1651, from which the English was possibly translated by Martin Llewellyn. For more on Harvey, automata, and his peculiar meaning of mechanism, see Riskin, *The Restless Clock*, 2016, 87–94. Riskin however does not discuss spontaneous generation and creatures generated *automata* as referenced in *De Generatione*.

> nor can you ratifie this our doctrine, by introducing a soul into the seed or geniture.[586]

Crucially, he also cites Hieronymus Fabricius, his former professor, on the claim that the Greeks called "αὐτόματα" (*automata*) those animals born of their own accord (*seu sponte naturae nascentia*), from putrefaction.[587]

Keeping this in mind, we may turn afresh to *De Cive* where Hobbes had in fact utilized his own store of natural history and experience[588] to "consider men as if but even now sprung out of the earth, and suddainly (like Mushromes) come to full maturity without all kind of engagement to each other".[589] This anti-Adamic characterization of man in the state of nature all but ensured Hobbes's later castigation. Robert Filmer explicitly attacked what he saw as an anti-Scriptural, anti-familial, and anti-paternalistic absurdity that moreover denied man's original mutual dependency:

> I cannot understand how this *Right of Nature* can be conceived without imagining a Company of men at the very first to have been all Created together without any Dependency one of another, or as *Mushroms (fungorum more) they all on a sudden were sprung out of the Earth without any Obligation one to another,* as Mr. *Hobs*'s words are in his Book *De Cive, cap.* 8. *sect.* 3. the Scripture teacheth us otherwise, that all men came by Succession, and

[586] Harvey, *De Generatione*, 256 (XLIX). For Harvey's other mentions of Aristotle's artificial '*automata*', see 243 (XLVII), 263 (L). Latin, 132 (XLVI), 139 (XLVIII), 143 (XLIX), respectively.

[587] Harvey, *De Generatione*, 2–3 (I), Latin, 2 (I). For an overview of some of Aristotle's many references to natural things that are described as generating '*automata*' (or variants thereof) in his biological works, see Dudley, *Aristotle's Concept of Chance*, 2012, 174–175.

[588] Hobbes, *Decameron Physiologicum*, 22 (II), "What I want of experiments you may supply out of your own store, or such natural history as you know to be true".

[589] Hobbes, *De Cive*, 117 (VIII: 1), Latin, 160: *consideremusque homines tanquam si effent jamjam subito e terra (fungorum more) exorti & adulti, sine omni unius ad alterum obligatione…*

> Generation from one man: We must not deny the Truth of the History of the Creation.[590]

Similarly, Thomas Beconsall thought Hobbes offered a "wild Supposition" in believing "a Multitude of Men, by Divine Appointment, sprung up like Mushrooms".[591]

Hobbes's mushroom men are still seen as "atomized beings seeking their own survival", and "completely autonomous individuals".[592] Paul Sagar goes further in suggesting that emphasis on Hobbes's commonwealth as a theory of social contract is therefore untenable. Hobbes's turn to mushroom men is "no arbitrary stipulation or minor expository device" but instead one that really underscores the impracticality of sovereignty by institution. The latter is merely an "irenic device for explaining the [natural] grounds of legitimate political authority and reconciling men to it accordingly".[593]

But Sagar moves a bit too quickly in claiming that Hobbes's mushroom men demand consideration from a "purely analytic framework without appeal to contingent historical or genetic factors known only by experience".[594] Mushrooms do and must emerge from Hobbes's own store of natural history, and they emerge in a very particular way. As Theodore Christov has shrewdly noticed, Hobbes's comparison relies on

---

[590] Filmer, "Observations Concerning the Originall of Government", 187.

[591] Beconsall, *Grounds and Foundation of Natural Religion*, 140, 22–23. For a more comprehensive list of mushroom-critics (including Bramhall), see Christov, *Before Anarchy*, 2015, 50–56. On the relation of mushroom man to the Multitude, see Jakonen, *Multitude in Motion*, 2013, 182. Asserting a powerful conceptualization of the Hobbesian 'Multitude', Jakonen notes here that "the multitude refers to a multiplicity of individuals, who do not have any obligation with each other, much like mushrooms in Hobbes's famous definition".

[592] Sarasohn, "Was "Leviathan" A Patronage Artifact?", 2000, 615. Also Pateman, "'God Hath Ordained to Man a Helper'", 1989, 446, on how Hobbes's mushrooms offer a "picture of natural, atomized individuals"; Schochet, "Thomas Hobbes on the Family and the State of Nature", 1967, 428–429, on patriarchy in Hobbes.

[593] Sagar, "Of Mushrooms and Method", 2014, 99; 110.

[594] Sagar, "Of Mushrooms and Method", 2014, 101.

mushrooms as spontaneously generated. [595] However, Christov does not examine spontaneous generation or its conditions further. Spontaneous generation was still a leading explanation for the emergence of mushrooms at the time, and certainly Hobbes shows no sign of believing otherwise. What is crucial is that Hobbes's mushrooms generate spontaneously *from the earth*, standing on the border between the animate and the inanimate.

The conditions and manner in which this emergence takes place should not be ignored, since Hobbes supports a creationist theory of spontaneous generation in the *Decameron Physiologicum*, though he is a bit more cautious with his wording about its occurrence subsequent to the biblical deluge. He concludes as follows:

> And it may be the Earth may yet produce some very small Living Creatures: And perhaps Male and Female. For the smallest Creatures which we take notice of, do engender, though they do not all by conjunction; therefore if the Earth produce living Creatures at this day, God did not absolutely rest from all his Works on the seventh day, but (as it is *Cap. 2. ver. 2.) he rested from all the work he had made.* And therefore it is no harm to think that God worketh still, and when and where and what he pleaseth. [596]

Hobbes still seems to imply that spontaneous generation can be a cause of generation in his time – "it may yet be" the case and there is "no harm to think" so. Moreover, there is nothing in Scripture that would necessarily preclude it.

[595] Christov, *Before Anarchy*, 2015, 55. Louis Pasteur's 1864 Sorbonne lecture criticized Comte de Buffon's idea of spontaneous generation, singling out his characterization that refers it explicitly to the generation of both earthworms and fungi. See Vallery-Radot, *The Life of Pasteur*, 1914, 91.

[596] Hobbes, *Decameron Physiologicum*, 129–130 (X). Hobbes also mentions an "antient Historian", possibly Athanasius Kircher (given Hobbes's similar interest in inter alia magnetism, gravity, Egypt in this text) as supporting spontaneous generation in the deluge narrative. Kircher was also a renowned automaton-maker himself. See also the spontaneous generation of worms (which become flies), 81–82(VII).

As a theory, spontaneous generation was supported by William Harvey.[597] Harvey discusses spontaneous generation throughout his *De Generatione*, engaging both Aristotle and other theorists. But importantly, he does not dismiss it through any doctrine of *omne vivum ex ovo* that would preclude it. His understanding is ultimately indebted to Aristotle's own theory of spontaneous generation (*genesis automatos*).[598] Aristotle's *genesis automatos* is found not only in his biological works like the *Generation of Animals*, but also the *Meteorologica*, where the operation of the sun, and the elemental conditions involved in the processes of corruption and putrefaction are further emphasized.[599] We know that Hobbes reportedly claimed Aristotle's "discourse of animals was rare",[600] and he certainly knew the *Meteorologica*.[601] Importantly for Aristotle, Harvey, and Hobbes, spontaneous generation does not happen *ex nihilo*.[602] Hobbes's mushroom men in *De Cive* should therefore be seen as a counterfactual way of considering man as creatures generated *automata*.

While man is factually excluded from these creatures in the *Decameron*, Hobbes still sees an *ecological* relation between spontaneous generation and anthropology. In a virulently anti-poor discussion of plagues and contagion he gives us a less cautious indication that he too subscribes to spontaneous generation's occurrence post-deluge:

And therefore the cause must also be partly ascribed to the multitude

[597] See Foote, "Harvey: Spontaneous Generation and the Egg", 1969, 139–163.

[598] *Gen. an.* IV. 11. 761a14–763b16, note *genesis automatos* at 762a9.

[599] *Mete.* IV. 2. 379b1–9.

[600] Aubrey, *Aubrey's Brief Lives*, 158, "I have heard him say that Aristotle was the worst teacher that ever was, the worst polititian and ethick—a countrey-fellow that could live in the world would be as good: but his rhetorique and discourse of animals was rare".

[601] Hobbes, *De Mundo,* 24, fol. 5v.

[602] On this point in Aristotle see Sissa, "La génération automatique", 1997, 98.

> thronged together, and constrained to carry their Excrements into the fields round about and neer to their habitation. *Which in time fermenting breed Worms* [my emphasis], which commonly in a month or little more, naturally become Flies; and though engendred at one Town, may flie to another. Secondly, in the beginning of a Plague, those that dwell in the Suburbs, that is to say, neerest to this corruption, are the poorest of the people, that are nourished for the most part with the Roots and Herbs which grow in that corrupted dirt; so that the same filth makes both the blood of poor people, and the substance of the Fly. And 'tis said by Aristotle, that every-thing is nourished by the matter whereof it is generated. [603]

In reality for Hobbes his mushroom men are exemplified most closely by the sub-urban poorest of the people, and the "savage people in many places of *America*",[604] who are more immediately determined by corrupted environmental conditions like plague[605] or war.

Together they form different examples of the Hobbesian Multitude, which Mikko Jakonen has analysed and described as "more or less a monster, a Behemoth, which makes a terrible noise and has many, constantly changing facets".[606] Almost anything can happen when men are considered as spontaneously-generated mushrooms, including a *bellum omnium contra omnes*. But amongst those things that are possible – though difficult – men may "become at last weary of irregular justling and hewing one another" and institute a commonwealth.[607]

---

[603] Hobbes, *Decameron Physiologicum*, 81–82 (VII). See also Hobbes, *Leviathan*, 394 (II: 24. 130), "For naturall Bloud is in like manner made of the fruits of the Earth; and circulating, nourisheth by the way, every Member of the Body of Man".

[604] Hobbes, *Leviathan*, 194 (I: 13. 63).

[605] For a fascinating discussion of sanitation and biopower in Hobbes's politics, and a persuasive argument for the presence of plague doctors with their characteristic beaked masks ('*Schnabelmasken*') in *Leviathan*'s frontispiece, see Falk, *Eine gestiche Geschichte der Grenze*, 2011, 63–90: "Schnabelmasken: Sanität, Souveränitat, Selektion".

[606] Jakonen, *Multitude in Motion*, 2013, 67.

[607] Hobbes, *Leviathan*, 498 (II: 29. 167).

But how? Hobbes tells us that it begins when "a Multitude of men do agree, and *Covenant*, *every one, with everyone*…" In the Latin however he says a bit more about this agreement. The right conditions are required, as agreement occurs with these individuals coming together spontaneously of themselves (*sponte sua convenientes*).[608] Through *sponte*, therefore, we find ourselves *circling* again to the first head of automata, reminded of Hobbes' own definition of spontaneity and *automatos* in his polemic against Bramhall.

Leviathan is therefore created by an action of spontaneity, where man acts *sponte sua* or *automatos*. In doing so, this spontaneity is transferred into the artifice of Leviathan itself. There is little wonder why Hobbes chose to introduce Leviathan by contemplating the vitality of automata. Automata are examples of how man's ingenuity is used to bring the persistent motions of biological life into art, to keep something working and moving. It remains for us to examine Leviathan as an automated artifice itself, and whether Hobbes's political theory of state resonates with Aristotle's theory of automation in any way, beyond his understanding of automata as mediated through the Aristotelian tradition.

V. Industry, Automation, and the Automated State

Nowhere in Hobbes's corpus does he directly engage Aristotle's theory of automation in the *Politics*. While we have seen how medieval and early Renaissance thinkers translated and discussed Aristotle's counterfactual passage, Hobbes thrusts automata into the heart of his conception of the state without any reference to Aristotle's theory. However, the creation of the commonwealth in *Leviathan*'s Introduction contains perhaps Hobbes's most decisive break from that theory. Instead of the possibility of artifice acting to *substitute* for

[608] Hobbes, *Leviathan*, 264–265 (II: 18. 88 in English and 86 in Latin). Malcolm translates this as "of their own accord".

man's work, Leviathan is created spontaneously by men so that it can do something that they, as the Multitude, can do only "poore[ly]" on their own.[609] The artificial commonwealth therefore *augments* human capabilities:

> Art goes yet further, imitating that Rationall and most excellent worke of Nature, *Man*. For by Art is created that great LEVIATHAN called a COMMON-WEALTH, or STATE, (in latine CIVITAS) which is but an Artificiall Man; though of greater stature and strength than the Naturall, for whose protection and defence it was intended; and in which, the *Sovereignty* is an Artificiall *Soul*, as giving life and motion to the whole body.[610]

Leviathan is needed to do something man cannot do well by himself – namely provide proper protection and defence. Famously, without this augmented capability, the Multitude lives in perpetual fear and war "where every man is Enemy to every man" and there is "continuall feare, and danger of violent death". In this condition, Industry has no place "because the fruit thereof is uncertain". As a result there can be "no Culture of the Earth; no Navigation, nor use of the commodities that may be imported by Sea; no commodious Building; no Instruments of moving, and removing such things as require much force; no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society".[611] For Hobbes, when members of the Multitude must rely on their own strength and invention very little is possible. This does not mean that people cannot and do not individually labor to provide for themselves. It means that any products of such labor are not secure, *and* that mankind, as a whole, cannot be said to be diligently and

[609] Hobbes, *Leviathan*, 192 (I: 13. 62).

[610] Hobbes, *Leviathan*, 16 (I: Introduction. 1).

[611] Hobbes, *Leviathan*, 192 (I: 13. 62).

systematically applying itself in any kind of effort:

> Time, and Industry, produce every day new knowledge. And as the art of well building, is derived from Principles of Reason, observed by industrious men, that had long studied the nature of materials, and the divers effects of figure, and proportion, long after mankind began (though poorly) to build: So, long time after men have begun to constitute Commonwealths, imperfect, and apt to relapse into disorder, there may, Principles of Reason be found out, by industrious meditation, to make use of them, or be neglected by them, or not, concerneth my particular interest, at this day, very little.[612]

Hobbes's state of nature, therefore, is also a state of *pre*-industry. Once civil society is inaugurated through the creation of the commonwealth – even imperfect ones – industry begins as well. Hobbesian automata therefore also stand at the margin between pre-industry and industry, well before the technological advent of the Industrial Revolution in manufacturing.

So, while it is true that Hobbes does not explicitly take up Aristotle's ideas about automation in the *Politics*, his characterization of the commonwealth as an automated artifice – moreover a condition of possibility for industry – represents a shift from pre-industrial thinking to industrial thinking. Aristotle's determinations about automation sat within the natural, prepolitical realm of the household (*oikos*) and its comparative relations with artificial craft work. For Hobbes, it is not possible to imagine automation without the spontaneous act of agreement that gives rise to the state, inaugurating mankind's industry. Automation could not be prepolitical, for Hobbes.

It is moreover man's industry in civil society that can lead to "new knowledge" every

[612] Hobbes, *Leviathan*, 522 (II: 30. 176).

day and the march towards revolutions in arts and manufacturing. While Hobbes's economic theory has been termed "[quaint]" by theorists like William Dunning,[613] nevertheless a chief concern of his is the prevention of idleness. Hobbes tells us that the commonwealth should provide for those who "by accident unevitable, become unable unable to maintain themselves by their labour…". However, "for such as have strong bodies, the case is otherwise: they are to be forced to work; and to avoid the excuse of not finding employment". Therefore "there ought to be such Lawes, as may encourage all manner of Arts; as Navigation, Agriculture, Fishing, and all manner of Manifacture that requires labour."[614] Hobbes clearly demands that the able-bodied be forced to work. Like Aristotle he does not see automated tools replacing human labor in his time. In fact, he is concerned about idleness and the intestine disorder it might bring to the state. Such tools would therefore greatly exacerbate this problem.

Hobbes also distrusts the kind of life we saw in the golden Age of Kronos or the communities of the Homeric Cyclopes also referenced in Aristotle's *Politics*,[615] where communities are released from cultivation and labor:

> The NUTRITION of a Common-wealth consisteth, in the Plenty, and Distribution of Materials conducing to Life: In Concoction, or Preparation; and (when concocted) in the Conveyance of it, by convenient conduits, to the Publique use. As for the Plenty of Matter, it is a thing limited by Nature, to those commodities, which from (the two breasts of our common Mother) Land, and Sea, God usually either freely giveth, or for labour selleth to man-kind. For the Matter of this Nutriment, consisting in Animals, Vegetals, and Minerals, God hath freely layd them before us, in or neer to the face of the Earth; so as there needeth no more but the labour, and industry of receiving

[613] Dunning, *A History of Political Theories from Luther to Montesquieu*, 1905, 292, fn. 3.

[614] Hobbes, *Leviathan*, 539–540 (II: 30. 181). See also Levy, "Economic Views of Thomas Hobbes", 1954, 589–595.

[615] *Pol.* I. 2. 1252b23–25.

> them. Insomuch as Plenty dependeth (next to Gods favour) meerly on the labour and industry of men.[616]

While God does "usually freely giveth" commodities, Hobbes specifies that it is the "Plenty" of their matter – or their resource limit – that is determined by God *or* man's labor. The "Matter" itself of these resources requires no more but the "labour, and industry of receiving them". He emphasizes again that "Plenty" depends on labor and industry in addition to "Gods favour", while the matter depends merely on labor and industry. Hobbes simply does not envisage or prefer a world without human labor.

But industry develops alongside political despotism. To see this, we must examine three final points regarding Hobbes's automated state and its connection with Aristotelian automata and automation. The first concerns Leviathan's affective power. We saw how humankind's natural *orexis* to know, through Hobbes's avid desire to know how things work to keep moving, inspired his understanding of automata and the creation of Leviathan. This *orexis* is distinct from *thauma*. But once Leviathan is created, it must keep subjects in "awe", or even "over-awe" them so that their covenants are not broken.[617] The creation of the common power that does so requires the multitude to do the following:

> conferre all their power and strength upon one Man, or upon one Assembly of men, that may reduce all their Wills, by plurality of voices, unto one Will: which is as much as to say, to appoint one man, or Assembly of men, to beare their Person… And he that carryeth this Person, as called SOVERAIGNE, and said to have Soveraigne Power;

[616] Hobbes, *Leviathan*, 386 (II: 24. 127).

[617] See Hobbes, *Leviathan*, 192 (I: 13. 62); 190 (I: 13. 61); 224 (I: 15. 73); 254 (II: 17. 85); 256 (II: 17. 86); 260 (II: 17. 87); 370 (II: 22. 121).

The artificial sovereign is responsible, through the natural person or persons that bear its own person, to keep subjects in a state of awe. As Kye Barker has noted, this account of awe is indebted to Aristotle, because Hobbes "psychologically sublates—in other words, it isolates, transforms, and incorporates—the experience of wonder into his political philosophy through means which...can mostly be found in ancient philosophy…". In particular, "Hobbes relied in his own work on the treatment of *thaumazein* as it appeared in Book Alpha of Aristotle's *Metaphysics*."[618]

Fear is also co-located in Hobbes's account of awe, which Barker suggests can be traced back to a distinct root in [*to*] *deinon*. Hobbes therefore follows the path of many before him in using the inherently thaumaturgical properties of automata to appropriate both political and theoretical power for Leviathan. Note that Aristotle's theory of automation in the *Politics*, when referring to Homer's *automatous* tripods, does much the same.

Secondly, Hobbes's Leviathan is said to have both an artificial reason and will: "*Equity and Lawes*, and artificiall *Reason* and *Will;*". Curiously, The Latin removes the reference to "Will" and corresponds equity and law to artificial reason only.[619] Nevertheless, Leviathan is an *intelligent* artifice Here we see another departure from Aristotle's theory of automation, where automated tools only require perceptive faculties, and not cognition, to substitute for human labor. Hobbes's automated artifice not only augments human capabilities, but it does so with its own cognition – artificial reason in the

[618] Barker, "Of Wonder: Thomas Hobbes's Political Appropriation of Thaumazein", 2017, 364.

[619] Hobbes, *Leviathan*, 16–17 (I: Introduction. 1).

form of equity and laws.[620] This represents the elevation of intelligent automata into the highest expression of the political community – the state.

Finally, once Leviathan has been constructed, equity and laws as artificial reason proceed from the sovereign:

> When a Common-wealth is once settled, then are they actually Lawes, and not before; as being then the commands of the Common-wealth; and therefore also Civill Lawes: for it is the Soveraign Power that obliges men to obey them. For in the differences of private men, to declare, what is Equity, what is Justice, and what is morall Vertue, and to make them binding, there is need of the Ordinances of Soveraign Power, and Punishments to be ordained for such as shall break them; which Ordinances are therefore part of the Civill Law.[621]

Famously for Hobbes, civil laws owe their authority to the command of the sovereign. Recall that one of the conditions in Aristotle's theory automation is that automated tools complete their work when commanded (*keleusthen*) by masters or master-craftsmen. These tools assume the despotic and quasi-despotic relation, respectively, from slaves and subordinate craft workers. Hobbes's emphasis on the command, within the context of the automated state and artificial sovereign, seems to place human subjects within the despotic rule of an artifice. Sheldon Wolin has noticed this "culture of despotism", namely, that the "sovereign tells his subjects what right consists in, what is justice, and what salvation."[622] Well before Marx's comments on the autocratic control of automata over factory laborers

[620] See Bates, *States of War*, 2012, 65, "Hobbes's project in Leviathan is to give an account of human reason as essentially embodied and then to suggest exactly what kind of "artificial intelligence" the state must possess to operate success-fully as a kind of automaton analogous to the human being" but see his conclusion at 72 that "Hobbes's *Leviathan*, as a text, is a prosthetic instrument, literally (for the reader), an artificial intelligence device."

[621] Hobbes, *Leviathan*, 418 (II: 26. 138).

[622] Wolin, "Hobbes and the Culture of Despotism", 1990, 20.

in *Das Kapital*,[623] therefore, we find Hobbes theorizing the sovereign, exercising despotic political control over subjects at large, as the movement-giving part of the automated, artificial state. Following Wolin's line of thought, which emphasizes continuity in the "presuppositions of monotheistic absolutism" in Hobbes,[624] we could say that the Hobbesian *Organ*, as opposed to the *christliche Organ*, transforms slavery of the masses into subjection of the masses. This movement occurs as the intelligent, automated tool is elevated to the locus of political control, with its ability to over-awe subjects.

VI. Brute Mechanism?

To consider Hobbes's man or commonwealth as identical to, or even simply analogous with an automaton can therefore lead us astray if we have in mind a narrow account of passive machines or brute mechanism.[625] Automata are found scattered and layered in Hobbes's thought far more expansively than is usually presented, and the concept demonstrates Hobbes's assertion of the power of translation, the mechanical arts, and physiology in his world of politics. Automata work to bring the persistent cycles and motions of life not only to the artificial man that is the commonwealth, but to our understanding of '*nobilissimum animalium*', the Hobbesian natural man.[626]

To Hobbes, automata represent man's unique curiosity and ingenuity in delving into the workings of nature and imitating its vital processes. But they also illustrate our natural dependence and limitations, as well as the real contingency of what we might

[623] Marx, *Das Kapital*, 410–411 (544–545), on the automaton as autocrat, *passim*.

[624] Wolin, "Hobbes and the Culture of Despotism", 1990, 18.

[625] On reading against 'brute mechanism' and passivity, see Riskin, *The Restless Clock*, 2016, 7–8; 94; 101–102; 247–250. Unfortunately, Riskin applies this term to Hobbes's own thought, as noted already, 72–74.

[626] Hobbes, *Leviathan*, 17 (I: Introduction. 1).

therefore create and how we might do so. The moment between the natural, spontaneous coming together of the at-last weary Multitude, and the artificial covenant instituting the commonwealth, is one in which nature and art are dissolved into each other. This is the Cerberian, marginal space of automata, standing between two worlds as Hobbes in *Leviathan*'s Introduction had realized.

As he also knew, the ever-present tug-of-war between the mushroom men forming the monstrous Multitude, and the civil men forming the ordered Leviathan persists as a real and 'unsolvable' problem for political thought: 'the logic of multitude haunts the organized political community'. [627] Environmental conditions of corruption and putrefaction, of war and plague in Hobbes's most pointed examples, very much determine man and the commonwealths man can and might therefore create in a given situation. They present limits to our achievements and political arts, but paradoxically also the precarious conditions for their renewal.

As such, the commonwealth itself, nourished by man's efforts to culture from out of the environment,[628] is not a purely utopian, abstracted or analytic ideal. Hobbes in fact took pains to distinguish his *Leviathan* from Plato's *Republic*, Thomas More's *Utopia*, and Francis Bacon's *New Atlantis* – fearing their comparison.[629] Recovering automata from Hobbes's thought provides us with further depth to a world teeming with life, agency, and real political possibilities.

This world takes on different contours once Leviathan, as an automated artifice, is

[627] Jakonen, *Multitude in Motion*, 2013, 26.

[628] Hobbes, *Leviathan*, 386 (II: 24. 127), "As for the Plenty of Matter, it is a thing limited by Nature, to those commodities, which from (the two breasts of our common Mother) Land, and Sea, God usually either freely giveth, or for labour selleth to man-kind."

[629] Hobbes, *Leviathan*, 574–575 (II: 31. 193 in English and 172 in Latin). The Latin contains newer mentions to More and Bacon.

created. Despite a lack of direct engagement with Aristotle's theory of automation, Hobbes's conception of the state marks several important shifts in that theory. Leviathan *augments* instead of *substitutes* for man's capabilities, and moreover contains its own artificial cognitive capacities: artificial reason as equity and law. The moment of spontaneity that creates Leviathan also inaugurates the possibility of human industry, leaving automata on both sides of a pre-industrial state of nature and an industrial civil society. Hobbes' conception of the automated state therefore marks a shift from preindustry to industry, moving away from Aristotle's theory of automation in the prepolitical realms of the household and craft workmanship.

For Hobbes, industrial development and despotic artifice go hand in hand. His i) affective use of the thaumaturgical power of automata to over-awe subjects, ii) characterization Leviathan as an intelligent artifice, and iii) determination of law as authoritative through the command of the artificial sovereign, show an ideational appropriation of Aristotle's theory of automation. The despotic relations outlined in Aristotle's theory are reconfigured for Hobbes's own theory of law and affective subjection: the state, through an artificial sovereign, commands and over-awes humans as subjects, placing them within the despotic, political rule of intelligent artifice. The development of human knowledge and industry is a consolation for this despotic arrangement.

Hobbes's understanding of automata therefore owes much to Aristotle and the interpretive tradition. We could too quickly dismiss Hobbes as globally anti-Aristotelian. It is true that he openly avers against the Schools throughout his works, and Aristotle's *Metaphysics, Ethics,* and *Politics* especially in *Leviathan*'s final chapters.[630] But the present

[630] Hobbes, *Leviathan*, 1060 (IV: 46. 370); 1110 (IV: 47. 383).

examination of automata has shown how Aristotle's ideas loom large in Hobbes's works, and how other works like the *Meteorologica*, the biological works, the *Physics*, and even Aristotle's logical works, continue to hold open areas fruitful for examining Hobbes's thought. And here Hobbes did not protest so loudly – sometimes, quite the opposite.

Conclusion

I. Automation and Aristotelian Political Thought

As the previous chapters have shown, to ask questions in the history of political thought invariably means asking questions about the state of technology and technological thinking. Technology and politics are entangled – we are technological animals as much as we are political animals, constituted in and through the fact of technicity. As Bernard Stiegler has so poignantly suggested, "it may still be asked, *What is the human?,* and asked again, *What is the human world insofar as worldness is also always already technicity, technical power, activity?* And perhaps it will finally be asked, for once, *What is technology, qua the power of the human, that is to say, the human empowered?*"[631] To examine technology and the power of the human helps us understand the way in which political ideas manifest. Automation, therefore, is as much a political idea as it is a technological one. It marks a kind of thinking that – far from seeing humans as simply substituted and replaced – elevates the relation of humans to tools through the creation of an artificial sense of life. Humans cannot stand completely apart from this development, and neither can tools.

Aristotle's peculiar and enduring idea of automation and automated tools signifies a concrete reception of technology into political thought. In doing so, it opens the pre-industrial, premodern world to a renewed consideration by scholars of both technology and politics. Automation did not simply materialize in the 20th century US context when it was finally given a name – far from it. Its content had, by that time, been understood for thousands of years. Automation's name came later than its ideation. Aristotle and his

[631] Stiegler, *Technics and Time*, 1998 [1994], 91.

interpreters show us that automation is an idea that spans the history of humanity, with roots in ancient thought. Its various permutations mean that political theory would do well to understand it as a porous concept. Automation, so construed, specifies the conditions, limits, and consequences of substituting or augmenting human work with artificial tools capable of acting themselves to complete the relevant task. It is neither a uniquely modern phenomenon, nor tied to the advent of machines.

This historicity of automation should not surprise us. As Chapter One shows, a trace of the term *automation* is found in its etymological roots in the Greek language itself. Before automation, or even any discernible field of mechanics, the Greeks cognized *automata*. In this sense, *automata* prefigure automation and mechanism. Surveying this term in Greek literature and material culture yields a kind of *cinematic experience* for the Greeks – moreover one that defies a neat and closed translation or conception. *Automata* are closely tied to ideas about natural spontaneity, chance, and self-striving things. Simply put, the Greeks were fascinated by nature's ability to produce things and effects in a way that seemingly defied ordered explanation. *Automata* were natural wonders before they were instantiated in mechanical marvels by human hands.

This is no trivial fact. It illustrates that human imagination, regarding the lively and creative world of nature, has kept the idea of natural *automata* alive by giving it a concrete, artificial life. In our contemporary quests for AI and new algorithms we continue to create our own automata by witnessing the characteristics of life and its vicissitudes. The comparisons and comments that Aristotle makes to various automata throughout his corpus are a striking early example of this imaginative thinking at work. Automata appear to the Greeks as powerful spectacles, with affective dimensions that inaugurate wonder and miracle. There is little doubt how impressive the procession of Demetrius of Phalerum's

snail automaton must have been as a display of power, for example – an account of it is given by Polybius hundreds of years later! That Aristotle refers to automata in stimulating political and philosophical contexts, therefore, is unsurprising.

These Greek *automata* are also closely associated with chance, although not a full randomness: *automata* are not *chaos.* The body healing *automatos* in the Hippocratic corpus does not mean it does so purely randomly, but rather through a convergence of causes and conditions. The Greeks moreover often associated *automata* with circular motion – examples including the Hephaestus' golden tripods in the *Iliad*, Plato's revolution of the cosmos in the age of Zeus per the *Statesman*, or what we have discovered as puppets, having articulated limbs, in the archaeological record– *neurospasta*. It is as though the Greeks wondered at, and observed the heavenly circular motions as a source of all life, and desired to instantiate this in the world of their arts. Sometimes they refer to these *automata* by using the term explicitly, other times it is implied as a way to make sense of the inherent tensions of life – how order and errancy negotiate a shared existence in the self.

In application, the idea that *automata* provide a relief from work is one that precedes Aristotle's formulation in the *Politics*. The natural bounties and spontaneity of nature are a common motif in Greek poetry, particularly the Hesiodic Age of Kronos. Greek comedy – Crates in particular – takes this motif into the Greek household and imagines a world where slaves are replaced by all manner of animated household items operating on command. His characters in the *Beasts* discuss self-setting tables, self-pouring ladles, automatic heated water systems – to name but a few – as substitutes for male and female slaves. It sets the stage, therefore, for the direct appearance of this idea in the context of Aristotle's formation of the political community.

But *automata*'s slippery nature and its association with a life of plenty and ease meant that Greek philosophers like Xenophon and Plato approached it with caution and suspicion. Human *effort* is required for a life well-lived, in accordance with self-development and virtue. *Automata* represented an errant resource to be tamed and cultivated by the ingenuity of human minds and hands. The mythical statues of Daedalus, Plato's Socrates tell us in the *Meno*, need to be tied down (*dedemenon*) so that they don't run away, and so that they can therefore realize their value.[632] Human effort and endeavour to master nature's errancy and realize value, therefore, is very much contained in the philosophers' relationship with *automata*. Aristotle was no exception to this, and his theory of automation takes this schematic of control and mastery directly into the building blocks of the *polis*. He does so by rooting the *polis* in natural slavery, and associating slavery with the technology of (automated) tools.

Chapter Two shows us how Aristotle, a master *organizer* of knowledge himself, takes the idea of *automata* into politics. It therefore offers an exegesis and analysis of Aristotle's theory of automation in the context of the formation of the *polis*. For Aristotle, the *polis* requires a partnership between the master type (*despotei*) and slavish (*doulōi*) for preservation (*dia tēn sōtērian*).[633] Not only is slavery 'baked in' to his understanding of the political community, but it is also necessary in his realizable, best state. Automated tools – or *organa automata* – appear in this context as a kind of impossibility for the present in which he lived, yet an open possibility for another time. *Organa*, as tools, form a building block of the Aristotelian *polis*. They are, as Robert Gallagher summarizes, "not an end, but only a

[632] *Meno*, 97d–98a.

[633] *Pol.* I. 2. 1252a25–35.

means".[634] Coloured by the chains of slavery, however, these artificial and natural 'tools' of the state are anything but neutral or trivial – Aristotle's *polis* turns on the determination of who and what they are.

But who and what these necessary tools were also implied their requisite cognitive capacities for work. Contemporary theorists of politics and technology have been quick to see in Aristotle's theory of automation an early imagination of intelligent artifice or AI. Referring directly to Aristotle's passage, Genevieve Lively and Sam Thomas, for example, tell us that, "Already in antiquity, then, automata and *intelligent* [my emphasis] machines were conceived as artificial slaves".[635] In order to replace slaves and craft subordinate workers, automated tools needed to possess the requisite cognition to do so. Certainly these workers, qua humans – an identity that Aristotle does not deny them – must possess intelligence. Therefore, we might easily assume that the automated tools Aristotle contemplates must also do so.

For Aristotle, however, a difference exists between the cognitive faculties that workers inherently possess as humans, and those which they need to employ for their work. In order to substitute for human work, automated tools need to have the *dynamis* to complete the relevant work, and be able to do so i) on command (*keleusthen*) or ii) by perceiving in advance what to do (*proaisthanomenon*). Neither of these two conditions call for higher noetic intelligence – they both simply require perceptual (and not causal) knowledge. Obeying a command is something that animals can do, and moreover something which we do all the time when listening to our passionate, desiderative side with a view to a present

[634] Gallagher, *Aristotle's Critique of Political Economy*, 2018, 96.

[635] Liveley and Thomas, "Homer's Intelligent Machines", 2020, 41.

action. When we are hungry and see a delicious meal, for example, our desiderative side commands us to eat immediately – whether we obey this command is a different matter. But we can understand what needs to be done through desire's command alone.

Advance perception (*proaisthanomenon*) has too often been described as an 'intelligent' anticipation in scholarship dealing with Aristotle's theory. And yet this too is something that is perceptual and shared with animals, as we see when turning to consult Aristotle's broader corpus like *De Sensu* and *De Memoria*. While it involves an apprehension of time, and memory, it is still a form of conditioning whereby a being understands what to do when a stimulus is present, but does not necessarily know why. Simply put, for Aristotle executing technical work does not require higher intelligence. Masters and master-craftsman are still engaged in the work process, by way of design and instruction, and do possess these faculties. However, the idea that substitutable automated tools require higher intelligence – that they somehow refer to intelligent artifice or smart machines, especially in the history of AI – is not Aristotle's idea.

In Chapter Three, we saw how the relatively late rediscovery of the *Politics* into the Latin Christian West complicates the idea that Aristotle's automated tools do not perform work requiring higher intelligence. The medieval period was replete with magical, occult, and even diabolical literary allusions to automata, as well as material automata as magnificent displays of Church power. Christian interpreters of Aristotle's theory therefore transformed it within this milieu, resulting in *das specifisch christliche Organ*, as Marx tells us. Work and workers, qua Church *organs*, find themselves in the bath of the Christian West and the Pauline context where it 'can be a good thing to be a slave'. This affects the understanding of the cognition required to perform technical work, and moreover the condition(s) such that that work can be automated.

Per the summary table below, Moerbeke's translation, which was the standard for the Magnus, Aquinas, and Oresme commentaries, collapsed the disjunctive condition and emphasized the command. While Magnus reassures his readers that the type of perception and preconception (*praeconciperet*) involved in understanding the command still only require the perceptive faculties, he nevertheless subscribes to the idea, unlike Aristotle, that immaterial faculties can be an *organon*. Aquinas's idea of recognition (*agnoscens*) of the command does seem to imply a higher language-based intelligence, while Oresme focuses only on the command in his commentary. It is only really when Leonardo Bruni's rhetorical translation begins to supersede Moerbeke's in the Renaissance that the familiar disjunctive conditions appear.

<table>
<tr><th>Aristotle</th><th>Moerbeke</th><th>Magnus</th><th>Aquinas</th><th>Oresme</th><th>Bruni</th></tr>
<tr><td>Keleusthen
Command</td><td rowspan="2">Iussum et praesentiens
Command and fore-perception</td><td rowspan="2">Praesentiens et praeconciperet jussum
Fore-perception and pre-conception of command</td><td rowspan="2">Ad imperium domini, agnoscens
Recognition of the command</td><td rowspan="2">Commande, eust apparcevance
Command, having perception (thereof)</td><td>Ad iussum
At the command</td></tr>
<tr><td>Proaisthanomenon
Advance Perception</td><td>(Ad) Nutum
At the unspoken will</td></tr>
</table>

Table VI.1. Comparative medieval terminology across Aristotle's conditions for automation

It would be a mistake to think assume that the idea of intelligent artifice and automation ends with the dawn of the early modern period, and that there is a complete break with the Peripatetic interpretive tradition. In Chapter Four, we saw how Thomas Hobbes takes the idea of automata – a concept indebted to ancient sources, including Aristotle – into the creation of the state. Now, instead of referencing Homer's tripods or

Daedalus' statues as examples of *organa automata* that might substitute for the building blocks of the natural *polis*, as Aristotle does, Hobbes turns to automata to explain his artificial state. Despite his protestations, Hobbes shares with Aristotle a fascination with technology. It is only natural that we marvel at the life-imitative artifacts we create, which in turn stimulates both political and philosophical thinking. These artifacts symbolize the durability of our creative potential, and the different possibilities of extending ourselves into the world around us. Hobbes clearly understood this – instead of dismissing Aristotelian ideas about automata and automation in political explanation, he appropriates the interpretative tradition to thrust technology into the formation of the commonwealth. He is not content to leave the state to nature – rather he wants to elevate artifice so that we may leave a state of nature altogether. In doing so he goes further than Aristotle and introduces the idea of an automated state serving the interests of man. His Leviathan augments instead of substitutes for man's capabilities, endowed as it is with its own artificial reason and will: equity and law. The idea of intelligent artifice in politics, therefore, not only persists from the medieval period, but is embraced by Hobbes's political philosophy.

Hobbes also marks a shift to thinking about automation as industrial. Industry for Hobbes meant the collective human exertion and effort in cultivating natural resources. None of this is possible without the automated state. Whereas Aristotle's ideas about automation sat within the natural, prepolitical realm of the household (*oikos*), for Hobbes there cannot be automation without the spontaneous act of agreement that gives rise to the automated state. This is a condition for human industry. Automation therefore could not be prepolitical, for Hobbes, and his political philosophy sets the stage for automation as an industrial fact of human life.

Aristotle's theory of automation is also rooted in an extreme despotism that threads

its way through the interpretive tradition and into Hobbes's thought. For Aristotle, the Greeks were caught somewhere between the ideal political context of the gods, who gathered in their assemblies and were assisted in their tasks by automated tools, and the *barbaroi* societies who were composed almost exclusively of slavish peoples. The Greeks could therefore aim higher and had more liberal regime types, such as democracy, open to them, while the types of regimes open to the *barbaroi* were more despotic in nature (*despotikēn*): monarchy and tyranny suited these societies best. But the Greeks couldn't quite live a life of complete leisure and discussion as the gatherings gods themselves. Aristotle still believes that slavery is necessary in his best regime, and his idea of automation is theorized alongside the idea that enslaving one being is required for the freedom and development of another.

Hobbes's automated Leviathan similarly rests on despotism. For Hobbes, man trades freedom from despotism for peace, security, and thus the development of human knowledge and industry. Paradoxically, therefore, art is wielded over man, so that man may properly wield art. Technological despotism, the "autocratic philosophy of technics" as Simondon calls it, therefore remains the unbroken thread that follows political thought from Aristotle to Hobbes through this interpretative tradition. If, as Marx tells us, Aristotle's theory of automation can be attributed to the assumption *die Sklaverei des Einen als Mittel zur vollen menslichen Entwicklung des Andern* – that despotism of one is *necessary* for the development of another, that moreover Christianity's *specifisch…Organ* paved the way for a mass slavery,[636] then we might say that Hobbes's theory of automata and automation turns mass slavery into mass subjection by resting despotism in the technical object that becomes the

[636] Marx, *Das Kapital,* 398–399 (532–533).

state. This is precisely what Lewis Mumford observes in the development of an "authoritarian technics" – namely its beginning "in a new configuration of technical invention, scientific observation, and centralized political control that [gives] rise to the peculiar mode of life we may now identify, without eulogy, as civilization". The early modern moment that birthed Leviathan "threw off the ancient regime of absolute government, operating under a once-divine king", and "[restored] this same system in a far more effective form in…technology."[637] The automated state stands as an awesome testament to this – the new king is increasingly technological.

In short, therefore, there are four conclusions that emerge from our extended analysis of Aristotle's theory of automation –

I. Automation is a contested term whose content has been understood prior to the advent of modern machines.

II. Automata prefigure automation and mechanism.

III. Originally for Aristotle, neither automated tools nor workers require higher 'intelligence' to perform work. However, the rediscovery of the *Politics* in the medieval period complicates this idea.

IV. Aristotle's idea of automation is rooted in an extreme despotism, while dubiously associating freer and more democratic regimes with the substitution of work by automated

[637] Mumford, "Authoritarian and Democratic Technics", 1964, 3–4.

tools.

II. "No One is Free But Zeus": The Possibility of a Democratic Technics of Automation

Where might we find a democratic technics, then? If we circle back to *Prometheus Bound*, we are reminded of Power's stark caution to Hephaestus, "No one is free but Zeus" (*eleutheros gar outis esti plēn dios*). The fact of the technological is used to bind the Titan in place for his crime of disseminating the knowledge of fire and crafts to humankind. Technological knowledge is privileged, dangerous, and used to maintain Zeus's despotic authority. Prometheus tell us how he acted against Zeus and devised all manner of technical arts (*mechanēmata*) to give freely to man – from to brick-house (*plinthuphreis*) construction and woodworking (*xulougrian*), to numbers (*arithmon*) and combining letters (*grammatōn te suntheseis*), to domestication of beasts (*knōdala douleuonta*), to ships (*linopter'[os] nautilōn*), to medicine (*pharmakōn*), to the occult arts (*dustekmarton es technēn*) as a species of predictive auguries, to the discovery of metals like bronze, iron, silver, and gold (*chalkon, sidēron*, *agruron*, *chruson*).[638] For this errancy, he was bound by the god of technics himself. A despotic, authoritarian technics is set against Prometheus' defiant, democratic technics.

But Prometheus knows that what he has set in motion will ultimately lead to Zeus's doom. Zeus will be thrown from his tyranny (*ekpesēi tyrannidos*). And it will be, in Aristotelian terms, the reproductive relation that will do so. Zeus will be overthrown by a new generation, where the son will be mightier than the father (*paida spherteron patros*).[639] Prometheus himself will be freed from his torment by Io's generation as well. For his

[638] *PV*. 50; 447–506.

[639] *PV*. 755–775.

knowledge of Zeus's doom and his refusal to share it with the god and his herald, Hermes, Prometheus's punishment is made even more severe – during the day his liver is to be eaten by an eagle, while at night he is to be buried alive in darkness to heal again for the next day.[640] Hobbes tells us that this, in fact, is the condition of man in the state of nature and in the ignorance of causes:

> For as Prometheus (which, interpreted, is the prudent man) was bound to the hill Caucasus, a place of large prospect, where an eagle, feeding on his liver, devoured in the day as much as was repaired in the night: so that man, which looks too far before him in the care of future time, hath his heart all the day long gnawed on by fear of death, poverty, or other calamity; and has no repose, nor pause of his anxiety, but in sleep.[641]

Promethean man is placed into perpetual fear and anxiety about the future, which can only be rectified, for Hobbes, by the knowledge of causes made possible by the commonwealth. Hobbes replaces the divine authority with the civil authority.

But can the new generation exert a democratic challenge to this authority? In response to the Aristotelian "autocratic philosophy of technics" (*philosophie autocritique des techniques*), Simondon proposes man as a kind of permanent coordinator and inventor, akin to a musical conductor:

> Far from being the supervisor of a group of slaves, man is the permanent organizer of a society of technical objects that need him in the same way musicians in an orchestra need the conductor. The conductor can only direct the musicians because he plays the piece the same way they do, as intensely as they all do; he tempers or hurries them, but is also tempered or hurried by them; in fact, it is through the conductor that the members of the

[640] *PV*. 1015–1030.

[641] Hobbes, *Leviathan*, 165–166 (I: 12. 52).

> orchestra temper or hurry one another, he is the moving and current form of the group as it exists for each of them; he is the mutual interpreter of all of them in relation to one another. Man thus has the function of being the permanent coordinator and inventor of the machines that surround him. He is among the machines that operate with him.[642]

Simondon therefore offers a fundamental rethinking of the relationship of man to technology. Instead of the despotic relation between man and tool, it is man among the tools (and species of tools qua machines) as a conducting element.

Simondon recognizes that man is both moved and moved in the technical system (tempers/tempered, hurries, hurried). Marx had realized the potential for the despotic relation between man and tool to be reversed in favour of the tool's service to capital – i.e., that man becomes *moved* by, and in rhythm to the tool: "[to] work at a machine, the workman should be taught from childhood, in order that he may learn to adapt his own movements to the uniform and unceasing motion of an automaton."[643] Unlike Marx, Simondon sees a movement *amongst* tools – man shaping the movement of tools and in turn being shaped by the movement of tools.

Simondon's proposition is somewhat confounding, however. While it makes intuitive sense for man to shape tools, and be shaped by tools, this position makes it difficult to observe and disentangle a cause-effect relation between social and political change, and

---

[642] Simondon, *Du mode d'existence des objets techniques*, 1989 [1958], 11–12, (17–18 in translated edition): *Loin d'être le surveillant d'une troupe d'esclaves, l'homme est l'organisateur permanent d'une société des objets techniques qui ont besoin de lui comme les musiciens ont besoin du chef d'orchestre. Le chef d'orchestre ne peut diriger les musiciens que parce qu'il joue comme eux, aussi intensément qu'eux tous, le morceau execute; il les modère ou les presse, mais est aussi modéré et pressé par eux; en fait, à travers lui, le groupe des musiciens modère et pressec chacun d'eux, il est pour chacun la forme mouvante et actuelle du groupe en train d'exister; il est l'interprète mutuel de tous par rapport à tous. Ainsi l'homme a pour function d'être le coordinateur et l'inventeur permanent des machines qui sont autour de lui. Il est parmi les machines qui opèrent avec lui.*

[643] Marx, *Das Kapital,* 412 (546): *Alle Arbeit an der Maschine erfordert frühzeitigen Einbruch des Arbeiters , damit er seine eigne Bewegung der gleichförmig kontinuirlichen Bewegung eines Automaten anpassen lerne.*

technological change. Aristotle's position has the benefit of specifying that automated tools would lead to human economic and political freedom, or unfreedom per Marx's reversal. If we are to assess the possibility of a democratic technics, Simondon makes it difficult to locate whether the requisite change for such a technics should be socio-political, technological, or somehow both.

Moreover, the Simondonian orchestral conductor can hardly *always* be a democratic model – while both musicians and conductor play the same piece, it is the conductor who enforces the rules of that piece and stands as a central authority for the musicians. In fact, there exists a long history of the conductor as a model of autocratic command, as Buch Esteban shows. Conductors are, in fact, subject to various external pressures that determine the degree to which they might be considered more or less autocratic:

> In reality, the modern conductor, readily described as an autocrat, remains subjected to many pressures: he conducts orchestras strongly institutionalized and/or unionized, who often make decisions in an independent manner, including, in some cases, decisions to choose their [own] conductors; its services are subject to a market logic, while remaining dependent on logics institutions that are sometimes not very autonomous in relation to the State and the political class; he is the interpreter of a repertoire already known to musicians and the public, of which he is not alone in ensuring interpretative orthodoxy. [644]

[644] Esteban, "Le chef d'orchestre", 2002, 1003: *En réalité, le chef moderne, volontiers décrit comme un autocrate, reste soumis à de nombreuses pressions : il dirige des orchestres fortement institutionnalisés et/ou syndicalisés, qui prennent des décisions de manière souvent indépendante, y compris, dans certains cas, celle de choisir leurs chefs; ses prestations sont soumises à une logique marchande, tout en restant dépendantes de logiques institutionnelles parfois peu autonomes par rapport à l'État et la classe politique; il est l'interprète d'un répertoire déjà connu des musiciens et du public, dont il n'est pas seul à en assurer l'orthodoxie interprétative.*

Andrew Feenberg, therefore, is correct to note that Simondon is "vague on the political implications of his argument" and misses "an understanding of the role of conflicts of interest and differences in power in the technical realm".[645] Whereas Simondon's attempt to replace an autocratic philosophy of technology rests on the metaphysical assumptions of technics as a whole – and so different assumptions to the substantivist Aristotelian tradition in particular – it is less clear how this bears out in everyday democratic politics and theory.

Through his critical theoretical approach, Feenberg offers a model of what he calls 'democratic rationalization', which describes "resistances, like the environmental movement, that challenge the horizon of rationality under which technology is currently designed". Here rationalization refers to how "society responds to a particular definition of technology as a means to profit and power" and is based on the "responsibility for the human and natural contexts of technical action". For Feenberg democratic rationalization "requires technological advances that can be made only in opposition to the dominant hegemony." [646] Questioning "why democracy has not been extended to technically mediated domains of social life despite a century of struggles",[647] Feenberg therefore roots resistances in cultural, social, and political practices that resist and respond to technologies designed to control and dominate. As such it is collective, social, and human-driven response to the problem of authoritarian technical systems.

How does such a human, collective resistance to technological hegemony manifest? Feenberg gives the example of France's precursor to the World Wide Web in the 1980s, a

[645] Feenberg, "Concretizing Simondon and Constructivism", 2017, 64; 79.

[646] Feenberg, *Between Reason and Experience*, 2010, 28.

[647] Feenberg, *Between Reason and Experience*, 2010, 28–29.

videotex technology called the Minitel. In essence, the Minitel terminal was designed by the French government as a domestic database of centralized information – a kind of yellow pages albeit on a videotex interface. However, the Minitel's accessory nature to the telephone system prompted users to consider it as a means to communication as well. The terminal became a course of inter alia online communication, chatting, dating services, and pornography: "[users] 'hacked' the network in which they were inserted and altered its functioning, introducing human communication on a vast scale where only the centralized distribution of information had been planned.[648] The transformation of *users* into *hackers* marks a moment in hegemonic technological resistance that leads to the creation of a more democratic technological system – in this case a Minitel with far more functions, uses, and creative input than a simple repository of government-held information.

The critical theoretical approach has the advantage of accounting for the ongoing struggle between democratic technological resistance and authoritarian hegemony. But is the Heideggerian or Ellulian technological pessimism not warranted if this struggle continues to be rigged in favour of authoritarianism? We certainly see that moments of democratic resistance themselves are prone to further authoritarian consolidation: the empire strikes back, so to speak. For example, the technologically-led democratic promise of social media and the Arab Spring gave way to a new geo-politically structured and distributed authoritarian ordering in the Middle East. Authoritarianism was "shaken", but there continued to be a stark absence of meaningful democratization. [649]

[648] Feenberg, *Between Reason and Experience*, 2010, 15; 27.

[649] Brownlee, Masoud, Reynolds, *The Arab Spring*, 2015, 23.

In fact, when authoritarian regimes "adjust" and "embrace" to new technologies built on advanced automation, i.e. digital communications, they can deepen and entrench themselves even further. Rebecca MacKinnon terms this phenomenon, especially as it relates to 21st century China, as 'networked authoritarianism', also known as digital authoritarianism. In such a regime, "the single ruling party remains in control while a wide range of conversations about the country's problems nonetheless occurs on websites and social-networking services." Though the "average person with Internet or mobile access has a much greater sense of freedom—and may feel that he has the ability to speak and be heard—in ways that were not possible under classic authoritarianism", governments are still able to monitor and censor these conversations. Especially "in the networked authoritarian state, there is no guarantee of individual rights and freedoms. Those whom the rulers see as threats are jailed; truly competitive, free, and fair elections are not held; and the courts and the legal system are tools of the ruling party."[650] The promise of democratic technological resistance, therefore, can be one that becomes increasingly difficult to keep as we march towards a hyperindustrial society. As Bernard Stiegler puts it, "we live in decadent times for democracy, a decadence entailed by the becoming-consumerist of industrial societies". [651]

Do we now sound the death knell for democratic society? Perhaps it is yet premature to do so. Aristotle's theory of automation, though rooted in despotism, tells us far more about the structure of political thought and technology that may still be of use to us. Not only is a technological infrastructure 'baked in' to the formation and operation of the state,

[650] MacKinnon, "Liberation Technology" 2011, 33.

[651] Stiegler: *The Decadence of Industrial Democracies*, 2011 [2004], 36.

but politics itself is a matter of technological knowledge (*architektonikēs*). The progressive development of technology obscures each preceding stratified layer on which it is built. AI and algorithms are built on automation technologies, for example. This in turn was built on a technology of slavery over a long history, as we have seen. Traces of this techno-archaeological record can be found in digital technologies. It is no accident, for example, that programming languages privilege the *command*, or that master/slave and client/server protocols still form the backbone of network infrastructures. What makes a true democratic resistance difficult, therefore, is contending not only with prevailing techno-political hegemony, but the longer historical sediment, so to speak, of this hegemony over time.

This does not make true democratic resistance impossible. But it should shift the problems of contemporary technology deeper into the very assumptions that lie behind its existence. Discrimination and group oppression, bias and autonomy, surveillance and disinformation – all are systematic effects of a techno-system that has been built to privilege an authoritarian technics. We would be foolish to believe that the technological structures of the systems we have built over human history would not somehow manifest into social and political realities. The answer is to remodel, and not to renovate.

Automation stands at a critical juncture for remodelling our relation to technology. The reason for this is not simply its necessity regarding today's contemporary advanced technologies, but the way it is bound up with what life itself is. *Automatos*, from the Greek, takes us into the heart of natural liveliness, chance, and accident. The creation of artificial liveliness, through human ingenuity, is a schema that is appropriated by automation and fixed into productive economic and socio-political relations. Aristotle located these relations in slavery and craft subordinate slavishness, moreover making an equivalence between inanimate tools and animate slaves. The worlds of the master and master-craftsmen are

privileged ones, predicated on political rule and technological skill, respectively. Hephaestus and Daedalus stand as exemplary characters in their relations to tools.

But what if we turn to Prometheus as a model, instead of Hephaestus or Daedalus? Prometheus' great crime was to give knowledge of fire and arts (*technas*) to mankind. In essence, the Promethean model is one that consists in the democratic dissemination of technical knowledge to all. Technology is not confined the gods or only specific mythical master-craftsmen. Instead, both design and use of technologies appear accessible to all members of society, who moreover have an equitable and controlling stake in their development. Mumford echoes this kind of Promethean democratic technics as follows,

> What I would call democratic technics is the small scale method of production, resting mainly on human skill and animal energy but always, even when employing machines, remaining under the active direction of the craftsman or the farmer, each group developing its own gifts, through appropriate arts and social ceremonies, as well as making discreet use of the gifts of nature.[652]

A democratic technics places the productive relations in the hands of the craftsmen, as a decentralized form of technological use and development.

What might such a democratic technics look like in a hyperindustrialized, contemporary society with centralized technological systems? We may give the promising example of rising citizen *developers* or *designers* in the context of low/no code algorithmic automation. Instead of relying on ever-advancing technical skills to create programs, low/no code automation allows erstwhile digital users to become creators, empowering non-technical domain experts in digital development. These empowered digital citizens are

[652] Mumford, "Authoritarian and Democratic Technics", 1964, 2–3.

thereby also able to automate their own tasks and processes according to their preferences and rhythms. This returns to society a type of automation that became unfavoured in the 20th century, record-playback automation, which recorded an individual machinist's rhythms and movements to reproduce them in the production process. [653] As with democracy itself, such a possibility is never without its own risks and costs. It nevertheless allows us to rethink the despotic line of technological and political thought that endures with us today. Perhaps we might therefore revise Aristotle's theory of automation as follows,

> For if each of the tools were able to complete its own work under the guidance of human individuals who are technically empowered in the same way that Prometheus originally empowered mankind – if thusly shuttles wove themselves and plectra played lyres, craftsmen would continue to master their craft, and enslavement would cease to be a model for political and economic freedom.

In doing so, therefore, we recognize automation's genuine potential for freedom, marking the sheer ingenuity of our shared humanity.

[653] David Noble, *Forces of Production*, 2011 [1984], 144–192.

Bibliography

PRIMARY:

ANCIENT

[Aeschylus], *Prometheus Bound*, trans. Herbert Weir Smyth, (Cambridge: Harvard University Press, 1926).

Aeschylus, *Fragments*, trans. Alan H. Sommerstein, (Cambridge: Harvard University Press, 2009).

Apollonius Rhodius, *Argonautica*, trans. Edward P. Coleridge, (London: Bell and Sons, 1889).

Aristophanes,

- *Acharnians*, trans. Jeffrey Henderson, (Cambridge: Harvard University Press, 1998).
- *Clouds*, trans. William James Hickie, (London: Bohn, 1853).
- *Ecclesiazusae*, trans. Eugene O'Neill Jr., (New York: Random House, 1938).
- *Plutus*, trans. Eugene O'Neill Jr., (New York: Random House, 1938).
- *Wasps*, trans. Eugene O'Neill Jr., (New York: Random House, 1938).

Aristotle,

- *Constitution of the Athenians*, trans. H. Rackham, (Cambridge: Harvard University Press, 1952).
- *De Anima*, trans. W.S. Hett, (Cambridge: Harvard University Press, 1957).
- *De Caelo*, trans. C. D. C. Reeve, (Indianapolis: Hackett Pub. Co., 2020).
- *De Memoria*, trans. W. S. Hett (Cambridge: Harvard University Press, 1957).
- *De Motu Animalium*, trans. Martha Nussbaum, (Princeton: Princeton University Press, 1985).

- *De Partibus Animalium*, trans. A. L. Peck and E. S. Forster, (Cambridge: Harvard University Press, 1937).

- *De Sensu*, trans. W. S. Hett (Cambridge: Harvard University Press, 1957).

- *Generation of Animals*, trans. A. L. Peck, (Cambridge: Harvard University Press, 1942).

- *History of Animals*, trans. A. L. Peck, (Cambridge: Harvard University Press, 1965).

- *Metaphysics*, trans. C.D.C Reeve, (Indianapolis: Hackett Pub. Co., 2016).

- *Meteorologica*, trans. H. D. P. Lee, (Cambridge: Harvard University Press, 1952).

- *Nicomachean Ethics*, trans. Joe Sachs, (Indianapolis: Focus Publishing, 2002).

- *Physics*, trans. C.D.C. Reeve, (Indianapolis: Hackett Pub. Co., 2018).

- *Poetics*, trans. Joe Sachs, (Indianapolis: Focus Publishing, 2006).

- *Politics*, 2nd ed., trans. Carnes Lord, (Chicago: University of Chicago Press, 2013).

- *Posterior Analytics*, trans. Hugh Tredennick and E. S Forster (Cambridge, 1960).

- *Prior Analytics*, trans. H. P. Cooke and Hugh Tredennick, (Cambridge: Harvard University Press, 1938).

- *Rhetoric*, trans. J. H. Freese, (Cambridge: Harvard University Press, 1926).

- *Topica*, trans. Hugh Tredennick and E. S. Forster, (Cambridge: Harvard University Press, 1960).

Athenaeus, *Deipnosophistae*, G. Kaibel text, (Stuttgart: Teubner, 1887).

Aulus Gellius, *Noctes Atticae*, trans. J. C. Rolfe, (Cambridge: Harvard University, 1927).

Crates, *Fragments*, trans. Ian C. Story, (Cambridge: Harvard University Press, 2011).

Diodorus Siculus, *Bibliotheca Historica*, trans. C. H. Oldfather, (Cambridge: Harvard University Press, 1939).

Euripides,

- *Bacchae*, trans. T. A. Buckley, (London: Bohn, 1850).

- *Fragments (Eurystheus)*, trans. Christopher Collard and Martin Cropp, (Cambridge: Harvard University Press, 2008).

- *Iphigenia Among the Taurians, Bacchae, Iphigenia at Aulis, Rhesus*, trans. By James Morwood, (Oxford: Oxford University Press, 1999).

Herodotus, *Histories*, trans. A. D. Godley, (Cambridge: Harvard University Press, 1920).

Hesiod,

- *Theogony*, trans. Hugh G. Evelyn-White, (Cambridge: Harvard University Press, 1914).

- *Work and Days*, trans. Hugh G. Evelyn-White, (Cambridge: Harvard University Press, 1914).

Hippocrates,

- *Acute Diseases*, trans. Paul Potter, (Cambridge: Harvard University Press, 1988), and W. H. S. Jones, (Cambridge: Harvard University Press, 1923).

- *Ancient Medicine*, trans. W. H. S. Jones, (Cambridge: Harvard University Press, 1923).

- *Aphorisms*, trans. W. H. S. Jones, (Cambridge: Harvard University Press, 1931).

- *Diseases of Women*, trans. Paul Potter, (Cambridge: Harvard University Press, 2018).

- *Internal Affections*, trans. Paul Potter, (Cambridge: Harvard University Press, 1988)

- *On Diseases*, trans. Paul Potter, (Cambridge: Harvard University Press, 1988).

- *On Fractures*, trans. E. T. Withington, (Cambridge: Harvard University Press, 1928).

- *On Joints*, trans. E. T. Withington, (Cambridge: Harvard University Press, 1928).

- *On Wounds in the Head*, trans. E. T. Withington, (Cambridge: Harvard University Press, 1928).

- *Ulcers*, trans. Paul Potter (Cambridge: Harvard University Press, 1995).

Homer,

- *Iliad*, trans. Richmond Lattimore, (Chicago: University of Chicago Press, 2011).

- *Odyssey*, trans. A. T. Murray, (Cambridge: Harvard University Press, 1919).

Palaephatus, *Peri Apiston*, trans. Jacob Stern, (Wauconda: Bolchazy-Carducci, 1996).

Pausanias, *Description of Greece*, trans. W. H. S. Jones, (Cambridge: Harvard University Press, 1918).

Philostratus the Elder, *Imagines*, trans. Arthur Fairbanks, (Cambridge: Harvard University, 1931).

Pindar, *Olympian*, trans. William H. Race, (Cambridge: Harvard University Press, 1997).

Plato,

- *Euthydemus*, trans. W. R. M. Lamb, (Cambridge: Harvard University Press, 1967).
- *Euthyphro*, trans. Harold North Fowler, (Cambridge: Harvard University Press, 1914).
- *Laws*, trans. R. G. Bury, (Cambridge: Harvard University Press; London: William Heinemann, 1967 and 1968).
- *Meno*, trans. W. R. M Lamb, (Cambridge: Harvard University Press, 1924).
- *Protagoras*, trans. W. R. M. Lamb, (Cambridge: Harvard University Press, 1967).
- *Republic*, trans. Allan Bloom, (New York: Basic Books, 1968).
- *Sophist*, trans. Harold N. Fowler, (Cambridge: Harvard University Press, 1921).
- *Statesman*, trans. by Harold N. Fowler, (Cambridge: Harvard University Press, 1921).
- *Symposium*, trans. W. R. M Lamb, (Cambridge: Harvard University Press, 1925).

Polybius, *Histories*, trans. Evelyn S. Shuckburgh in F. Hultsch's text, (London: Macmillan, 1889).

Pseudo-Apollodorus, *Bibliotheca*, trans. James. G. Frazer, (Cambridge: Harvard University Press, 1921).

Pseudo-Aristotle,

- *De Mundo*, trans. E. S Forster and D. J. Furley, (Cambridge: Harvard University Press, 1955).
- *Mechanical Problems*, trans. W. S. Hett, (Cambridge: Harvard University Press, 1936).

Pseudo-Plato, *Minos*, trans. W. R. M. Lamb, (Cambridge: Harvard University press, 1925).

Simonides, *Fragments*, trans. David A. Campbell, (Cambridge: Harvard University Press, 1991).

Thucydides, *The Peloponnesian War*, trans. Thomas Hobbes, ed. David Grene, (London and Chicago: University of Chicago Press, 1989), and trans. Richmond Lattimore, (Indianapolis: Hackett Pub. Co., 1998.

Xenophon,

- *Anabasis*, trans. Carleton L. Brownson, revised by John Dillery, (Cambridge: Harvard University Press, 1998 [1922]).

- *Cyropaedia*, trans. Walter Miller, (Cambridge: Harvard University Press, 1914).

- *Hellenica*, trans. Carleton L. Brownson, (Cambridge: Harvard University Press, 1918), and trans. Carleton L. Brownson's translation, (Cambridge: Harvard University Press, 1921).

- *Memorabilia*, trans. E. C. Marchant, (Cambridge: Harvard University Press, 1923).

MEDIEVAL

Albertus Magnus,

- "Commentarii in Octo Libros Politicorum Aristotelis", in *Opera Omnia: Vol. 8*, ed. Augusti Borgnet, (Paris: Ludovicum Vivès, 1891).

- "De Memoria et Reminiscentia", in *Opera Omnia: Vol 9*, ed. Augusti Borgnet, (Paris: Ludovicum Vivès, 1890).

- "Metaphysicorum Lib. XIII", in *Opera Omnia: Vol 6*, ed. Augusti Borgnet, (Paris: Ludovicum Vivès, 1890), 18 (IX).

Annales regni Francorum, Inde ab a. 741 Usque ad a. 829: Qui Dicuntur Annales Laurissenses Maiores et Einhardi, ed. F. Kurze, (Hanover: Hahn, 1895).

Augustine of Hippo,

- *De Civitate Dei Contra Paganos*, trans. by George E. McCracken, (Cambridge: Harvard University Press, 1957), trans. R. W. Dyson, (Cambridge, University of Cambridge Press, 1998).

- *De Doctrina Christiana*, trans. R. P. H. Green, (Oxford: Clarendon Press, 1995).

- *De Trinitate*, trans. Arthur West Hadden, (Buffalo: Christian Literature Publishing Co., 1887).

Dasypodius, *Heron Mechanicus: Seu de Mechanicis Ejusdem Horologii Astronomici*, trans. Bernard Aratowsky with introduction and commentary by Günther Oestmann, (Augsburg: E. R. Rauner, 2008 [1580]).

Duns Scotus, "On the Nature of Man's Knowledge of God", *The Review of Metaphysics* 1, no. 2: 1947, 3–36.

Leonardo Bruni,

- "In hoc libro contenta. Politicorum libri octo...", comm. Jacques Lefèvre d'Étaples, (Paris: Simonis Colinaei, 1526).

- *Sulla perfetta traduzione [De interpretatione recta]*, ed. and trans. by P. Viti, (Napoli: Liguori, 2004), J. Hankin's translation, "On the Correct Way to Translate", in *The Humanism of Leonardo Bruni: Selected Texts*, eds. G. Griffiths, J. Hankins and D. Thompson (eds), (Binghampton: Renaissance Society of America, 1987).

Matteo Corsini, *Rosaio della Vita*, ed. Filippo Luigi Polidor, (Florence: Societá Poligrafica Italiana, 1845).

Nicole Oresme, "Livre De Politiques D'Aristote", ed. Albert Douglas Menut, *American Philosophical Society* 60, no. 6: 1970, 1–392.

Pèlerinage de Charlemagne, 1925 edition, (Paris: A. Lahure).

Perceval le Gallois, ou le conte du Graal, ed. Charles Potvin, (Geneva: Slatkine, 1977 [1866-1871).

Peter Abelard, *Scito te Ipsum*, Ilgner editions, (Turnhout: Brepols, 2001).

Roman de Thèbes, trans. Léopold Constans, (Paris: Firmin Didot, 1890).

Roman de Troie, trans. Glyn S. Burgess and Douglass Kelly, (Cambridge: D. S. Brewer, 2017).

Thomas Aquinas,

- "Sententia libri Politicorum", in *Opera Omnia iussu Leonis XIII edita, XLVIII A*, (Rome: Ad Sanctae Sabinae, 1971), *Commentary on Aristotle's Politics*, trans. Richard J. Regan, (Indianapolis: Hackett Pub. Co., 2007).

- *Commentaria in Octo Libros Physicorum*: *Books I-II*, trans. Richard J. Blackwell, Richard J. Spath, and W. Edmund Thirlkel, (New Haven: Yale University Press, 1963),

- *Commentary on the Metaphysics of Aristotle*, trans. John Patrick Rowan, (Chicago: Henry Regnery Company, 1961).

- *Summa Theologiae*, trans. by Fr. Laurence Shapcote, (Green Bay: Aquinas Institute, 2012).

William of Moerbeke, *Aristoteles Politicorum Libri Octo Cum Vetusta Translatione Guilelmi De Moerbeka*, ed. Franz Susemihl, (Leipzig: B. G. Teubner, 1872).

MODERN

Abraham Bosse, *Traité des pratiques géometrales et perspectives: Enseignées dans L'Academie royale de la peinture et sculpture* (Paris: Chez l'auteur, 1665).

Ephraim Chambers et al, *A Supplement to Mr. Chambers's Cyclopædia: or, Universal Dictionary of Arts and Science*s, (London: W. Innys et al, 1753).

Ernst Kapp, *Grundlinien Einer Philosophie der Technik: Zur Entstehungsgeschichte der Cultur aus Neuen Gesichtspunkten*, (Braunschweig: Verlag Von George Westermann, 1877).

Francesco de' Vieri, *Discorsi di M. Francesco de'Vieri, detto il verino secondo, cittadino fiorentino, delle maravigliose opere di Pratolino et d'Amore*, (Firenze: Giorgio Marescotti, 1587).

Francis Bacon, *Novum Organum*, (New York: P. F. Collier & Son, 1902 [1620]).

Galileo Galilei, *Two New Sciences Including Centres of Gravity and Force of Percussion*, trans. Stillman Drake, (Madison: University of Wisconsin Press, 1974).

Gilbert Simondon, *Du mode d'existence des objets techniques*, (Paris: Aubier, 1989 [1958). Translation edition by Malaspina, Cecile, John Rogove, (Minneapolis: University of Minnesota Press, 2017).

Hannah Arendt,

- "Cybernetics and Automation", in the Hannah Arendt Papers, Manuscript Division: Speeches and Writings File, 1923–1975, (Washington D.C: Library of Congress, 1964).

- *The Human Condition*, 2nd ed., (Chicago: University of Chicago Press, 1998 [1958].

Immanuel Kant, *Kritik der reinen Vernunft*, ed. Raymund Schmidt, (Hamburg: Felix Meiner, 1956 [1781]).

Jacques Lacan, *The Four Fundamental Concepts of Psychoanalysis: The Seminar of Jacques Lacan Book XI*, ed. Jacques-Alain Miller, trans. Alan Sheridan, (New York: W. W. Norton and Co., 1998 [1973]).

John Aubrey, *Aubrey's Brief Lives*, ed. Oliver Lawson Dick, (London: Secker & Warburg, 1949).

John Evelyn, *The Diary of John Evelyn*, ed. William Bray, (London: M. Walter Dunne, 1901 [1818]).

Karl Marx, *Das Kapital: Kritik der politischen Oekonomie – Buch I: Der Produktionprocess des Kapitals*, (Hamburg: Otto Meissner, 1867). Translation edition by Fowkes, Ben (London: Penguin, 1976).

Marin Mersenne, *Ballistica et Acontismologia*, (Paris: Antonii Beitier, 1644).

Martin Heidegger, "Die Frage nach der Technik", in *Martin Heidegger Gesamtausgabe: Band 7 – Vorträge und Aufsätze*, (Frankfurt, Vittorio Klostermann, 2000 [1954).

Michel De Montaigne, *Journal de voyage en Italie par la Suisse et L'Allemagne en 1580 et 1581*, ed. Louis Lautrey (Paris: Hachette, 1909).

Michel Foucault,

- *Surveiller et Punir: Naissance de la Prison*, (Paris: Gallimard, 1975).

- "The Subject and Power", *Critical Inquiry* 8, no 4 (1982): 777–795.

René Descartes,

- *Discours de la Méthode*, in *Oeuvres de Descartes: VI*, eds. Charles Adam and Paul Tannery, (Paris: L. Cerf, 1902).

- *L'Homme*, in *Oeuvres de Descartes: XI*, eds. Charles Adam and Paul Tannery, (Paris: L. Cerf, 1909).

- *Meditationes*, in *Oeuvres de Descartes: VII*, eds. Charles Adam and Paul Tannery, (Paris: L. Cerf, 1904).

Robert Filmer, "Observations Concerning the Originall of Government", in *Patriarcha and Other Political Works*, ed. Johann Sommerville, (Cambridge: Cambridge University Press, 1949).

Simon Patrick, *A Brief Account of the New Sect of Latitude-Men Together with Some Reflections Upon the New Philosophy*, (Oxford and Cambridge: s.n, 1662).

Thomas Beconsall, *Grounds and Foundation of Natural Religion*, (London: W.O., 1698).

Thomas Hobbes,

- "Of Liberty and Necessity", ed. Vere Chappell, (Cambridge: Cambridge University Press, 1999).

- "Thomae Hobbes Malmesburiensis Vita Carmine Expressa", in *Thomae Hobbes Malmesburiensis Opera Philosophica Quae Latine Scripsit Omnia*, ed. Sir William Molesworth, (London: John Bohn, 1839).

- *Behemoth*, in *The English Works of Thomas Hobbes of Malmesbury: Volume VI*, ed. Sir William Molesworth, (London: John Bohn, 1840).

- *De Cive: The English Version Entitled in the First Edition Philosophical Rudiments Concerning Government and Society*, ed. Howard Warrender, (Oxford: Oxford University Press, 1983, Warrender's Latin edition (Oxford: Oxford University Press, 1983).

- *De Corpore*, in *The English Works of Thomas Hobbes of Malmesbury: Volume I*, ed. Sir William Molesworth (London: John Bohn, 1839).

- *De Homine*, ed. Bernard Gert, (Indianapolis: Hackett Pub. Co, 1991).

- *Decameron Physiologicum* (London: J.C. for W. Crook, 1678).

- *Homer's Iliads*, in *The English Works of Thomas Hobbes of Malmesbury: Volume X*, ed. Sir William Molesworth, (London: John Bohn, 1844).

- *Letter 45, [24 September/] 4 October 1646, Hobbes to Samuel Sorbière*, in *The Correspondence of Thomas Hobbes: Volume I: 1622-1659*, ed. Noel Malcolm, (Oxford: Oxford University Press, 1994).

- *Leviathan*, in *Volumes 2 and 3: The English and Latin Texts (i) and ii)*, ed. Noel Malcolm, (Oxford: Oxford University Press, 2012).

- *Seven Philosophical Problems*, in *The English Works of Thomas Hobbes of Malmesbury: Volume VII*, ed. Sir William Molesworth, (London: Longman, Brown, Green, and Longmans, 1845).

- *Thomas White's De Mundo Examined*, trans. Harold Whitmore Jones, (London: Bradford University Press, 1976).

- *To The Reader: Considering the Virtues of an Heroic Poem*, in *The English Works of Thomas Hobbes of Malmesbury: Volume X*, ed. Sir William Molesworth, (London: John Bohn, 1844).

- *Exercitationes De Generatione Animalium*, (London: James Young 1653), Latin edition, (London: Du-Gardianis, 1651).

MATERIAL

"Corinthian Jointed 'Doll'" exhibited in the Metropolitan Museum of Art in New York, 44.11.8, 5th century BCE.

"I 3967: Kleroterion", (American School of Classical Studies at Athens: Museum Guide, 2014), 138–139, fig. 76.

"Table fountain, France, Paris, c. 1320–1340, gilt-silver and translucent enamel", 31.1 x 24.1 cm. The Cleveland Museum of Art, J. H. Wade Fund 1924. 859.

"Terracotta Ancient Greek Dolls" exhibited in the National Archaeological Museum in Athens, Room 56, 5th/4th century BCE

Alessandro Francini, Recueil, *Modèles de grottes et de fontaines. Dessins lavés,* in BNF Estampes et photograpgie, Réserve Hd-100(A)-Pet Fol; also in ANF, O^1 1598.

CONGRESSIONAL

Appendix, March 8th, 1955, 84th Cong., 1st sess., *Congressional Record* 101, pt. 11, A1521–1522.

SECONDARY:

Acemoglu, Daren, and Restrepo, Pascual, "Artificial Intelligence, Automation and Work", Working Paper 24196, (National Bureau of Economic Research: Cambridge, 2018).

Ackrill, John L., "Aristotle on Action", *Mind* 87, no. 348: 1978, 595–601.

Adkins, A. W. H., "The Connection Between Aristotle's Ethics and Politics", *Political Theory* 12, no. 1: 1984, 29–49.

Allard, Paul, *Les esclaves chrétiens, depuis les premiers temps de l'église jusqu'à la fin de la domination romaine en Occident*, (Paris: Didier, 1876).

Allen, Grace, *Vernacular Encounters with Aristotle's Politics in Italy, 1260–1600*, (London: University of London: Warburg Institute, 2015).

Ambrosetti, Nadia, *Cultural Roots of Technology: An Interdisciplinary Study of Automated Systems From the Antiquity to the Renaissance,* (Milano: Università degli Studi di Milano, 2010).

Angier, Tom, *Technē in Aristotle's Ethics: Crafting the Moral Life*, (London and New York: Continuum, 2010).

Armstrong, Tim, *The Logic of Slavery: Debt, Technology, and Pain in American Literature*, (Cambridge: Cambridge University Press, 2012).

Arp, Robert, "'The 'Quinque Viae' of Thomas Hobbes", *History of Philosophy* 16, no. 4: 1999, 367–394.

Babbich, Babette, *Günther Anders' Philosophy of Technology*, (London: Bloomsbury, 2021).

Babbit, Susan M., "Oresme's Livre de Politiques and the France of Charles V", *Transactions of the American Philosophical Society* 75, no. 1: 1985, 1–158.

Badiou, Alain, "The Democratic Emblem", in *Democracy in What State*, trans. William McCuaig, (New York: Columbia University Press, 2011).

Baldin, Gregorio, *Hobbes and Galileo*: *Method, Matter and the Science of Motion*, ([Online]: Springer, 2020).

Baldry, H. C., "The Idler's Paradise in Attic Comedy", *Greece & Rome* 22, no. 65: 1953, 49–60.

Balme, David, "Development of Biology in Aristotle and Theophrastus: Theory of Spontaneous Generation", *Phronesis* 7, no. 1: 1962, 91–104.

Barber, E. J. W., *Women's Work: The First 20000 Years: Women, Cloth, and Society in Early Times*, (New York: W. W. Norton and Co., 1994).

Barker, Kye, "Of Wonder: Thomas Hobbes's Political Appropriation of Thaumazein", *Political Theory* 45, no. 3: 2017, 362–384.

Bates, David, *States of War: Enlightenment Origins of the Political* (New York: Columbia University Press, 2012).

Bechmann, Roland, *Villard de Honnecourt: La pensée technique au XIIIème siècle et sa communication*, (Paris: Picard, 1991).

Bedini, Silvio, 'The Role of Automata in the History of Technology', *Technology and Culture* 5, 1964, 24–42.

Benanav, Aaron, *Automation and the Future of Work*, (London and New York: Veros, 2020).

Bermúdez-Rey, Juan Pablo, "Automaticity and Control in Human Action", (Toronto, University of Toronto, 2016).

Bernadete, Seth, "On Wisdom and Philosophy: The First Two Chapters of Aristotle's "Metaphysics" A", *The Review of Metaphysics* 32, no. 2: 1978, 205–215.

Berryman, Sylvia,

- "Ancient Automata and Mechanical Explanation", *Phronesis* 48, no. 4: 2003, 344–369.

- "Aristotle on Pneuma and Animal Self-Motion", in *Oxford Studies in Ancient Philosophy: Volume XXIII*, ed. David Sedley, (Oxford: Oxford University Press, 2002).

- *The Mechanical Hypothesis in Ancient Greek Natural Philosophy*, (Cambridge: Cambridge University Press, 2009).

Beullens, Pieter, "A 13th-Century Florilegium From Aristotle's Book on Animals", in *Aristotle's Animals in the Middle Ages*, ed. Carlos Steel, (Leuven: Leuven University Press, 1999), 69–95.

Bianchi, Emanuela, *The Feminine Symptom: Aleatory Matter in the Aristotelian Cosmos,* (Oxford: Oxford University Press, 2014).

Biener, Zvi, "Hobbes on the Order of Sciences: A Partial Defense of the Mathematization Thesis", *The Southern Journal of Philosophy* 54, no. 3: 2016, 312–333.

Bird, Alexander, "Squaring the Circle: Hobbes on Philosophy and Geometry", *Journal of the History of Ideas* 52, no. 2: 1996, 217–231.

Blakely, Sandra *Myth, Ritual and Metallurgy in Ancient Greece and Recent Africa*, (Cambridge: Cambridge University Press, 2006).

Bloomberg Jr., Warner, *The Age of Automation: Its Effects on Human Welfare*, (New York: League for Industrial Democracy, 1955).

Boesche, Roger, *Theories of Tyranny: From Plato to Arendt*, (University Park: Pennsylvania State University Press, 1996).

Boese, Vanessa A., "How (not) to Measure Democracy", *International Area Studies Review* 22, no. 2: 2019: 95–127.

Boese, Vanessa A., Alizada, Nazifa, Lundtstedt, Martin, Morrison, Kelly, Natsika, Natalia, Sato, Yuko, Tai, Hugo, and Lindberg, Staffan I., *Democracy Report 2022: Autocratization Changing Nature?*, (Gothenburg, V-Dem Institute, 2022).

Bonsignorio, Fabio, "The New Experimental Science of Physical Cognitive Systems: AI, Robotics, Neuroscience and Cognitive Sciences Under a New Name with the Old Philosophical Problems?", in *Philosophy and Theory of Artificial Intelligence*, ed. Vincent C. Müller, (Berlin: Springer, 2013), 133–150.

Bos, Abraham,

- "Pneuma as Quintessence of Aristotle's Philosophy", *Hermes* 141, no. 4: 2013, 417–434.

- *Aristotle on God's Life-Generating Power and on Pneuma as its Vehicle*, (Albany: State University of New York Press, 2018), 53–54.

- *The Soul and its Instrumental Body*: *Reinterpretation of Aristotle's Philosophy of Living Nature*, (Leiden: Brill, 2003).

Bosak-Schroeder, Clara, "The Religious Life of Greek Automata", *Archiv fur Religionsgeschichte* 17, no. 1: 2016, 123–136.

Bostock, David, *Aristotle's Ethics*, (Oxford: Oxford University Press, 2000).

Bottecchia Deho, Maria Elisabetta, *Aristotele, Problemi Meccanici: Introductione, Testo Greco, Traduzione Italiana, Note*, (Catanzaro: Studia Aristotelica, 2000).

Bowin, John, "Aristotle on Perception and Cognition", in *Philosophy of Mind in Antiquity: The History of the Philosophy of Mind Vol. 1*, ed. John E. Sisko, (London: Routledge, 2018), 175–193.

Brandt, Frithiof, *Hobbes's Mechanical Conception of Nature*, trans. Anne Fausbøll and Vaughan Maxwell, (Copenhagen: Levin & Munksgaard, 1928).

Bredekamp, Horst,

- 'Thomas Hobbes's Visual Strategies', in *The Cambridge Companion to Hobbes's Leviathan*, ed. Patricia Springborg, (Cambridge: Cambridge University Press, 2007), 29–60.

- *Der Leviathan: Das Urbild Des Modernen Staates und Seine Gegenbilder 1651-2001* (Berlin: De Gruyter, 2020).

- *Thomas Hobbes visuelle Strategien: Der Leviathan: Urbild des Modernen Staates; Werkillustrationen und Portraits*, (Berlin: Akademie Verlag, 1999).

Brett, Annabel, "'The Matter, Forme, and Power of a Common-wealth'": Thomas Hobbes and Late Renaissance Commentary on Aristotle's Politics", *Hobbes Studies* 23, no. 1: 2010, 1–392.

Brey, P., "Social Constructivism for Philosophers of Technology: A Shopper's Guide", *Techné: Journal of the Society for Philosophy and Technology* 2, nos. 3– 4: 1997, 56–78.

Broadie, Sarah, *Ethics with Aristotle*, (Oxford: Oxford University Press, 1991).

Brock, Roger, "The Labour of Women in Classical Athens", *Classical Quarterly* 44, no. 2: 1994, 336–346.

Brownlee, Jason, Masoud, Tarek, and Reynolds, Andrew, *The Arab Spring: Pathways of Repression and Reform*, (Oxford: Oxford University Press, 2015).

Brumbaugh, Robert S., *Ancient Greek Gadgets and Machines*, (New York: Crowell, 1966).

Brunt, P. A., *Studies in Greek History and Thought*, (Oxford: Clarendon Press, 1993).

Bryson, Joanna J., "Robots Should be Slaves", in *Close Engagements with Artificial Companions: Key Social, Psychological, Ethical and Design Issues*, ed. Yorick Wilks, (Amsterdam: John Benjamins Publishing Co., 2010).

Bucher, Taina, *If…Then: Algorithmic Power and Politics*, (Oxford: Oxford University Press, 2018).

Bur, Tatiana, *Mechanical Miracles: Automata in Ancient Greek Religion*, (Sydney: University of Sydney, 2016).

Burnett, Charles, "Arabic into Latin: The Reception of Arabic Philosophy into Western Europe", in *The Cambridge Companion to Arabic Philosophy*, eds. P. Adamson and R. C. Taylor, (Cambridge: Cambridge University Press, 2005), 370–404.

Burnyeat, M. F., *Explorations in Ancient and Modern Philosophy: Volume 1*, (Cambridge: Cambridge University Press, 2012).

Cassin, Barbara, "La « Fortuna » à la Renaissance", in *Vocabulaire européen des philosophies: Dictionnaire des intraduisibles*, (Paris: Seuil, 2004).

Castelnérac, B. "Impossibility in the *Prior Analytics* and Plato's Dialectic", *History and Philosophy of Logic* 36, no. 4: 2015, 303–320.

Celenza, Christopher S., *Renaissance Humanism and the Papal Curia: Lapo da Castiglionchio the Younger's De Curiae Commodis*, (Ann Arbor: University of Michigan Press, 1999).

Charles, David,

- "Aristotle: Ontology and Moral Reasoning", in *Oxford Studies in Ancient Philosophy IV: Festschrift for J. L. Ackrill*, ed. Michael Woods, (Oxford: Clarendon Press, 1986), 119–144.
- "Wittgenstein's Builders and Aristotle's Craftsmen", in *Wittgensteinian Themes: Essays in Honour of David Pears*, eds. David Charles and William Child, (Oxford: Oxford University Press, 2001), 49–79.

Cheneval, Francis, "Considérations presque philosophiques sur les commentaires de la "Politique" d'Albert le Grand et de Thomas d'Aquin"', *Freiburger Zeitschrift für Philosophie und Theologie* 45, 1998, 56–83.

Christov, Theodore, *Before Anarchy: Hobbes and his Critics in Modern International Thought*, (Cambridge: Cambridge University Press, 2015).

Collognat, Annie and Choppin, Bernadette, *Ex Machina: Machines, Automates et Robots Dans L'Antiquité*, (Paris: Les Belles Lettres, 2020).

Connell, Sophia, *Aristotle on Female Animals*, (Cambridge: Cambridge University Press, 2016).

Cuomo, Serafina *Technology and Culture in Greek and Roman Antiquity*, (Cambridge: Cambridge University Press, 2007).

Danaher, John, *Automation and Utopia: Human Flourishing in a World Without Work*, (Cambridge: Harvard University Press, 2019).

Davis, David Brion, *The Problem of Slavery in Western Culture*, (Oxford: Oxford University Press, 1988).

De Groot, Jean,

- "*Dunamis* and the Science of Mechanics", *Journal of the History of Philosophy* 46, no. 1: 2008, 43–68.
- *Aristotle's Empiricism: Experience and Mechanics in the 4th Century BC*, (Las Vegas: Parmenides Publishing, 2014), 117–124.

De Solla Price, Derek,
- "Automata and the Origins of Mechanism and Mechanistic Philosophy", *Technology and Culture* 5, no. 1: 1964, 9–23.
-
- *Gears from the Greeks: the Antikythera Mechanism – a Calendar Computer from ca. 80 B.C*, (New York: Science History Publications, 1975).

Delanty, Gerard, and Harris, Neal, "Critical Theory and the Question of Technology: The Frankfurt School Revisited", *Thesis Eleven* 166, no. 1: 2021, 88–108.

Des Chene, Dennis, *Spirits and Clocks: Machine & Organism in Descartes*, (Ithaca: Cornell University Press, 2001).

Devecka, Martin, "Did the Greeks Believe in Their Robots?", *The Cambridge Classical Journal* 59, 2013, 52–69.

Diebold, John,

- "Automation", *Textile Research Journal* 25, no. 7: 1955, 635–640.

- *Automation: The Advent of the Automatic Factory*, (New York: D. Van Nostrand Company Inc, 1952).

Diels, H., "Über Platos Nachtuhr", *Sitzungsberichte der Preussischen Akademie der Wissenschaften* 44, no. 2: 1915, 824–830.

Djiksterhuis, Eduard Jan, *The Mechanization of the World Picture*, trans. C. Dikshoorn, (Oxford, Oxford University Press, 1961).

Dobbs, Darrell, "Natural Right and the Problem of Aristotle's Defense of Slavery", *Journal of Politics* 56, no. 1: 1994, 69–94.

Drachmann, A. G., *The Mechanical Technology of Greek and Roman Antiquity: A Study of the Literary Sources*, (Copenhagen, University of Wisconsin Press, 1963).

Dudley, John, *Aristotle's Concept of Chance*: *Accidents, Cause, Necessity, and Determinism,* (Albany: State University of New York Press, 2012).

Dunning, William A., *A History of Political Theories from Luther to Montesquieu*, (New York: Macmillan, 1905).

Ebrey, David, "Why are There No Conditionals in Aristotle's Logic?", *Journal of the History of Philosophy* 53, no. 2: 2015, 185–205.

Economist Intelligence Unit, *Democracy Index 2022: The China Challenge*, (London: EIU, 2022).

Edgington, Dorothy, "I–Counterfactuals", *Proceedings of the Aristotelian Society* 108, no. 1: 2008, 1–28.

Ellul, Jacques, *The Technological Society*, (New York: Knopf, 1964).

Elsner, Henry, *The Technocrats: Prophets of Automation*, (New York: Syracuse University Press, 1967).

Elsner, Jaś (ed.), *Figurines: Figuration and the Sense of Scale*, (Oxford: Oxford University Press, 2020).

Esteban, Buch, "Le chef d'orchestre. Pratiques de l'autorité et métaphores politiques", *Annales. Histoire, Sciences Sociales* 57, no. 4: 2002, 1001–1028.

Falk, Francesca, *Eine gestiche Geschichte der Grenze: Wie der Liberalismus an der Grenze an seine Grenzen kommt*, (Munich: Wilhelm Fink, 2011).

Fanfani, Giovanni, "Weaving a Song. Convergences in Greek Poetic Imagery between Textile and Musical Terminology", in *Textile Terminologies from the Orient to the Mediterranean and Europe, 1000 BC to 1000 AD*, eds. Salvatore Gaspa, Cécile Michel, and Marie-Louise Nosch, (Lincoln: Zea Books, 2017), 421–436.

Feenberg, Andrew,

- "*Concretizing Simondon and Constructivism: A Recursive Contribution to the Theory of Concretization*", *Science, Technology, & Human Values* 42, no. 1: 2017, 62–85.

- *A Critical Theory of Technology*, (Oxford: University of Oxford, 1991).

- Andrew, *Between Reason and Experience: Essays in Technology and Modernity*, (Cambridge: MIT Press, 2010).

Fernandez, Patricio A., and Mittelman, Jorge, "When Life Imitates Art: Vital Locomotion and Aristotle's Craft Analogy", in *Heat, Pneuma, and Soul in Ancient Philosophy of Science*, eds. Hynek Bartoš and Colin Guthrie King, (Cambridge: Cambridge University Press, 2020).

Ferrari, Gian Arturo "Meccanica 'allargata'", in *La Scienze Ellenistica,* eds. G. Giannantoni and M. Vegetti, Atti delle tre giornate di studio tenutesi a Pavia dal 14 al 16 Aprile 1982, Napoli.

Finley, M. I., *The Ancient Economy*, (Berkeley: University of California Press, 1973).

Fliegel, Stephen N., "The Cleveland Table Fountain and Gothic Automata", *Cleveland Studies in the History of Art* 7, 2002, 6–49.

Flüeler, Christoph,

- "Political Aristotelianism", in *Encyclopedia of Medieval Philosophy*, ed. Henrik Lagerlund, (Dordrecht: Springer, 2011), 1038–1040.

- *Rezeption und Interpretation der Aristotelischen Politica im späten Mittelalter*, (Amsterdam: B. R. Grüner, 1992–1993).

Foote, Edward, "Harvey: Spontaneous Generation and the Egg", *Annals of Science* 25, no. 2: 1969, 139–163.

Ford, Andrew, "Catharsis: The Power of Music in Aristotle's *Politics*", in *Music and the Muses: The Culture of Mousikē in the Classical Athenian City*, eds. Penelope Murray and Peter Wilson, (Oxford: Oxford University Press, 2004).

Fortenbaugh, W. W,

- "Aristotle on Slaves and Women", in *Articles on Aristotle: 2. Ethics and Politics*, eds. Jonathan Barnes, Malcolm Schofield, and Richard Sorabji, (London: Duckworth, 1977), 135–139.

- "Aristotle: Animals, Emotion, and Moral Virtue", *Arethusa* 4, no. 2: 1971, 137–165.

Frank, Jill,

- "Citizens, Slaves, and Foreigners: Aristotle on Human Nature", *The American Political Science Review* 98, no. 1: 2004, 91–104.

- *A Democracy of Distinction: Aristotle and the Work of Politics*, (Chicago: University of Chicago, 2005).

Freedom House, *Freedom in the World: The Global Expansion of Authoritarian Rule*, (Washington: FH, 2021).

Frey, Carl Benedikt, Berger, Thor, and Chen, Chinchih, "Political Machinery: Did Robots Swing the 2016 Presidential Election?", *Oxford Review of Economic Policy* 34, no. 3: 2018, 418–442.

Frey, Carl Benedikt, *The Technology Trap: Capital, Labor, and Power in the Age of Automation*, (Princeton: Princeton University Press, 2019).

Friedmann, Georges, *Problèmes Humains du Machinisme Industriel*, (Paris: Gallimard, 1946).

Frost, Samantha, *Lessons of a Materialist Thinker: Hobbesian Reflections on Ethics and Politics*, (Stanford: Stanford University Press, 2008).

Furley, David, "Introduction; Self-Movers", in *Self-Motion: From Aristotle to Newton*, eds. Mary Louise Gill and James Lennox, (New Jersey: Princeton University Press, 1994).

Fynn-Paul, Jeffrey, "Empire, "Monotheism and Slavery in the Greater Mediterranean Region from Antiquity to the Early Modern Era", *Past & Present* 205, no. 1: 2009, 3–40.

Gallagher, Robert L., *Aristotle's Critique of Political Economy: With a Contemporary Application*, (New York: Routledge, 2018).

Garnsey, Peter, *Ideas of Slavery from Aristotle to Augustine*, (Cambridge: Cambridge University Press, 1996).

Gaukroger, Stephen, *Descartes: An Intellectual Biography*, (Oxford: Oxford University Press, 1995).

Gillioz, Stéphane, *Dieu et Leviathan: Mécanique du vivant et stratégies survivalistes dans la théorie de Thomas Hobbes*, (Berne: Peter Lang, 1990).

Goodrich, John K, "From Slaves of Sin to Slaves of God: Reconsidering the Origin of Paul's Slavery Metaphor in Romans 6", *Bulletin for Biblical Research* 23, no. 4: 2013, 509–530.

Goris, Harm, "The Angelic Doctor and Angelic Speech: The Development of Thomas Aquinas's Thought on how Angels Communicate", *Medieval Philosophy and Theology* 11, no. 1: 2003, 87–105.

Greene, Kevin, "Technological Innovation and Economic Progress in the Ancient World: M. I. Finley Reconsidered", *Economic History Review* 53, no. 1: 2000, 29–59.

Gregoric, Pavel, *Aristotle on the Common Sense*, (New York: Oxford University Press, 2007).

Griffin, Michael J, *Aristotle's Categories in the Early Roman Empire*, (Oxford: Oxford University Press, 2015).

Gutzwiller, Kathryn, "Homer and Ariadne", *The Classical Journal* 73, no. 1: 1977, 32–36.

Hadot, P., "Appendices: I. La logique, partie ou instrument de la philosophie?", in *Simplicius, Commentaire sur les Catégories: Fascicule I*, ed. I. Hadot (Leiden: Brill, 1989).

Hamesse, Jacqueline, *Les Auctoritates Aristotelis*, (Louvain and Paris: Publications universitaires, 1974).

Hass, Eric, and Emery, Stephen, *What Workers Should Know About Automation…And What Employers Don't Tell Them*, (New York: New York Labor News Co., 1957 [1955]).

Hasse, Dag N., "The Social Conditions of the Arabic-(Hebrew-)Latin Translation Movements in Medieval Spain and in the Renaissance", in *Wissen über Grenzen:*

Arabisches Wissen und lateinisches Mittelalter, eds. A. Speer and L. Wegener, (Berlin: De Gruyter, 2006), 68–86.

Hauptmann, Emily, *Putting Choice Before Democracy: A Critique of Rational Choice Theory*, (Albany: State University of New York Press, 1996).

Heath, Malcolm, "Aristotle on Natural Slavery", *Phronesis* 53, no. 3: 2008, 243–270.

Herbert, Gary, *Thomas Hobbes: The Unity of Scientific and Moral Wisdom*, (Vancouver: University of British Columbia Press, 1989.

Hirschhorn, Larry, *Beyond Mechanization: Work and Technology a Postindustrial Age*, (Cambridge: MIT Press, 1984).

Höffe, Otfried, *Aristotle*, trans. Christine Salazar, (Albany: State University of New York Press, 2003).

Hui, Yuk, *On the Existence of Digital Objects*, (Minneapolis: University of Minnesota Press, 2016).

Humphrey, John W., Oleson, John P,, and Sherwood, Andrew N., *Greek and Roman Technology: A Sourcebook*, (London and New York: Routledge, 1998).

Ierodiakonou, Katerina, "Aristotle's Logic: An Instrument, Not a Part of Philosophy", in *Aristotle on Logic, Language and Science*, eds. N. Avgelis and F. Peonidis, (Thessaloniki: Sakkoulas, 1998).

International Federation of Robotics, *World Robot Report 2021*, (Frankfurt: IFR, 2021).

Irvin, Nell, *The History of White People*, (New York: W. W. Norton and Co., 2010).

Ismard, Paulin, *La Démocratie contre les experts: Les esclaves publics en Grèce ancienne*, (Paris: Seuil, 2015).

Jakonen, Mikko, *Multitude in Motion: Re-Readings on the Political Philosophy of Thomas Hobbes* (Jyväskylä: University of Jyväskylä, 2013).

James Allen, "Aristotle on the Value of "Probability," Persuasiveness, and Verisimilitude in Rhetorical Argument", in *Probabilities, Hypotheticals, and Counterfactuals in Ancient Greek Thought*, ed. Victoria Wohl, (Cambridge: Cambridge University Press, 2014), 47–64.

Jesseph, Douglas, *Squaring the Circle: The War Between Hobbes and Wallis*, (Chicago: University of Chicago Press, 1999).

Joerges, Bernward, "Do Politics Have Artefacts?", *Social Studies of Science* 29, no. 3 (1999): 411–431.

Johnson, Curtis N., *Philosophy and Politics in Aristotle's Politics*, (New York: Palgrave Macmillan, 2015).

Johnson, Van, "Aristotle on Nomos", *The Classical Journal* 33, no. 6: 1938, 351–356.

Jones, Alexander, *A Portable Cosmos: Revealing the Antikythera Mechanism, Scientific Wonder of the Ancient World*, (Oxford: Oxford University Press, 2017).

Jordan, Boromir, "The Crews of Ancient Triremes", *L'antiquité classique* 69, no. 1: 2000, 81–101.

Kang, Minsoo, *Sublime Dreams of Living Machines*, (Cambridge: Harvard University Press, 2011).

Karanika, Andromache, *Voices at Work: Women, Performance, and Labor in Ancient Greece*, (Baltimore: Johns Hopkins University Press, 2014).

Karbowski, Joseph A., "Aristotle's Scientific Inquiry Into Natural Slavery", *Journal of the History of Philosophy* 51, no. 3: 2013, 331–353.

Kassler, Jamie, "On the Stretch: Hobbes, Mechanics and Shaking Palsy", in *1543 and All That: Image and Word, Change and Continuity in the Proto-Scientific Revolution*, eds. Guy Freeland and Anthony Corones, (Dordrecht: Springer, 2000), 151–188.

Katayama, Errol, "David Charles and Aristotle's Master Craftsmen", *Ancient Philosophy* 31, no. 1: 2011, 145–160.

Kenaan, Vered Lev, "*Thauma Idesthai*: The Mythical Origins of Philosophical Wonder", in *Contributions to Phenomenology: Philosophy's Moods: The Affective Grounds of Thinking*, eds. Hagi Kenaan and Ilit Ferber, (Dordrecht: Springer, 2011).

Keyt, David, "Three Fundamental Theorems in Aristotle's *Politics*", *Phronesis* 32, no. 1: 1987, 54–79.

Konstan, David, "A World Without Slaves: Crates' *Thêria*", in *No Laughing Matter: Studies in Athenian Comedy*, eds. C. W. Marshall and George Kovacs, (London: Bristol Classical Press, 2012), 13–18.

Koopman, Colin, "The Political Theory of Data: Institutions, Algorithms, & Formats in Racial Redlining", *Political Theory*, no. 1: 2021, 1–25.

Kosak, Jennifer Clarke *Heroic Measures: Hippocratic Medicine in the Making of Euripidean Tragedy*, (Leiden: Brill, 2004).

Kosmetatou, Elizabeth, "Tyche's Force: Lottery and Chance in Greek Government", in *A Companion to Ancient Greek Government*, ed. Hans Beck, (Chichester: Wiley & Sons, 2013), 235–251.

Krafft, Fritz, *Dynamische und Statische Betrachtungsweise in der AntikeMechanik*, (Wiesbaden: F. Steiner, 1970).

Kraut, Richard,

- *Aristotle – Politics: Books VII and VIII*, (Oxford: Clarendon Press, 1997).

- *Aristotle: Political Philosophy*, (Oxford: Oxford University Press, 2002).

Kruger, Kathryn Sullivan, *Weaving the Word: The Metaphorics of Weaving and Female Textual Production*, (Selinsgrove: Susquehanna University Press, 2001).

LaGrandeur, Kevin, "Artificial Slaves in the Renaissance and the Dangers of Independent Innovation", in *AI Narratives: A History of Imaginative Thinking About Intelligent Machines*, eds. Stephen Cave, Kanta Dihal, and Sarah Dillon, (Oxford: Oxford University Press, 2020), 95–118.

Landels, John G., *Engineering in the Ancient World*, (Berkeley and Los Angeles, University of California Press, 1978).

Landrum, Lisa, "Before Architecture: *Archai*, Architects and Architectonics in Plato and Aristotle", *Montreal Architectural Review* 2, no. 1: 2015, 5–25.

Latour, Bruno, *Science in Action*, (Cambridge: Harvard University Press, 1987).

Leacroft, Richard, and Leacroft, Helen *Theatre and Playhouse: An Illustrated Survey of Theatre Building from Ancient Greece to the Present Day*, (North Yorkshire: Methuen, 1984).

Lee, Mireille M., "Dress and Adornment in Archaic and Classical Greece", in *A Companion to Women in the Ancient World*, eds. Sharon L. James and Sheila Dillon, (Chichester: Wiley & Sons, 2012), 179–190.

Leijenhorst, Cees, *The Mechanisation of Aristotelianism: The Late Aristotelian Setting of Thomas Hobbes's Natural Philosophy*, (Leiden: Brill, 2002).

Lennox, James,

- "Aristotle on Chance", *Archiv für Geschichte der Philosophie* 66, no. 1: 1984, 52–60.

- "Teleology, Chance, and Aristotle's Theory of Spontaneous Generation", *Journal of the History of Philosophy* 20, no. 3: 1982, 213–238.

Leontief, Wassily, and Duchin, Faye, *The Future Impact of Automation on Workers*, (Oxford: Oxford University Press, 1986).

Lepore, Federica and Konstaninou, Eirini Kostara, *Ancient Theatres: Machines Designed for Listening: A Scenery Proposal for the Optimization of the Passive Acoustics for the Ancient Theatre of Tyndais*, (Torino: Politecnico di Torino, 2015).

Levy, Aaron, "Economic Views of Thomas Hobbes", *Journal of the History of Ideas* 15, no. 4: 1954, 589–595.

Liveley, Genevieve, and Thomas, Sam, "Homer's Intelligent Machines", in AI Narratives: A History of Imaginative Thinking About Intelligent Machines, eds. Stephen Cave, Kanta Dihal, and Sarah Dillon, (Oxford: Oxford University Press, 2020), 25–48.

Lloyd, G. E. R., *Early Greek Science: Thales to Aristotle*, (New York: W. W. Norton and Co., 1970).

Lord, Carnes, *Education and Culture in the Political Thought of Aristotle*, (Ithaca: Cornell University Press, 1982).

Luckhurst, Roger, "Automation", in *The Oxford Handbook of Science Fiction*, ed. Rob Latham, (Oxford: Oxford University Press, 2014), 317–328.

Lucore, Sandra K., "Greek Baths", in *A Companion to Greek Architecture*, ed. Margaret M. Miles, (Chichester: Wiley & Sons, 2016), 328–341.

MacKinnon, Rebecca, "Liberation Technology: China's "Networked Authoritarianism"", *Journal of Democracy* 22, no. 2: 2011, 32–46.

Malcolm, Noel,

- "The Title of Hobbes's Refutation of Thomas White's *De Mundo*", *Hobbes Studies* 24, no. 2: 2011, 179–188.

- *Aspects of Hobbes*, (Oxford: Oxford University Press, 2002).

Marchant, E. C., *Thucydides: Book I*, (London: Macmillan, 1905).

Marenbon, John, "Aristotelianism in the Greek, Latin, Syriac, Arabic, and Hebrew Traditions", in *Encyclopedia of Medieval Philosophy*, ed. Henrik Lagerlund, (Dordrecht: Springer, 2011), 99–105.

Markus, Gyorgy, "*Praxis* and *Poiesis*: Beyond the Dichotomy", *Thesis Eleven* 15, no. 1: 1986, 30–47.

Marshall, Margaret, "'Automation' Today and in 1662", *American Speech* 32, no. 2: 1957, 149–151.

Marshall, Monty G., and Elzinga-Marshall, Gabriella, *Global Report 2017: Conflict, Governance, and State Fragility*, (Vienna: Center for Systemic Peace, 2017).

Marshall, Monty G., Gurr, Ted Robert, and Jaggers, Keith, *Polity IV Project: Political Regime Characteristics and Transitions, 1800-2018. Dataset Users' Manual*, (Vienna: Center for Systemic Peace, 2019).

Martin, Conor, "Some Medieval Commentaries on Aristotle's "Politics"", *History* 36, nos. 126–127: 1951, 29–44.

Martinich, A. P. *Hobbes: A Biography*, (Cambridge: Cambridge University Press, 1999).

Maurice M. Goldsmith, *Hobbes's Science of Politics*, (New York: Columbia University Press, 1966).

Mayor, Adrienne, *Gods and Robots: Myths, Machines, and Ancient Dreams of Technology*, (Princeton: Princeton University Press, 2018), 152–153.

McCormick, Michael, "Slavery from Rome to Medieval Europe and Beyond: Words, Things, and Genomes", in *On Human Bondage: After Slavery and Social Death*, eds. John Bodel and Walter Scheidel, (Chichester: Wiley & Sons, 2017), 249–264.

Melissa Shew, *The Phenomenon of Chance in Ancient Greek Thought*, (Oregon: University of Oregon, 2008).

Morrison, J. S., Coates, J. F., and Rankov, N. B., *The Athenian Trireme: The History and Reconstruction of an Ancient Greek Warship*, 2nd ed., (Cambridge: Cambridge University Press, 2000).

Mousset, Albert, *Les Francine: Créateurs des eaux de Versailles, intendents des eaux et fontaines de France de 1623 à 1784* (Paris: A. Picard, 1930).

Mullany, Patrick Francis (Brother Azarias), *Essays Educational*, (New York: William H. Young & Co., 1905).

Mumford, Lewis, "Authoritarian and Democratic Technics", *Technology and Culture* 5, no. 1: 1964, 1–8.

Murphy, James Bernard, *The Philosophy of Customary Law*, (Oxford: Oxford University Press, 2014).

Naas, Michael, *Plato and the Invention of Life,* (New York: Fordham University Press, 2018).

Nederman, Cary J., "Aristotelianism and the Origins of "Political Science" in the Twelfth Century", *Journal of the History of Ideas* 52, no. 2: 1991, 179–194.

Nelson, Eric, *Thomas Hobbes: Translations of Homer: The Iliad and the Odyssey*, (Oxford: Clarendon Press, 2008).

Newman, W. L., *Politics of Aristotle with an Introduction, Two Prefaratory Essays and Notes Critical and Explanatory: Volume II*, (Oxford: Clarendon Press, 1887).

Nichols, M. P., *Citizens and Statesmen: A Study of Aristotle's Politics*, (Lanham: Rowman & Littlefield, 1991).

Noble, David F., *Forces of Production: A Social History of Industrial Automation*, (New Brunswick: Transaction Publishers, 2011 [1984]).

Noble, Safiya Umoja, *Algorithms of Oppression: How Search Engines Reinforce Racism*, (New York: New York University Press, 2018).

Nof, Shimon, "Automation: What it Means to us Around the World", in *Springer Handbook of Automation,* ed. Shimon Nof, (Heidelberg: Springer, 2009), 13–52.

Oakeshott, Michael, "Introduction to Leviathan", in *Hobbes on Civil Association*, (Indianapolis: Liberty Fund, 1975), 1–79.

Oelze, Anselm, *Animal Rationality: Later Medieval Theories 1250–1350*, (Leiden: Brill, 2018).

Owen, Mathew, and Gildenhard, Ingo, *Tacitus, Annals, 15.20–23, 33–45: Latin Text, Study Aids with Vocabulary, and Commentary*, (Cambridge: OpenBook Publishers, 2013).

Paganini, Gianni,

- "'Passionate Thought': Reason and the Passion of Curiosity in Thomas Hobbes", in *Emotional Minds: The Passions and the Limits of Pure Enquiry in Early Modern Philosophy*, ed. Sabrina Ebbersmeyer, (Berlin: De Gruyter, 2012), 227–256.

- "Hobbes's 'Mortal God' and Renaissance Hermeticism", *Hobbes Studies* 23, no. 1: 2010, 7–28.

- "Hobbes's Philosophical Method and the Passion of Curiosity", in *Interpreting Hobbes's Political Philosophy*, ed. S. A. Lloyd, (Cambridge: Cambridge University Press, 2019), 50–69.

Palmer, Michael, *Masters and Slaves: Revisioned Essays in Political Philosophy*, (Lanham: Lexington Books, 2001).

Panagia, David,

- "On the Political Ontology of the Dispositif", *Critical Inquiry* 45, no. 3 (2019): 714–746.

- "On the Possibilities of a Political Theory of Algorithms", *Political Theory* 49, no. 1: 2021, 109–133.

- "The Algorithm Dispositif: Risk and Automation in the Age of #datapolitik", in *The Routledge Companion to Media and Risk*, eds. Bishnupriya Ghosh and Bhaskar Sarkar, (New York: Routledge, 2020), 118–129.

Parker, H. N., "Aristotle's Unanswered Questions: Women and Slaves in *Politics* 1252a-1260b", *EuGeStA*, 2012, 71–122.

Pateman, Carol, "'God Hath Ordained to Man a Helper': Hobbes, Patriarchy and Conjugal Right", *British Journal of Political Science* 19, no. 4: 1989, 445–463.

Patterson, Orlando, *Slavery and Social Death: A Comparative Study*, (Cambridge, Harvard University Press, 1982).

Pellegrin, P., "La théorie aristotélicienne de l'esclavage: tendances actuelles de l'interprétation", *Revue Philosophique de la France et de l'etranger* 172, no. 2: 1982, 345–357.

Peychaux, Diego Fernández, "*El Leviathan Como Automata: Método y Política en Thomas Hobbes*", *Anales Del Seminario de Historia de la Filosofia* 30, no. 2, 2013, 413–430.

Phillips, William D., *Slavery from Roman Times to the Early Transatlantic Trade*, (Minneapolis: University of Minnesota Press, 1985).

Pinch, Trevor J., and. Bijker, Wiebe E., "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other", *Social Studies of Science* 14, no. 3: 1984, 399–441.

Polansky, Ronald, *Aristotle's De Anima: A Critical Commentary*, (Cambridge: Cambridge University Press, 2009).

Pugliara, Monica, *Il Mirabile e L'Artificio: Creature Animate e Semoventi nel Mito e Nella Tecnica Degli Antichi*, (Rome: L'erma di Bretschneider, 2003).

Rapp, Christoff, "Aporia and Dialectical Method in Aristotle", in *The Aporetic Tradition in Ancient Philosophy*, eds. George Karamanolis and Vasilis Politis, (Cambridge: Cambridge University Press, 2018), 112–136.

Richardson, Henry S., "Desire and the Good in *De Anima*", in *Essays on Aristotle's De Anima*, eds. Martha Nussbaum and Amélie Oksenberg Rorty, (Oxford: Oxford University Press, 1992), 381–400.

Rini, Adriane, "Aristotle on the Necessity of the Consequence", in *Logical Modalities from Aristotle to Carnap*, eds. Max Cresswell, Edwin Mares, and Adriane Rini, (Cambridge: Cambridge University Press, 2016), 11–28.

Risch, Ernst, *Wortbildung der Homerischen Sprache*, (Berlin: De Gruyter, 1974).

Riskin, Jessica, *The Restless Clock: A History of the Centuries-Long Argument Over What Makes Living Things Tick* (Chicago: University of Chicago Press, 2016), 27–28.

Roberto Lambertini, "Burley's Commentary on the Politics: Exegetic Techniques and Political Language", in *A Companion to Walter Burley Late Medieval Logician and Metaphysician*, ed. Alessandro Conti, (Leiden: Brill, 2013), 347–373.

Robiglio, Andrea Aldo, "Aquinas on Recognition", in *Recognition and Religion: Contemporary and Historical Perspectives*, eds. Maijastina Kahlos, Heikki J. Koskinnen, and Ritva Palmén, (London: Routledge, 2019), 168–179.

Rogers, Gayle, *Speculation: A Cultural History from Aristotle to AI*, (New York: Columbia University Press, 2021).

Ross, David, "Aristotle", (London: Methuen and Co., 1923).

Rudolph, Ross, "Hobbes et la psychologie morale", in *Thomas Hobbes: philosophie première, théorie de la science et politique*, eds. Yves Charles Zarka and Jean Bernhardt, (Paris: Presses universitaires de France, 1990), 247–264.

Ruffell, Ian, "The World Turned Upside Down: Utopia and Utopianism in the Fragments of Old Comedy", in *The Rivals of Aristophanes*, eds. David Harvey and John Wilkins, (London: Duckworth, 2001).

Sagar, Paul, "Of Mushrooms and Method: History and the Family in Hobbes's Science of Politics," *European Journal of Political Theory* 14, no. 1: 2014, 98–117.

Sanders, Jennifer Marie, *The Trinitarian Telos of the Summa Theologiae: Thomas's Application of the Aristotelian Ordo Disciplinae to Sacra Doctrina in Light of his Augustinian Heritage*, (Boston: Boston College University, 2017).

Sarasohn, Lisa T., "Was "Leviathan" a Patronage Artifact?", *History of Political Thought* 21, no. 4: 2000, 606–631.

Schellhase, Kenneth, *Tacitus in Renaissance Political Thought*, (Chicago: University of Chicago Press, 1976).

Schiefsky, Mark, "Art and Nature in Ancient Mechanics", in *The Artificial and the Natural: An Evolving Polarity*, eds. Bernadette Bensaude-Vincent and William R. Newman, (Cambridge: MIT Press, 2007).

Schlogl Lukas, and Sumner, Andy, "The Rise of the Robot Reserve Army: Automation and the Future of Economic Development, Work, and Wages in Developing Countries", Working Paper 487, (Washington DC: Center for Global Development, 2018).

Schochet, Gordon, "Thomas Hobbes on the Family and the State of Nature", *Political Science Quarterly* 82, no. 3: 1967, 427–445.

Schofield, Malcolm, "Ideology and Philosophy in Aristotle's Theory of Slavery", in *Saving the City: Philosopher Kings and Other Classical Paradigms*, (London and New York: Routledge, 1999), 101–123.

Schütrumpf, Eckhart, *The Earliest Translations of Aristotle's Politics and the Creation of Political Terminology*, (Paderborn, Wilhelm Fink, 2014).

Scully, Stephen, "The Polis in Homer: A Definition and Interpretation", *Ramus* 10, no. 1: 1981, 1–34.

Sentesy, Mark, *Aristotle's Ontology of Change*, (Evanston: Northwestern University Press, 2020).

Shull, Charles, "Political Aspects of Automation", in *Automation and Society*, eds. Howard Boone Jacobson and Joseph Roucek, (New York: Philosophical Library, 1959), 330–340.

Sicking, C. M. J, "Aristotle and Herodotus", in *Distant Companions*, (Leiden: Brill, 1998), 147–157.

Simpson, Peter, "Aristotle's Defensible Defence of Slavery", *Polis* 23, no. 1: 2006, 95–115.

Sissa, Giulia,

- "Bulls and Deer, Women and Warriors: Aristotle's Physics of Morals", in *Marginality, Canonicity, Passion*, eds. Marco Formisano and Christina Shuttleworth Kraus, (Oxford: Oxford University Press, 2018), 141–176.

- "La Génération Automatique", in *L'Animal Dans L'Antiquité*, eds. Barbara Cassin, and Jean-Louis Labarrière, (Paris: LP J. Vrin, 1997), 95–111.

Skinner, Quentin,

- *From Humanism to Hobbes: Studies in Rhetoric and Politics*, (Cambridge: Cambridge University Press, 2018).

- *Reason and Rhetoric in the Philosophy of Hobbes*, (Cambridge: Cambridge University Press, 1996).

Slomp, Gabriella, "The Politics of Motion and the Motion of Politics", in *International Political Theory After Hobbes: Analysis, Interpretation and Orientation*, eds. Raia Prokhovnik and Gabriella Slomp, (New York: Palgrave Macmillan, 2010).

Sorabji, Richard,

- (ed.), *Ancient Commentators on Aristotle, Alexander of Aphrodisias: On Aristotle Prior Analytics 1.1–7*, trans. Jonathan Barnes, Susanne Bozien, Kevin Flannery S. J., and Katerina Ierodiakonou, (London and New York: Bloomsbury, 1991).

- *Aristotle on Memory*, 2nd ed., (Chicago: University of Chicago Press, 2006 [1972]).

- *The Philosophy of the Commentators, 200-600 AD: Volume 3. Logic and Metaphysics*, (Ithaca: Cornell University Press, 2005).

Sorell, Tom, "Hobbes's Moral Philosophy", in *The Cambridge Companion to Hobbes's Leviathan*, ed. Patricia Springborg, (Cambridge: Cambridge University Press, 2007), 128–156.

Sparshott, Francis, *Taking Life Seriously: A Study of the Argument of the Nicomachean Ethics*, (Toronto: University of Toronto Press, 1994).

Speliotis, E, "Women and Slaves in Aristotle's *Politics* I", in *Nature, Woman, and the Art of Politics*, ed. E.A. Velásquez, (Lanham: Rowman & Littlefield, 2000), 73–94.

Spragens, Thomas A., *The Politics of Motion: The World of Thomas Hobbes*, (Lexington: University of Kentucky Press, 1973).

Steneck, Nicholas H., "Albert the Great on the Classification and Localization of the Internal Senses", *Isis* 65, no. 2: 1974, 193–211.

Stephen G. Miller, *Ancient Greek Athletics*, (New Haven: Yale University Press, 2004).

Stiegler, Bernard,

- "Automatic Society - Londres février 2015" *Journal of Visual Art Practice* 15, nos. 2–3: 2016, 192–203.

- *Automatic Society Volume 1: The Future of Work*, trans. Daniel Ross, (Cambridge: Polity Press, 2016).

- *Technics and Time, 1: The Fault of Epimetheus*, trans. Richard Beardsworth and George Collins, (Stanford: Stanford University Press, 1998 [1994]).

- *The Decadence of Industrial Democracies: Disbelief and Discredit, Vol. 1*, trans. Daniel Ross and Suzanne Arnold, (Cambridge: Polity, 2011 [2004]).

Strauss, Leo,

- *Plato's Apology of Socrates & Crito. Session 15: Xenophon, Anabasis, Hellenica, Memorabilia (selections)*, ed. David Janssens, (Estate of Leo Strauss, 1966).

- *The Political Philosophy of Hobbes: Its Basis and its Genesis*, (Chicago: University of Chicago Press, [1936] 1963).

Sullivan, Penny, "Medieval Automata: The 'Chambre De Beautés' in Benoît's *Roman de Troie*", *Romance Studies* 3, no. 2: 1985, 1–20.

Susskind, Daniel, *A World Without Work: Technology, Automation, and How We Should Respond*, (New York: Henry Holt and Company, 2020).

Taplin, Oliver, "The Shield of Achilles Within the 'Iliad'", *Greece & Rome* 27, no. 1: 1980, 1–21.

Taylor, Alfred E., "The Ethical Doctrine of Hobbes", *Philosophy*, 13, 1938, 406–424.

Terrel, Jean, *Hobbes, matérialisme et politique*, (Paris: J. Vrin, 1994).

Thewissen, Stefan, and Rueda, David, "Automation and the Welfare State: Technological Change as a Determinant of Redistribution Preferences", *Comparative Political Studies* 52, no. 2: 2018, 171–208.

Thompson, Norma, *Herodotus and the Origins of the Political Community: Arion's Leap*, (New Haven: Yale University Press, 1996).

Thorndike, Lynn, *A History of Magic and Experimental Science Vol. II*, (New York: The Macmillan Company, 1923).

Timcke, Scott, *Algorithms and the End of Politics: How Technology Shapes 21st-Century American Life*, (Bristol: Bristol University Press, 2021).

Titus, Craig Steven, "Passions in Christ: Spontaneity, Development, and Virtue", *The Thomist: A Speculative Quarterly Review* 73, no. 1: 2009, 53–87.

Tkacz, Michael W., "Albertus Magnus and the Recovery of Aristotelian Form", *The Review of Metaphysics* 64, no. 4, 2011: 735–762.

Truitt, E. R., *Medieval Robots: Mechanism, Magic, Nature, and Art*, (Philadelphia: University of Pennsylvania Press, 2015).

Trümper, Monika, "Baths and Bathing Culture, Greek", in *Encyclopedia of Global Archaeology*, ed. Claire Smith, (Wien and New York: Springer, 2014), 784–799.

Trott, A. M., *Aristotle on the Nature of the Community*, (Cambridge: Cambridge University Press, 2013).

Tsakirgis, Barbara, "Whole Cloth", in *The Ancient Greek Economy: Markets, Households and City-States*, eds. Edward M. Harris, David M. Lewis, and Mark Woolmer, (Cambridge University Press, 2016), 166–186.

Tuckwell, Jason, *Creation and the Function of Art: Technē, Poiesis and the Problem of Aesthetics*, (London and New York: Bloomsbury, 2018).

Ueberweg, Friedrich, "History of Philosophy, From Thales to the Present Time", in *Vols. I. and II. of the Philosophical Division: Ueberweg's History of Philosophy*, eds. Henry B. Smith and Philip Schaff, trans. Geo S. Morris, (New York: Scribner, Armstrong & Co., 1874).

Vaccaro, Andrea, "Comparing Measures of Democracy: Statistical Properties, Convergence, and Interchangeability", *European Political Science*, 2021.

Vallery-Radot, René, *The Life of Pasteur*, trans. R. L Devonshire (New York: Doubleday, 1914).

Van 't Spijker, Ineke, "Conflict and Correspondence. Inner and Outer in Abelard and Hugh of Saint Victor", in *Rethinking Abelard: A Collection of Critical Essays*, ed. Babette S. Hellemans, (Leiden: Brill: 2014), 84–102.

Veillette, Paul, "The Rise of the Concept of Automation", in *Automation and Society*, eds. Howard Boone Jacobson and Joseph Roucek, (New York: Philosophical Library, 1959), 1–16.

Verbeke, Gérard, "Moerbeke, traducteur et interprète; un texte et une pensée", in *Guillaume de Moerbeke. Recueil d'études à l'occasion du 700e anniversaire de sa mort (1286)*, eds. J. Brams and W. Vanhamel, (Leuven: Leuven University Press, 1989), 1–21.

Verhaeghe, Paul, "Causality in Science and Psychoanalysis", in *Lacan & Science*, eds. Jason Glynos and Yannis Stavrakakis, (London: Karnac, 2002), 119–145.

Verlinden, Charles, *L'Esclavage dans l'Europe médiévale*, (Ghent: Rijksuniversiteit te Gent, 1955–1977).

Vernant, Jean-Pierre, *Myth and Thought Among the Greeks*, (Routledge & Kegan Paul, 1983 [1965]).

W. B. Gallie, "Essentially Contested Concepts", *Proceedings of the Aristotelian Society* 56, no. 1: 1956, 167–198.

Wallon, Henri Alexandre, *Histoire de l'esclavage dans l'antiquité,* (Paris: Hachette, 1847).

Warrender, Howard, *The Political Philosophy of Hobbes: His Theory of Obligation*, (Oxford: Oxford University Press, 1957).

Watkins, John W. N., *Hobbes's System of Ideas*, (London: Hutchinson, 1965).

Weisheipl, James A., "The Life and Works of St. Albert the Great", in *Albertus Magnus and the Sciences: Commemorative Essays 1980*, ed. James A. Weisheipl, (Toronto: Pontifical Institute of Mediaeval Studies, 1980).

Wiedemann, Thomas, *Greek and Roman Slavery*, (Baltimore: Johns Hopkins University Press, 1981).

Wiener, Norbert, *The Human Use of Human Beings*, (Boston: Da Capo Press, 1954 [1950]).

Wilson, Malcolm, "Heat, Meteorology, and Spontaneous Generation", in *Heat, Pneuma, and Soul in Ancient Philosophy of Science*, eds. Hynek Bartoš and Colin Guthrie King, (Cambridge, Cambridge University Press, 2020).

Winner, Langdon,

- "Do Artefacts Have Politics?", *Daedalus* 109, no. 1 (1980): 121–136.

- *Autonomous Technology: Technics-out-of-control as a Theme in Political Thought*, (Cambridge: MIT Press, 1978).

Wolin, Sheldon S., "Hobbes and the Culture of Despotism", in *Thomas Hobbes and Political Theory*, ed. Mary G. Dietz, (Lawrence: University Press of Kansas, 1990), 9–36.

Zhmud, Leonid, *The Origin of the History of Science in Classical Antiquity,* trans. Alexander Chernoglazov, (Berlin: De Gruyter, 2006).

Zuboff, Shoshana, *In the Age of the Smart Machine*, (New York: Basic Books, 1988).