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ARISTOTLE'S EMPIRICISM

Experience and Mechanics
in the 4th Century BC

Jean De Groot

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To the memory of my parents

Carl and Vera Christensen

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Table of Contents

List of Illustrations	xi
Figures	xi
Charts and Tables	xiii
Acknowledgments	xv
Introduction	xvii
Note on Transliterations and Abbreviations	xxv
Chapter 1	
Empiricism and Mathematical Science in Aristotle	1
Qualitative Science	6
Experience of Mathematical Properties	10
Experience and <i>Dunamis</i>	12
Powers and Mechanical Philosophy	15
<i>Automata</i> in Plato and Aristotle	17
Chapter 2	
Expressions of the Moving Radius Principle in the Fourth Century BC	21
The Aristotelian <i>Mechanics</i>	22
Two Versions in Plato and Aristotle	25
The Lever In Aristotle's <i>Movement of Animals</i>	31
<i>Physical Problems</i> XVI	39
A New Proportional Rule	45
Classification of Expressions by Texts	48
Chapter 3	
Kinesthetic Awareness, Experience, and <i>Phainomena</i>	51
The Moving Radius in Kinesthetic Awareness	55
<i>Empeiria</i> and Universals	63
Experience and Natural Philosophy	75

Chapter 4	
<i>Phainomena</i> in Aristotle's Astronomy	83
<i>Phainomena</i> and Propositional Knowledge	84
Percepts and Intelligibility	87
Experience and Concentric Circles in the Heavens	97
Mechanical Properties as Perceived	103
<i>Theôrein Ta Phainomena</i>	104
Chapter 5	
<i>Dunamis</i> and <i>Automata</i> in Aristotle's <i>Movement of Animals</i>	107
Prospectus	107
What is <i>Movement of Animals</i> About?	110
The Rolling Cone in <i>Movement of Animals</i> 7	113
<i>Dunamis</i> , Leverage, and Form	124
<i>Dunamis</i> as Active Receptivity	135
Chapter 6	
<i>Dunamis</i> in Aristotle's Embryology	141
Causes and Motion in Embryology	142
<i>Dunamis</i> and Matter	146
The Sensitive Soul and the Nutritive Soul	151
The Micro-Structure of Movement	153
<i>Dunamis</i> , Soul, and Efficient Cause	159
Chapter 7	
Leverage and Balance in <i>Physical Problems</i> XVI	163
Scientific Problems in the Aristotelian School Literature	165
The Related Topics of Book XVI	170
Constraint and Curved Motion	173
The Rebound of Objects from a Surface, Falling, and the Descent of Airborne Objects	181
The Cone, the Cylinder, and the Scroll	188
Archytas on the Shape of Growth	195
An Aristotelian Argument for the Proportion of Equality	207
The Rounding of Shells in the Surf	214
Summary and Results	216
Chapter 8	
The Maturity of Kinematics in the Aristotelian <i>Mechanics</i>	221
<i>Physical Problems</i> XVI and <i>Mechanics</i> 1	221
The Demonstration of <i>Mechanics</i> 1	225
The Scholarly Context	236

Chapter 9	
Did Aristotle have a Dynamics?	249
An Interpretive Frame	249
Multi-Variant Movement in <i>Physics</i> IV.8	254
Continuum Reasoning Without Mechanics	269
Homonymy in <i>Physics</i> VII	281
Summary	296
Coda on the Sequence of Aristotle's Interests	297
Chapter 10	
Weight and Mathematical Science	301
Quantity and Proportion	303
Weight in Plato	306
Aristotle's Criticism of Earlier Cosmology	312
Aristotle on Quantity and Relation	318
Mechanics and <i>Phainomena</i> in <i>Posterior Analytics</i> I.13	326
Proportionality and Commonality	336
Chapter 11	
Aristotle's Empiricism in Cognitive History	339
The Fundamental Insight of Mechanics	339
Proportional Reasoning and Versions of Action	352
A Summation of Coming to Know	361
Conclusion	
Empiricism and Experience	363
The Other Aristotle	366
Bibliography	
Primary Sources	371
Texts	371
Translations and Modern Commentaries	373
Secondary Sources	374
Index Locorum	389
Index of Names and Subjects	397

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List of Illustrations

Figures

- 1.1 Relative speeds of points along a moving radius or on rotating concentric circles
- 2.1 A line rotating horizontally
- 2.2 Speeds along arcs lying opposite one another
- 2.3a The linkage of speeds along concentric arcs in different positions
- 2.3b Rotating points on a disk as in *Laws X*
- 2.4a–b Arcs of concentric circles unable to be superposed and so not directly comparable
- 2.5a Aristotle’s diagram in *Movement of Animals* 1
- 2.5b The movement of a joint as Aristotle describes it in *Movement of Animals* 1
- 2.6a The placement of rudders on an ancient vessel
- 2.6b The ancient rudder
- 2.6c A modern rudder and tiller mounted at the stern
- 2.7a The rolling cylinder in *Physical Problems* XVI.5
- 2.7b The rolling cone in *Physical Problems* XVI.5
- 2.8 The line of contact of the rolling cone with the surface on which it rolls; lines described on the surface by the rolling cone
- 2.9a–b The revolving forward movement of an unbalanced projectile: (a) a baseball bat, and (b) loaded dice

- 2.10 The proportion of rectilinear elements of the circle in *Mechanics* 1 that selects arcs along a moving radius that are covered in the same time
- 2.11 The parallelogram of movements
 - 3.1 Fishing from a stationary promontory
 - 3.2 The arc of haling a catch
 - 3.3 Falling backward due to a blow from behind in *Physical Problems* XVI.4
- 4.1 The occultation of Mars by the moon
- 5.1 The rolling cone
- 5.2 Wheels of the toy cart
- 5.3 The ordinary wheel and axle
- 5.4 The drive mechanism of Hero's automatic theater
- 5.5 Detail of the drive mechanism of Hero's automatic theater
- 7.1a Loaded dice and the throwing of an unbalanced stone in *Physical Problems* XVI.3 and 12
 - 7.1b Mid-point (*meson*) of the unbalanced stone
- 7.2a The perpendicular rebound of a rounded object in *Physical Problems* XVI.4
 - 7.2b The rebound of a rounded object striking at an angle
- 7.3a–b A rounded object glancing off a sloped surface
- 7.4a–b A rounded object rebounding at an angle
- 7.5 The fall of a rectangular solid onto an inclined plane in *Physical Problems* XVI.4
- 7.6 Falling backward due to a blow from behind
- 7.7 Edges described by cuts in a rolled scroll in *Physical Problems* XVI.5
 - 7.8a The parallelogram of movements of *Mechanics* 1
 - 7.8b The proportion of rectilinear elements determining arcs of concentric circles that are covered in the same time in *Mechanics* 1
- 7.9 Growth rings of a tree with radius and chords
- 7.10 Chords of a circle
- 7.11 The *trigōnon*, an ancient lyre

- 7.12a Ratios of chords and segments of a radius
- 7.12b The special case of the quadrant of a circle, the ratio of the chord that is the same length as the radius
- 7.13 A proportion of equality for two concentric growth rings
- 8.1 Reprise: a proportion of equality for two concentric growth rings
- 8.2 Ratios for different pairs of concentric circles
- 8.3 Ratios of rectilinear elements of arcs subtended by the same radii
- 8.4 Parallelogram of movements in *Mechanics* 1
- 8.5 Euclid's parallelogram complements in *Elements* 2, Definition 2
- 8.6 Travel of a point along a square and a quadrant of a circle in *Mechanics* 1
- 8.7 Simulation of the parallelogram of movements along points on the circumference of a quadrant of a circle
- 8.8 The proportion for arcs covered in the same time in *Mechanics* 1
- 11.1 The *gnômôn* of the sundial
- 11.2 Pebble numbers

Charts and Tables

- 2.0 Expressions of the principle of the lever in the Aristotelian writings and Plato's *Laws*
- 5.1 The correlation of small and large changes in *Movement of Animals* 7
- 5.2 Instrumental form as the link between small and large changes
- 5.3 Instrumental form and the senses of device
- 5.4 *Dunamis*, latent form, and instrumental form
- 7.0 Chapters of *Physical Problems* XVI to be treated and their topics
- 10.1 The relation of *mathêmata* in *Physics* II.2 and *Metaphysics* E.1
- 10.2 The relation of *mathêmata* in *Posterior Analytics* I.13

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Jean De Groot
Arlington, Virginia, October 2013

Introduction

This book was written during a period of roughly five years from the fall of 2008 to spring 2013. The seeds of the present interpretation of Aristotle and of ancient mechanics, however, were sown much earlier in my work in the history of early physics as a graduate student in the History of Science department at Harvard University. I studied ancient, medieval, and Arabic science with John E. Murdoch and Abdelhamid I. Sabra. A course in nineteenth century physics taught by Erwin Hiebert made an enduring impression on me. I saw that truthfulness to nature in classical mechanics had a distinctive character, evident both in the questions pursued and in the logical method. Building upon this insight over a period of years, I came to discern in antiquity the footprint of mechanics as a way of thinking about natural movement and as an empirical method.

Studying the thought of Ludwig Wittgenstein reinforced my sense of the philosophical fruitfulness of (what I understood as) the *minimalism* of mechanics. Mechanics makes few assumptions. Its concepts are structural or relational in character, and their meanings are linked very closely to what has or can transpire. The concepts of mechanics remain close to the very changes of which they give an account. This was to me the most intriguing feature of mechanics, which was remarkably universal to the science throughout its history. There is a similar minimalism and empiricism in Aristotle's way of analyzing things in natural philosophy.

It seemed to me that this minimalism made Aristotle's works especially hospitable to explication by ordinary language philosophy during its golden era from about 1945 to 1985. I refer to the philosophy and scholarship of Ryle, Owen, Ackrill, Austin, Anscombe, Geach, and others. The approach to Aristotle by way of philosophy of language was striking for its brilliance and penetration but also because it never seemed completely

to capture Aristotle's own way of thinking. My historical training made me sensitive to the unlikelihood of Aristotle's physical science and biology being mainly dialectical and endoxic. The puzzle of the uncaptured Aristotle provided the impetus for me to look for the source of Aristotle's minimalism in what is universal to mechanics. I believed the mechanics of Aristotle's own time could be one of the mainsprings of his investigations into nature and movement and could thus bring us closer to Aristotle's own way of thinking in these areas of investigation.

The Platonist Atticus complained that Aristotle is hard to catch because like the squid he escapes using darkness.¹ The allusion is to the squid's inky defense. This book is for anyone who has ever felt after close study of Aristotle that he still slips away. I provide a new point of entry for some of the most basic concepts of Aristotle's philosophy, in particular *dunamis* and *archê*. I argue that these concepts had a strong physicalistic meaning at their inception. I believe that this fact should be relevant to the evaluation of Aristotle's philosophy more generally.²

The connection I have undertaken to establish—between mechanics and Aristotle—would have been unthinkable for centuries, since modernity early on claimed mechanics as its own. A mechanical philosophy (as exemplified in Robert Boyle's corpuscularian philosophy) came into being in the early modern period after the efflorescence of mechanics proper. The mechanical philosophy provided an alternative to the persistent vein of causal teleology that runs through Aristotle's scientific thinking. My study does not address that teleology, which has been the subject of many fine studies already. The best tactic, it seemed to me, for uncovering the source of Aristotle's natural philosophy in ancient mechanics was to pursue it independently without continual reference to teleological issues in biology or cosmology.

With respect to the mechanical philosophy, it became clear to me that, with the possible exception of Newton's pragmatic formulation of it, the mechanical philosophy of the early moderns does not follow very closely

1 Atticus took the obscurity to be intentional. I do not. The passage is quoted by Barnes, "Metacommentary," in Barnes, *Method and Metaphysics*, 195. It comes from Eusebius' *Preparatio Evangelica* XV, ix, 13.

2 Aristotle develops more than one line of thought and, in his lecture notes that are our record of his thought, sometimes leaves standing philosophical conclusions that do not form a systematic whole. (For affirmation and clarification of this judgment, I am grateful to conversations with John Rist.) This fact only reinforces the need for a more complete understanding of the influences on Aristotle.

how mechanics actually works. Like the theory of Epicurus, early modern mechanical philosophy is dogmatic philosophy. On the other hand, some aspects of Aristotle's procedure in natural philosophy do match up rather neatly with the rudimentary but perennial mechanics he knew. My studies of *Movement of Animals* 7 and *Physics* IV.8 and VII.4 have a bearing on this claim (Chapters 5 and 9) and lay the groundwork for my account of what is minimal about mechanics and what are the philosophical implications of this minimalism in antiquity (Chapter 11).

One benefit of doing the present work has been the occasional glimpse into the archeological layers of interpretation of Aristotle, which extend from late antiquity all the way up through modern philosophy. These interpretive layers have *remade* the philosophy of the Peripatetic and remain part of our present day understanding of Aristotle. The unacceptability of natural teleology by modern scientific standards is certainly one of these interpretations. Another is the default to metaphysics—the nearly irresistible tendency to commence study of Aristotle's natural philosophy with a standard metaphysical meaning for key terms like potency and form. For the most part, the Aristotle of the twentieth and twenty-first centuries is the medieval Aristotle viewed from a distance of many centuries.

I do not want to make present-day interpretation of Aristotle seem like a hall of mirrors. I bring up the topic of layers of interpretation of Aristotle in order to account for the wide-ranging and sometimes dense historical grounding presented here. This historical grounding is an avenue to understanding Aristotle in his ancient context. My rationale at least constitutes an alternate approach to the Peripatetic. It could contribute something of value to more metaphysical approaches. These issues receive an airing in Chapter 3.

A central theme of the book is the relation of empiricism and mathematics. The book looks first at mathematical connections in natural contexts—mathematics as it appears in nature. I contend that some mathematical connections are first *perceived*, and I develop in some detail what this would mean. That the ancient formulation of movement was primarily kinematic is a theme of the book. A specific instance central to ancient mechanics up to Aristotle, the moving radius principle and its various formulations, is explored in some depth. Using ancient sources and ordinary experiences, I argue in concert with a late fifth-century BC view that, at the least, some objects and properties of a mathematical sort just are part of nature and sometimes are principles of nature. This original mathematics is not,