Diagramming Aristotle's and Philoponus' Theories of Projectile Motion

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Abstract. The purpose of this presentation is to show a fruitful application of a diagrammatic notation to the study of ancient and early medieval theories of projectile motion. The aim is to clarify the arguments encountered, uncovering the precise line of deductions the philosophers purportedly made to further or refute a certain theory. The notation used allows for the detection of tacit premises (i.e., unstated assumptions), those necessary for the logical coherence of the given arguments. The claim here is not that these philosophers' arguments were truly illogical, but simply that their current purely prose form is insufficient for precise understanding. By extracting arguments and premises from texts and representing their relations diagrammatically, ambiguous or densely written excerpts can be highlighted and clarified.

1 Introduction

In this work, I analyzed and diagrammed various arguments for theories of projectile motion given by Aristotle and Philoponus, two influential figures in the development of the subject in ancient and medieval times [1].

A close examination of the source texts along with the use of an appropriate diagrammatic toolkit allow for the clarification of these philosophers' often ambiguously represented arguments. The diagrammatic notation used is detailed in the forthcoming collected volume *Visualizing Worldviews: Diagrams for Belief Systems* [2, 3]. The logical analysis to which this notation lends itself leads to the uncovering of tacit premises (i.e., unstated assumptions). As becomes clear, these tacit premises cannot always be uniquely determined. Such variations, even when similarly plausible, can change the structure of the author's seeming line of reasoning. In these cases, there is great potential for further research to result.

For the analysis, I relied mainly on passages from two sources: Marshall Clagett's authoritative *The Science of Mechanics in the Middle Ages* [1] and Jürgen Sarnowsky's "Concepts of Impetus and the History of Mechanics" [4].

In the diagrams that follow, implicit premises are in the form of boxes with dashed line borders while implications are denoted with arrows. Premises given explicitly in the text occupy boxes with solid line borders.

2 Analysis

Beginning from fundamental Aristotelian principles of motion, I diagrammed Aristotle's and Philoponus' arguments. I analyzed the text to extract premises and implications before using diagrams to uncover tacit premises necessary to achieve logical validity and approximately reconstruct the arguments as they were originally intended. Below I present a sample of diagrams on two of Philoponus' arguments.

In setting up his refutation of what I refer to as *Proposition 2*, a particular theory of projectile motion given by Aristotle, Philoponus deduces that the air being solely responsible for the projectile's continued motion is a consequence of the theory [1]. The reasoning Clagett provides, however, leaves room for interpretation. Figure 1 contains my attempt to uncover the hidden implicit premises used to improve this portion of the argument's validity.
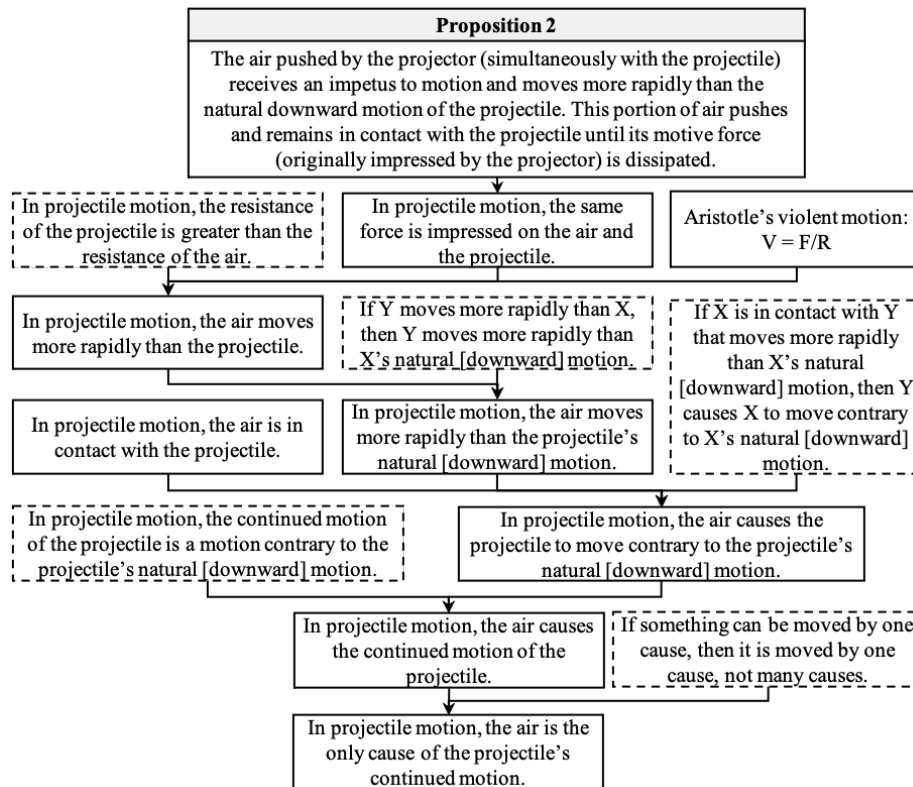

Fig. 1. Representation of the first portion of Philoponus' *Proposition 2* refutation [1].

Although I do not claim they are here uniquely articulated, it is clear tacit premises are necessary to properly complete the argument.

Figure 2 represents three representations of the similarly ambiguous line of reasoning given in Clagett's passage on Philoponus' incorporeal motive force argument.
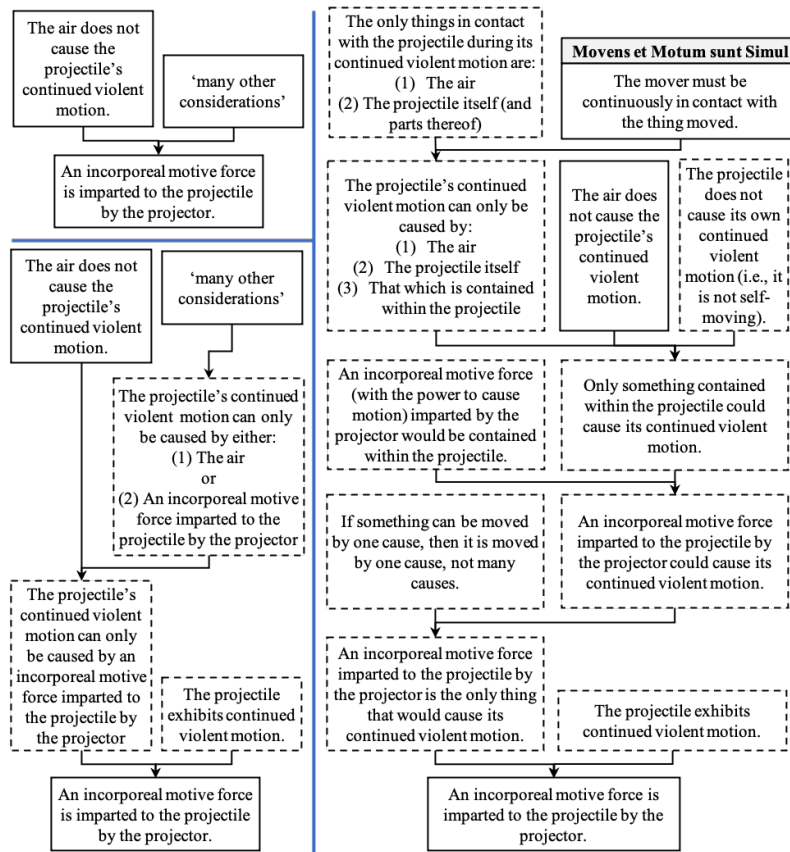
Fig. 2. Three representations of Philoponus' justification for an incorporeal motive force [1].

The top-left depiction is most faithful to the text while the right-hand depiction, though with a more complete logical framework of implications, sees me take more liberties. I go on to create equivalently valid diagrams of the same argument that nonetheless rely on different tacit premises. This diagrammatic approach allows us to clearly highlight a text's ambiguities along with their subsequent ramifications. It can serve to better focus research efforts and suggest novel new avenues for future pursuit.

References

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